2. BALcanOSH MEDNARODNA KONFERENCA ZA REGIONALNO SODELOVANJE, BLED, SLOVENIJA

2nd BALcanOSH INTERNATIONAL CONFERENCE FOR REGIONAL COLABORATION, BLED, SLOVENIA

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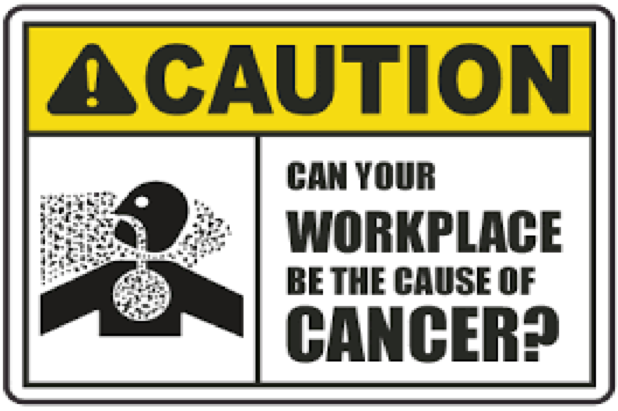

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VSEBINA

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POKLICNI RAK

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Povzetek

Rak je kompleksen patološki proces, ki ima svoj izvor v spremenjenem genomu. Vzroki za maligno transformacijo so različni, od kemičnih, fizikalnih, bioloških do starosti, spola in genskih dejavnikov.
Incidenca raka v Sloveniji narašča. Prav tako se umrljivost zaradi daljšanja pričakovane življenjske dobe in postopnega zmanjševanja drugih vzrokov smrti, kot so nalezljive bolezni in poškodbe, povečuje. Raki, ki nastanejo kot posledica izpostavljenosti dejavnikom na delovnem mestu, imajo visoko stopnjo umrljivosti, kot na primer rak pljuč. Poklicni pljučni rak predstavlja 54-75% vsega poklicnega raka. Med najpogostejše oblike poklicnega raka spadajo še rak sinusov, nosu in grla, mehurja, ledvic, prebavil, ščitnice.
Po globalnih podatkih ILO vsako leto zabeležimo 666.000 smrtnih primerov raka, povezanega z delom. V EU dosegajo smrti zaradi poklicnega raka že 53% vseh smrti povezanih z delom.
Skoraj polovico vseh izpostavljenosti predstavljata izpostavljenost UV sevanju v sončni svetlobi (delo na prostem) in tobačnemu dimu iz okolja.
V našem okolju je okoli 4 milijone kemikalij s škodljivimi kratkoročnimi in dolgoročnimi zdravstvenimi posledicami. Med najpogostejše karcinogene delovnega okolja spadajo nikelj, kadmij, arzen, krom, berilij, azbest. Med poklici z največjim tveganjem poklicnega raka uvrščamo delo v kemijski industriji, rudarstvu, kovinski industriji, usnjarstvu, pa tudi v kmetijstvu in lesni industriji. Natančnejših podatkov o deležu poklicnih rakov slovenskem prostoru nimamo, v prispevku pa prikazujemo delež posameznih najbolj zastopanih rakov ter potencialne izpostavljenosti oz tveganja.

Uvod

Tumor (neoplazma) je lokalizirana, nenormalno razraščajoča se masa tkiva ali masa avtonomnih celic, ki nima fiziološke vloge za telo. Tumorji lahko nastanejo praktično v vseh tkivih ali organih v telesu. Nekateri tumorji imajo lastnost, da se iz mesta nastanka premaknejo na drugo mesto v telesu; temu pravimo zasevanje ali metastaziranje, kar pospeši nekontrolirano razrast tumorja. Ko se to dogodi, bolezen imenujemo rak.
Rak je kompleksen patološki proces, ki ima svoj izvor v spremenjenem genomu. Na celični ravni gre za nebrzdano razmnoževanje celic zaradi okvarjenega nadzora celične delitve in okvare odmiranja celic. Klinično se kaže v več kot sto boleznih z različnimi lokalnimi in sistemskimi znamenji, ki imajo skupen učinek – spremembo v genih somatskih celic in skupen konec- smrt v primeru, da se bolezen ne zdravi ali pa je zdravljenje neuspešno.
Vzroki za maligno transformacijo celic so lahko:
- notranji: spol, starost, genski dejavniki;
- zunanji: biološki (virusi z DNA in RNA), kemični in fizikalni.

Rak se sicer lahko razvije v vsakem življenjskem obdobju, vendar najpogosteje po 50. letu starosti zaradi kopičenja sprememb v somatskih celicah, slabenja imunskega sistema in slabenja mehanizmov za popravljanje poškodb DNA. Pri nastanku raka so pomembna tudi različna dolgotrajna draženja, ki stalno spodbujajo procese regeneracije celic z njihovim razmnoževanjem: kronična vnetja, mehanska draženja.
Nekatere dedne napake v družini pogosto vodijo v rakavo bolezen, ali pa se ta pojavi kot zaplet manifestne dedne bolezni. Dedna napaka lahko pomeni prvo stopnjo v neoplastični transformaciji. Vsaka od mutacij prispeva k destabilizaciji genoma in s tem pospeši neoplastično transformacijo.
Od leta 1775, ko je Pott povezal nastanek raka na skrotumu pri dimnikarjih s sajami, so odkrili več kot 100 kemičnih snovi, ki lahko povzročijo rakavo rast. Kemični karcinogeni si za svojo tarčo lahko izberejo različne gene, najpogosteje povzročajo mutacijo gena *ras*. Kemični karcinogeni so raznovrstne eksogene snovi (ksenobiotiki) ali endogeni produkti presnove (npr. reaktivne kisikove spojine), lahko so anorganske ali organske snovi.
Anorganske snovi delujejo na membranske strukture in makromolekule. Pri tem lahko nastanejo prosti radikali, ki poškodujejo celico (npr. kovine kadmij, kobalt, nikelj, kovinske spojine, silikatne spojine, azbest, nekovine, arzen…).
Organske spojine delimo v neposredno in posredno delujoče kancerogene. Neposredno delujoči kancerogeni za svoje delovanje ne potrebujejo presnovne aktivacije (zelo aktivni elektrofiti): zdravila-alkilirajoče snovi. Posredno delujoči kancerogeni se nahajajo v organizmu v neaktivni obliki in postanejo

aktivne šele po presnovni spremembi, ko dobijo elektrofilni center in tako postanejo končni kancerogeni: policiklični aromatski ogljikovodiki, aromatski amini, azobarvila in naravni rastlinski in mikrobni produkti. Biološki dejavniki so številni virusi, ki lahko spremenijo normalno celico v rakavo pri različnih živalskih in rastlinskih vrstah. Ločimo onkogene viruse z DNA in RNA, ki spremenijo celico tako, da svojo genetsko informacijo vgradijo v genom gostitelja.
Za poškodbo DNA sta med fizikalnimi dejavniki še posebno nevarna dva tipa sevanj: neionizirajoči žarki UV svetlobe in ionizirajoči žarki. Energija ionizirajočega sevanja lahko povzroči točkovne mutacije, prelome kromosomov in translokacije med kromosomi. Neionizirajoče sevanje deluje predvsem prek vzburjenja molekul, ionizirajoče sevanje pa povzroči prekinitev DNA verige[5,9].

Nastanek rakavega obolenja
Nastanek malignega tumorja je rezultat izgube kontrole nad celično delitvijo in proliferacijo. Spontano ali pod vplivom različnih fizikalnih, kemijskih ali bioloških dejavnikov pride do spremembe v strukturi DNA molekul celic (spremembe v razporeditvi nukleotidov, prekinitve verig ipd.), kar imenujemo mutacija. Takšna celica lahko izgubi svojo primarno funkcijo in organizem s procesom reparacije poskuša tako spremembo popraviti z odstranitvijo spremenjene DNA molekule oz uničenjem transformirane celice pred nastankom njene delitve. V kolikor do delitve celice pride pred reparacijo (posebno v celicah, ki se hitro delijo), se okvarjena DNA koristi kot šablona za nadaljnjo DNA podvajanje. Patološke celice proliferirajo in nastajajo paraneoplastični vozliči, od katerih so bodo nekateri razvili v tumor.
Kancerogenezo lahko v grobem razdelimo v tri stopnje:
- iniciacija - posledica ireverzibilne spremembe genetskega materiala DNA celice zaradi interakcije s kancerogenim materialom; med podvajanjem DNK se kopičijo mutacije, katerih posledica je nenadzorovano izražanje proto-onkogenov in/ali inaktivacija tumor-supresorskih genov, spremeni pa se tudi stopnja metilacije teh genov, in sicer se na promotorskih regijah pri proto-onkogenih zmanjša stopnja metilacije, pri tumor-supresorskih genih pa se poveča;
- promocija - kot posledica dejstva nekega drugega kancerogena (ne tistega, ki je izzval spremembe genetskega materiala) ti. promotorja, pride do stimulacije razvoja primarno spremenjene celice; promocija torej ni rezultat vezave ali spremembe DNA; podvajajo se celice z mutacijami, s čemer se kopičijo nove mutacije, katerih število raste sorazmerno s številom celičnih delitev;
- progresija - karakterizira jo pospešena rast, invazivnost in nastanek metastaz; izrazijo se maligne lastnosti: tvori se tumorsko ožilje (vaskularna faza), le to pa privede do močnejšega protitumorskega odgovora zaradi vdora celic imunskega sistema ter metastaziranje.
Raka povzroča več različnih mutacij na proto-onkogenih in tumor-supresorskih genih, kar vodi v intenzivne celične delitve.
Različne vrste tumorjev (novotvorb) zahtevajo različne kombinacije lastnosti za razvoj, kljub temu pa imajo vse tumorske celice nekaj skupnih lastnosti:
- intenzivne delitve (neoplazija) – celice imajo zaradi mutacij komponent v celični signalizaciji zmanjšano odvisnost ali popolno neodvisnost od rastnih faktorjev za rast, preživetje in delitev, v nekaterih primerih pa celice same proizvajajo rastne faktorje in s tem stimulirajo lastne delitve, kar imenujemo avtokrina rastna stimulacija;
- genetska nestabilnost – kopičenje mutacij, ki ovirajo točno podvajanje dednega materiala, popravljanja napak ter sprememb na nivoju kromosomov (npr. prelomi);
neodvisnost od kontaktne inhibicije – tumorske celice so neodvisne od kontaktne inhibicije, kar pomeni, da migracija in proliferacija celic ni preprečena kljub tvorbi stikov s sosednjimi celicami;
- »nesmrtnost« - zaradi reaktivacije telomeraz lahko poteče neomejeno število delitev, saj telomeraze konstantno vzdržujejo dolžino telomernih regij na koncih kromosomov;
- odpornost proti apoptozi – zaradi mutacij komponent kontrolnih točk celičnega cikla proces programirane celične smrti kljub napakam ne poteče;
- angiogeneza – celice spodbujajo rast krvnih žil, s čemer omogočijo dovod hrane in kisika (O_2), odvod ogljikovega dioksida (CO_2) in presnovkov (metabolitov) ter metastaziranje;
manjša adhezivnost – rakaste celice so nenormalno invazivne, v veliki meri zaradi nepravilnosti v stičnih proteinih pri stikih celica-zunajcelični matriks in celica-celica, kot je npr. izguba kadherina E pri medceličnih stikih epitelijskih celic, poleg tega pa te nepravilnosti prispevajo k spremembam citoskeleta in s tem oblike celic, zaradi česar so tumorske celice velikokrat bolj okrogle kot pa normalne celice;
- izločanje proteaz – k invazivnosti prispeva tudi izločanje proteaz, ki razgrajujejo proteine v medceličnini, kar torej omogoči prodiranje v sosednja tkiva;
- metastaziranje – rakaste celice lahko večkrat vdrejo v tuja tkiva in se delijo.

Iz mehanizmov je torej razvidno, da za nastanek raka ne zadostuje samo en mutacija, temveč več različnih mutacij. Dokaz za to so tudi epidemiološke študije incidence raka v odvisnosti od starosti, kjer incidenca eksponentno narašča v odvisnosti od starosti, [10] kar sovpada z dejstvom, da se s starostjo kopičijo mutacije v organizmu.

Kemijske kancerogene delimo glede na način delovanja na strukturo DNA na snovi, ki so:

- odvisne od metabolične aktivacije, ki svoje kancerogeno delovanje povzročajo preko metabolitov, ki so nastali z različnimi encimskimi sestavinami biotransformacije v organizmu
- neodvisne o metabolični aktivnosti, ki imajo že v svoji začetni strukturi aktivne dele molekule, ki delujejo na DNA.

Mnogi poznani kancerogeni življenjskega in delovnega okolja se v organizmu obnašajo kot prokancerogeni (promotorji), ki dovedejo do metabolične aktivacije in inicirajo onkogenezo. Reaktivna forma kemijske substance je elektrofilna, s svojo zvezo in interakcijo z DNA povzroča promutageni efekt [4,5,6,7,8,9,10,11,12].

Splošni epidemiološki kazalci

Tabela 1: Incidenca raka in umrljivost zaradi raka v obdobju od 2008 do 2012 ter prevalenca ob koncu leta 2012 [2,15].

Incidenca rakavih obolenj (novih primerov v enem letu) v R Sloveniji (povprečje 2008 do 2012)

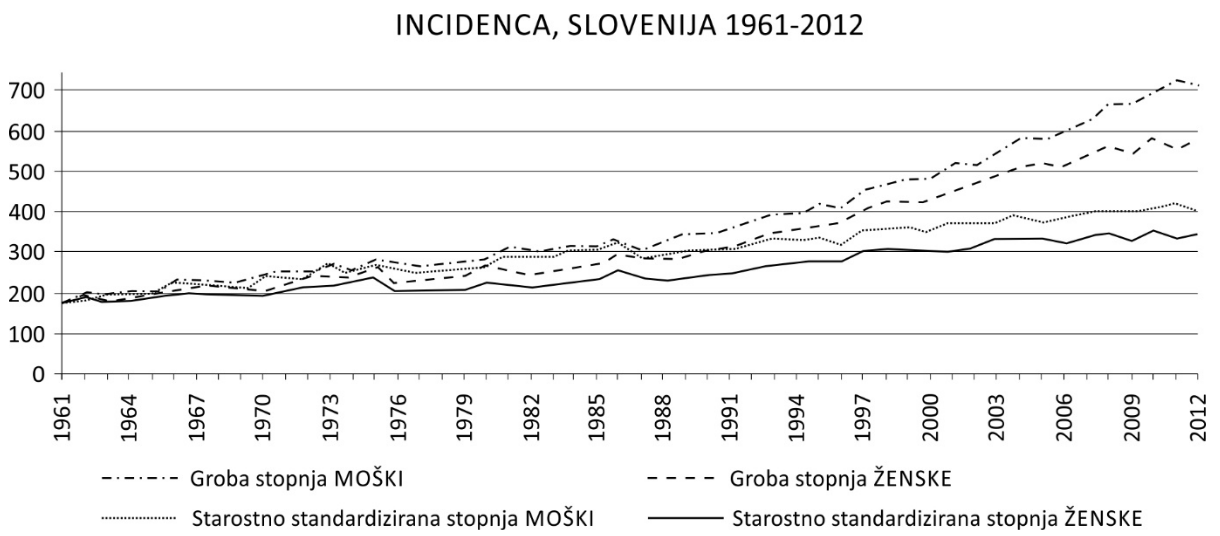
Moški	Ženske	Oba spola
6.997	5.902	12.899

Umrljivost (povprečje R Slovenija v enem letu za obdobje 2008 do 2012)

Moški	Ženske	Oba spola
3.242	2.577	5.818

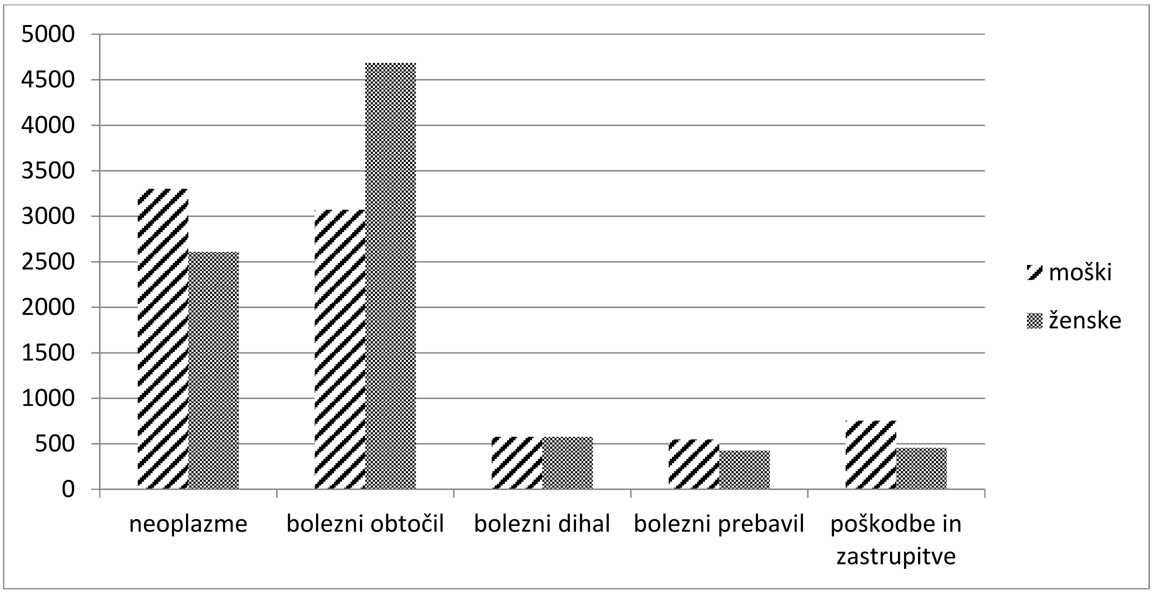
Število živih oseb z diagnozo raka v R Sloveniji ob koncu leta 2012 (prevalenca)

Moški	Ženske	Oba spola
39.340	50.455	89.795



Graf 1: Incidenca raka v Sloveniji pri obeh spolih in starostna standardizirana stopnja pri obeh spolih v opazovanem obdobju od 1961 do 2012 [2].

Tako groba kot starostno standardizirana incidenčna stopnja vseh rakov skupaj pri obeh spolih v opazovanem obdobju od 1961 do 2012 v Sloveniji narašča (pri moških bolj kot pri ženskah).
Groba umrljivostna stopnja tudi raste, zadnjih 10 let za 1,6 % letno, medtem ko pa pri starostno standardizirani stopnja za vse rake skupaj pri obeh spolih opažamo trend padanja. Letno se starostno standardiziran umrljivostna stopnja zmanjšuje za 0,8 % (pri moških bolj kot pri ženskah)



Graf 2: Vzroki umrljivosti po petih najpomembnejših vzrokih in spolu v Sloveniji 2014 [2].

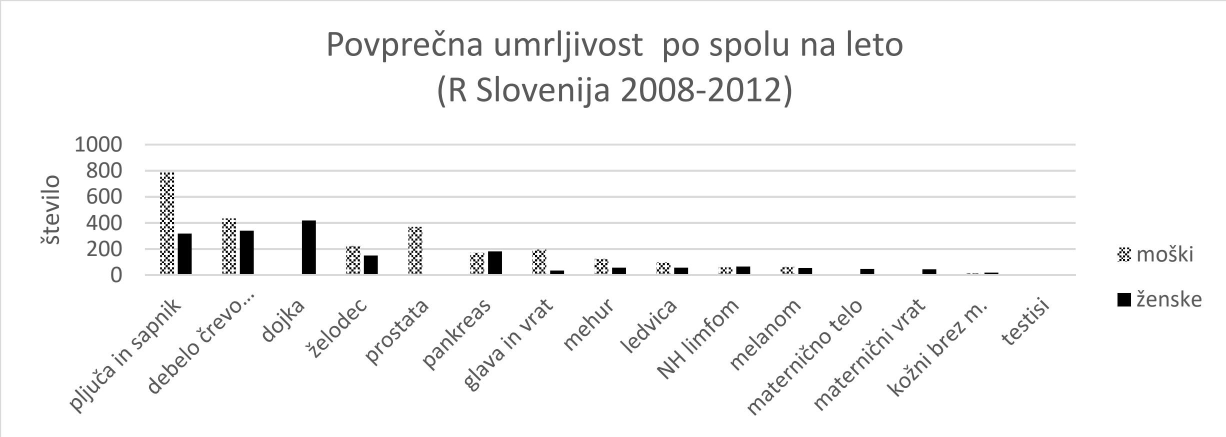
V letu 2014 so bile vodilni vzrok umrljivost žensk bolezni obtočil, na drugem mestu so bile neoplazme, sledile pa so bolezni dihal, prebavil ter poškodbe in zastrupitve. Pri moških pa so bile vodilni vzrok umrljivosti neoplazme, na drugem mestu so bile bolezni obtočil, sledile pa so poškodbe in zastrupitve, bolezni prebavil in dihal.

Pogostost raka hitro narašča s starostjo, saj je rak zelo redek v otroštvu in adolescenci ter v zgodnjem odraslem življenjskem obdobju. S srednjimi leti pa se pogostost hitro povečuje. V otroštvu je najpogostejša rakava bolezen levkemija, med 20. in 34. letom rak testisa in rak materničnega vratu, med 35. in 49. letom je med moškimi najpogostejši rak ustne votline in pljuč, pri ženskah pa rak dojke in materničnega vratu. Rak debelega črevesa in danke je najpogostejša rakava bolezen pri obeh spolih med 50. in 74. letom, v visoki starosti pa je med moškimi najpogostejši rak prostate, pri ženskah pa rak dojke, debelega črevesa in danke ter želodca.

Pri moških je največ novih primerov raka, 31,4 % in 31,8 % v starostnih skupinah 65-74 in 50-64 let, na tretjem mestu je z 28,8 % starostna skupina 75 in več let. Sledi pa s 5,9 % starostna skupina 35-49 let, nato z 1,7 % starostna skupina 20-34 let, na zadnjem mestu je z 0,4 % starostna skupina 0-19 let.

Pri ženskah je največ novih primerov raka, 34,0 % v starostni skupini 75 in več let, z 29,3 % sledi starostna skupina 50-64 let, na tretjem mestu je z 22,7% starostna skupina 65-74 let. Sledi pa z 10,9 % starostna skupina 35-49 let, nato z 2,7 % starostna skupina 20-34 let, na zadnjem mestu je z 0,4 % starostna skupina 0-19 let.

Najpogostejši rak pri moških je rak prostate, na drugem mestu je rak debelega črevesa in danke, na tretjem mestu je rak kože brez melanoma, sledi pa rak pljuč. Pri ženskah je najpogostejši rak dojke, sledijo raki kože, rak debelega črevesa in danke ter pljučni rak[2,15].



Graf 3: Povprečna umrljivost zaradi raka po spolu na leto v Sloveniji v obdobju od 2008 do 2012 [2].

Pri moških je bilo v proučevanem obdobju največ mrtvih zaradi raka pljuč in sapnika, sledijo debelo črevo in danka ter prostata. Pri ženskah je bilo največje število mrtvih zaradi raka dojk, sledita pa debelo črevo in danka in pljuča ter sapnik [2,15..

Poklicni rak

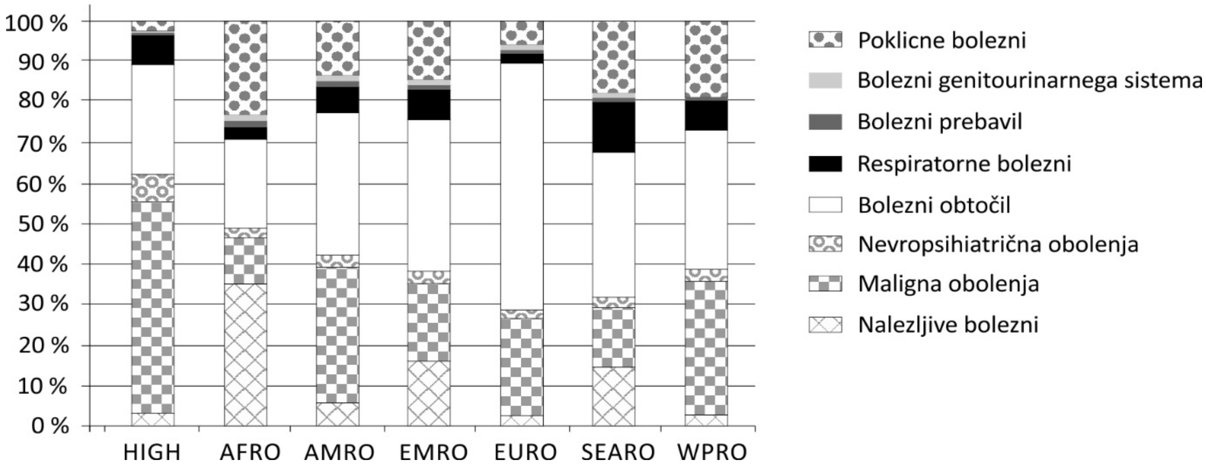
Po navedbah SZO/IARC v svetovnem merilu zaradi raka vsako leto umre 8,2 milijona ljudi. Vsako leto odkrijejo 14 milijonov novih primerov raka. Po ocenah se bo do leta 2035 smrtnost za rakom povečala za 78 odstotkov in incidenca za 70 odstotkov. V EU28 je bilo v letu 2013 1,314 milijona smrtnih primerov raka.

Nobenega dvoma ni, da je rak največji morilec pri delu v državah z visokim dohodkom (WHO klasifikacija), vključno z EU. Pljučni rak predstavlja 54-75 odstotkov vseh poklicnih rakov. Epidemiološke študije kažejo, da po ocenah poklicna izpostavljenost povzroči 5,3-8,4 odstotkov vseh rakov in pri moških 17-29 odstotkov vseh smrti zaradi pljučnega raka. Od 102.500 smrti zaradi poklicnega raka v EU28, jih azbest vsako leto povzroči med 30.000 in 47.000, pri čemer številke še vedno naraščajo.

Umrljivosti zaradi raka in poklicnega raka se povečuje zaradi daljšanja pričakovane življenjske dobe in postopnega zmanjševanja drugih vzrokov smrti, kot so nalezljive bolezni in poškodbe. Raki, ki nastanejo kot posledica izpostavljenosti dejavnikom na delovnem mestu, imajo visoko stopnjo umrljivosti, kot na primer rak pljuč. Deset najpomembnejših poklicnih karcinogenov povzroči približno 85 odstotkov vseh smrti zaradi poklicne bolezni.

V letu 1981 sta Doll in Peto ocenjevala, da izpostavljenost dejavnikom na delovnem mestu povzroči 4 odstotke vseh smrti zaradi raka in 12,5 odstotkov smrti zaradi raka pljuč. To so bile podcenjujoče številke glede na dosedanje znanje in postopoma naraščajoče število karcinogenov, ki jih priznava IARC. Približno 17-29 odstotkov vseh primerov pljučnega raka pri moških nastane zaradi poklicne izpostavljenosti, poklicni pljučni rak predstavlja 54-75 odstotkov vsega poklicnega raka.

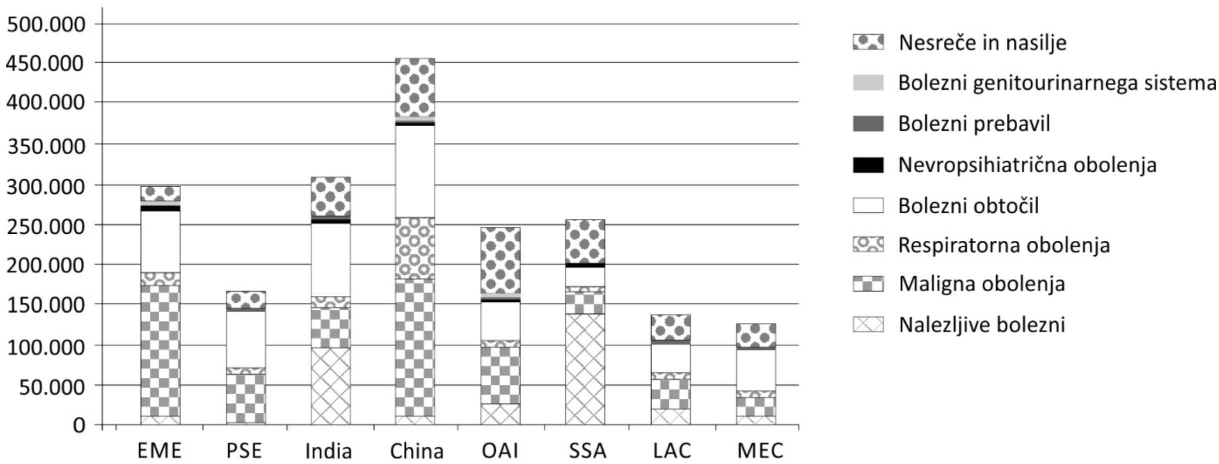
Po najnovejših globalnih podatkih ILO (glede na podatke iz leta 2010 in 2011) vsako leto zabeležimo približno 666.000 smrtnih primerov raka, povezanega z delom [8,10,11,16].



REGIJE SVETOVNE BANKE: EME-Tržna ekonomija, FSE-nekdanja socialistična ekonomija, IND-Indija, CHN-Kitajska, OAI-druge azijske države, SSA-Sub-saharska Afrika, LAC-Latinska Amerika in Karibi, MEC-države bližnjevzhodnega polmeseca

Graf 4: Globalna ocenjena smrtnost povezana z delom, absolutne številke [14].

Iz grafa je razvidno, da je največ smrtnosti zaradi raka, povezanega z delom v na Kitajskem in na območjih tržne ekonomije, najmanj pa v državah bližnjevzhodnega polmeseca ter na območju Latinske Amerike in Karibov.

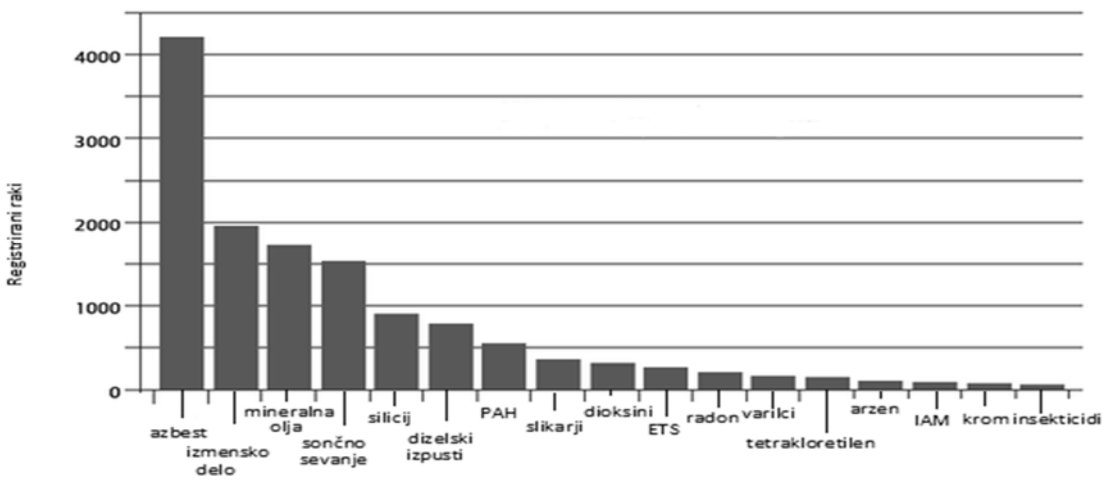


HIGH-države z visokimi dohodki, AFRO-afriška regija, AMRO-regija Amerike (države z nizkimi in srednjimi dohodki), EMRO-regija Vzhodnega Mediterana (države z nizkimi in srednjimi dohodki), EURO-Evropska regija (države z nizkimi in srednjimi dohodki), SEARO-Jugovzhodna azijska regija (države z nizkimi in srednjimi dohodki), WPRO-Zahodnopacifiška regija (države z nizkimi in srednjimi dohodki)

Graf 5: Breme, povzročeno z rakom in drugimi boleznimi povezanimi z delom po SZO regijah v 2014[14].

Graf prikazuje, da je bilo v letu 2014 breme, povzročeno z rakom, povezanim z delom, največje v državah z visokimi dohodki, sledile pa so države zahodno-pacifiške regije ter regije Amerike. Najmanjše je bilo breme v državah afriške regije.
ILO-ove globalne ocene prikazujejo, da se vsako leto v državah z visokim dohodkom po klasifikaciji Svetovne zdravstvene organizacije, ki med drugimi vključuje ZDA, Kanado, večino držav Evropske Unije, Japonsko, Avstralijo, Novo Zelandijo in Singapur, zgodi 212.000 smrti zaradi poklicnega raka, glede na podatke o umrljivosti WHO leta 2011. V nedavnem poročilu za grško predsedstvo Konference o varnosti in zdravju pri delu v letu 2014 je bilo v EU 102,500 smrti zaradi poklicnega raka.

Nekdanje globalne ocene o poklicnih rakih ILO so pokazale, da je bilo 32 odstotkov vseh smrti na svetu, povezanih z delom, povezanih z rakom. Vendar poklicni rak postaja hitro globaliziran in se v številnih industrializiranih državah odstotek smrti zaradi poklicnega raka pri delu med vsemi smrtmi povezanimi z delom približuje tistemu v državah z visokimi dohodki, na primer, v EU dosegajo smrti zaradi poklicnega raka že 53 odstotkov vseh smrti, povezanih z delom.
Poklicni karcinogeni vplivajo na 1 od 5 delavcev v EU, po podatkih EU Carex (podatkovne baze izpostavljenosti karcinogenim), oziroma 23 odstotkov tistih, ki so zaposleni, so izpostavljeni rakotvornim snovem. Najnovejši podatek glede na nedavno študijo v Kanadi je 43 odstotkov in v Avstraliji 37,6 odstotkov.
Najpogosteje so bili delavci izpostavljeni ultravijoličnemu sevanju v sončni svetlobi (med rednim delom na prostem) in tobačnemu dimu iz okolja (ETS) (v restavracijah in na drugih delovnim mestih), pri čemer sta ti dve vrsti predstavljali okoli polovico vseh izpostavljenosti.
Od začetka devetdesetih je bila izpostavljenost tobačnemu dimu iz okolja na delovnem mestu občutno zmanjšana zaradi prepovedi in drugih omejitev. Druge relativno pogoste izpostavljenosti, ki so se najverjetneje zmanjšale, vključujejo svinec, etilen dibromid (dodatek, uporabljen v osvinčenem bencinu), azbest in benzen [14].



Graf 6: Najpogostejši karcinogeni in izpostavljenost pri delu v Veliki Britaniji [14].

V Veliki Britaniji je najpogostejši karcinogen, ki so mu delavci izpostavljeni pri delu azbest, sledijo izmensko delo, mineralna olja, sončno sevanje, silicij, dizelski izpusti in PAH ter ostali.

Tabela 2: Delež smrti za rakom, ki jih pripisujemo glavnim odpravljivim dejavnikom tveganja iz okolja in načina življenja, ki prispevajo k umrljivosti za rakom [9]

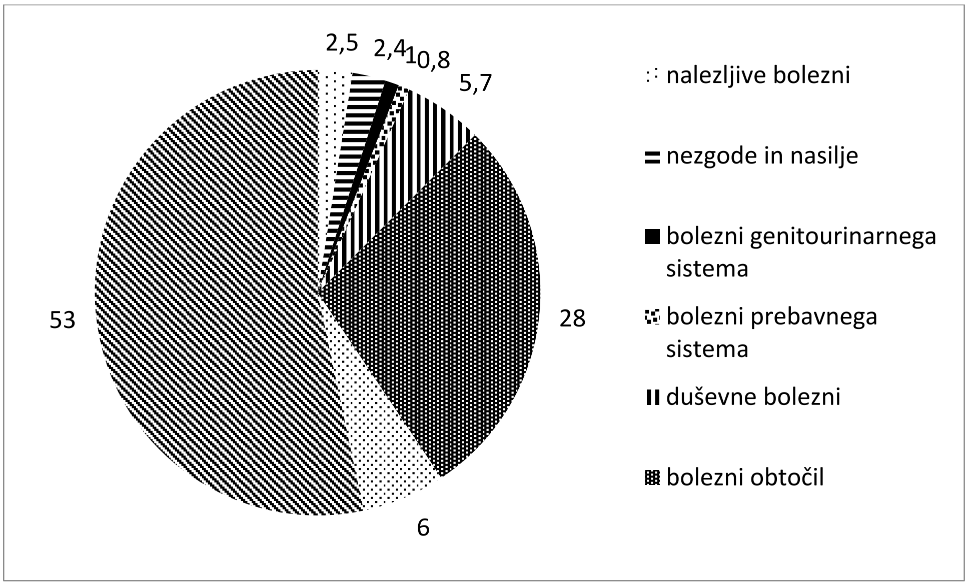
Nevarnostni dejavniki	Delež vseh smrti za rakom %
Kajenje	16
Prehrana in telesna dejavnost	30
Alkohol	3
Dodatki v prehrani	<1
Reproduktivni dejavniki in način spolnega življenja	7
Poklic	4
Onesnaženost okolja	1 do 4
Industrijski izdelki	<1
Zdravila in zdravstveni izdelki	1
Ionizirajoče sevanje naravnega ozadja in sevanje UV	3
Infekcije	9
Neznano	?

Več kot polovico smrti zaradi raka povzročajo dejavniki, ki so povezani z življenjskim slogom. Ogrožajo predvsem tisti, ki jih povezujemo z zahodnim načinom življenja: debelost, energijsko prebogata hrana z malo vlakninami in sedeč način življenja skupaj z razvadami, kot sta čezmerno uživanje alkoholnih pijač in kajenje. Med mikroorganizmi, ki povzročajo raka, so v Sloveniji pomembni Helicobacter pylori, ki povzroča želodčnega raka in nekateri humani virusi papiloma, ki povzročajo raka na materničnem vratu, anusu in sluznicah v ustih, žrelu in grlu. Z omenjenimi virusi je pri nas okužena približno tretjina odrasle populacije. Vsi, ki se okužijo, ne zbolijo za rakom, je pa med nami že leta 2005 živelo približno 3500 bolnikov z rakom, katerega nastanek pripisujejo infekcijam.
Poklicna izpostavljenost in onesnaženost okolja zavzemata šele 5. do 6. mesto na lestvici znanih nevarnostnih dejavnikov. Onesnaženo okolje lahko vpliva na zdravje ljudi na različne načine. V medicinski stroki je znanih precej bolezni in stanj, ki so posledica vdihovanja, uživanja ali drugačnega stika z nevarnimi snovmi v okolju. Večinoma gre za akutne zastrupitve, ki so posledica nenamerne izpostavljenosti visokim koncentracijam nevarnih snovi v delovnem, lahko pa tudi v bivalnem okolju. Dolgotrajna izpostavljenost nižjim koncentracijam nekaterih snovi lahko povzroči kronične spremembe[14,16].

Ugotavljanje poklicnih karcinogenov in njihove rakotvornosti

V našem okolju je okoli 4 milijone naravnih in sintetičnih kemikalij, brez katerih si ne moremo predstavljati vsakdanjega življenja, seveda pa imajo mnoge med njimi tudi škodljive zdravstvene posledice - tako kratkoročne, zastrupitve, kot dolgoročne, med katerimi je tudi rak. Morebitno rakotvornost ugotavljamo z bazičnimi (gre za kratkotrajne poskuse na celičnih kulturah in bakterijah ter dolgotrajne na živalih) in analitičnimi epidemiološkimi raziskavami (tako kohortnimi kot študijami primerov in kontrol).

Primarna pomanjkljivost tradicionalne epidemiologije je, da deluje zgolj kot »opozorilni sistem«, saj s temi raziskavami odkrivamo poklicne karcinogene šele več let po začetku izpostavljenosti (večinoma 10-30 let). Zaradi tega ne moremo oceniti možnih škodljivih posledic novejših snovi, hkrati pa se kažejo lahko tudi posledice snovi, ki danes niso več v uporabi ali so že pod strogim nadzorom. V epidemioloških raziskavah se vse bolj uporabljajo tudi dognanja s področja molekularne biologije. Take raziskave omogočajo boljši nadzor in preventivne ukrepe pred nastankom nepopravljivih okvar. Za karcinogene nismo vsi enako občutljivi. Določeni fenotipi so povezani z nastankom določene vrste raka. Pomembno vlogo pri odkrivanju imajo tudi eksperimentalne raziskave, ki pa jih danes epidemiološke raziskave že prehitevajo. Pri 800 testiranih kemikalijah na živalih se je za 65% izkazalo, da povzročajo tumorje vsaj pri eni živalski vrsti. Ko na osnovi živalskih poskusov sklepamo o nevarnosti na ljudi, je treba upoštevati, da pri živalih uporabljamo večje odmerke ter poti vnosa v telo kot so jim izpostavljeni ljudje, ter da niso vse živalske vrste enako občutljive. Današnje raziskave kažejo, da je število karcinogenov z epidemiološkimi raziskavami podcenjeno, z eksperimentalnimi pa precenjeno [9,11,14]. Mednarodna agencija za varnost in zdravje pri delu (NIOH) ocenjuje, da so tveganja povezana s: starostjo, spolom, raso, pozitivno družinsko anamnezo, stilom življenja (prehrana, kajenje, alkohol), zdravstvenim stanjem, izpostavljenostjo karcinogenim agensom v delovnem okolju.



Graf 7: Letne z delom povezane smrti v EU28 in drugih razvitih državah [14]

Največ, kar 53 % vseh smrti, povezane z delom v EU28 in drugih razvitih državah povzročijo raki. Na drugem mestu z 28 % sledijo bolezni obtočil, na tretjem mestu so s 6% respiratorne bolezni, na četrtem mestu s 5,7 % sledijo mentalne bolezni. Zatem sledijo še nalezljive bolezni, nezgode in nasilje, bolezni genitourinarnega sistema ter bolezni prebavnega sistema.

Poklicni karcinogen je po Occupational Safety and Health Administration (OSHA) vsaka snov ali kombinacija snovi (pripravkov) ki povzročajo porast incidence benignih in/ali malignih neoplazem ali pomembno skrajšujejo latentno dobo med izpostavljenostjo in nastankom karcinoma kot rezultat katerekoli ekspozicije (inhalacije, zaužitja ali dermalne izpostavljenosti) in ki privede do indukcije tumorja na drugih lokalizacijah, kjer ni bilo mesto njenega delovanja.

Delijo se v tri skupine:

- kemijski kancerogeni (benzen, vinil klorid, azbestna vlakna…);
- fizikalni kancerogeni (UV svetloba, ionizirajoče sevanje);
- biološki karcinogeni (virus hepatitisa B in C).

Poleg omenjeh skupin lahko določene poklicne okoliščine, kot je na primer delo soboslikarja in varilca povezujemo s povečanim tveganjem za obolevnost za nekaterim vrstam raka. Poleg tega so nedavne študije začele vključevati analizo premika delovnih vzorcev, predvsem dela ponoči, ter njihovega možnega vpliva na pojavnost raka pri delu.

PRILOGE

Tabela 3 : Smrti zaradi poklicnega raka v letu 2011 [14]

Država	**Smrti zaradi poklicnega raka**
Andora	17
Avstrija	1.820
Belgija	2.079
Bolgarija	1.445
Hrvaška	742
Ciper	179
Češka	2.238
Danska	1.242
Estonija	292
Finska	1.135
Francija	12.035
Nemčija	17.706
Gibraltar	5
Grčija	2.131
Grenlandija	14
Guersney	13
Madžarska	1.808
Irska	928
Otok Man	18
Italija	10.609
Jersey	23
Latvija	491
Litva	694
Luksemburg	98
Malta	75
Monako	21
Nizozemska	3.721
Poljska	7.501
Portugalska	2.371
Romunija	4.233
San Marino	0
Slovaška	1.150
Slovenija	442
Španija	9.807
Švedska	2.103
Združeno Kraljestvo	13.330
Skupno EU	102.517

V tabeli je prikazana približna pojavnost 102.500 smrti zaradi poklicnega raka po državah članicah EU. Ta ocena ne upošteva različne ocene ravni izpostavljenosti v vsaki državi članici in temelji na podatkih na evropski ravni.

Tabela 4: Najpomembnejši kancerogeni delovnega okolja [4]

	Kancerogeni agensi za ljudi	**Organ na katerega deluje**	**Vir oz. ekspozicija**
1.	Nikelj	nos, obnosne votline, bronhiji, pljuča	metalurgija, legure, katalizatorji
2.	Kadmij	pljuča, prostata	Proizvodnja barv in pigmentov
3.	Arzen in spojine	pljuča, koža, jetra, ,	steklo, kovine, pesticidi
4.	Krom (6. valentni)	obnosne votline, bronhiji, pljuča	galvaniziranje kovin, proizvodnja barv in pigmentov
5.	Berilij	pljuča, kosti	letalska industrija, kovine
6.	Azbest	pljuča, serozne membrane - plevra, peritonej	izolacije, filtri, azbestno cementni izdelki in azbestno tekstilni izdelki
7.	Hamatit	pljuča	rudarji v rudnikih železove rude
8.	Vinilklorid	jetra	plastika, monomer
9.	Katran, parafin	koža, pljuča, mehur	gorivo
10.	Benzen, toluen, ksilen	levkemija	organska topila, goriva, gumarstvo
11.	Etilenoksid	levkemija	sterilizacija, kemijski intermediator
12.	Mineralna olja	koža	maziva
13.	Iperit	žrelo, pljuča	bojni strupi
14.	2-naftilamin	mehur	industrija barv in pigmentov
15.	Bis-eter klormetiletileter	pljuča	kemijski polproizvodi –stranski produkti
16.	Nafta iz fosilnih goriv	koža	maziva, goriva
17.	Saje	koža, pljuča	pigmenti
18.	Megla močnih neorganskih kislin z žveplom	Pljuča	kovine
19.	Smola katrana premoga	koža, pljuča, mehur	gradbeni material, elektrode
20.	Lesni prah	nosna votlina	lesna industrija, drva
21.	Benzidin	Mehur	proizvodnja barv, pigmentov, laboratoriji
22.	4-aminobifenil	Mehur	proizvodnja gume

Tabela 5: Agensi in ekspozicije iz življenjskega okolja, ki so tudi v delovnem okolju in so za ljudi kancerogeni (1A skupina) [4]

	Kancerogeni agensi za ljudi	**Organ na katerega delujejo**	**Vir oz ekspozicija**
1.	UV sevanje (sonce) (1992)	Koža	delavci, ki delajo na prostem
2.	Radon in njegovi potomci (1988)	Pljuča	rudarji v rudnikih, delavci v kraških jamah
3.	Kronična infekcija z hepatitisom B (1993)	Jetra	zdravstveni delavci
4.	Kronična infekcija z hepatitisom C (1993)	Jetra	zdravstveni delavci
5.	Infekcija Schistosumom haematobium	Mehur	
6.	Humani papiloma virus (tip 16 in 18) (1995)	maternični vrat	
7.	Cigaretni dim	pljuča, mehur, dihala	natakarji
8.	Alfatoksin (1993)	Jetra	proizvodnja hrane
9.	Erionit	pljuča, plevra	

Tabela 6: Kateri poklici so najbolj izpostavljeni glede poklicnega raka [7]

Industrija	**Poklic, proces**	**Lokalizacija, vrsta**	**Možni vzročni agens**
Kmetijstvo, gozdarstvo, ribištvo	vinogradniki, ki uporabljajo insekticide na bazi arzena	pljuča, koža	spojine arzena
	ribiči, mornarji, poljedelci	koža, ustnice	UV sevanje
Rudarstvo, kamnolomi	rudniki arzena	pljuča, koža	spojine arzena
	rudniki železove rude (hematit)		radonovi potomci
	azbestni rudniki	pljuča, pleuralni in peritonealni mezoteliom	azbest
	rudniki urana	pljuča	radonovi potomci
	rudniki in mlini talka	pljuča	azbestiformna vlakna, ki vsebujejo talk
Kemijska industrija	delavci v proizvodnji in uporabi bis (klorometil) etra in klorometil-metiletra	pljuča	bis (klorometil) eter klorometil-metileter
	proizvodnja vinil-klorida	angiosarkom jeter	vinilklorid monomer
	proizvodnja izopropil – alkohola	obrazni sinusi	
	proizvodnja kromatidnih pigmentov	pljuča, obrazni sinusi	spojine 6 valentnega kroma
	proizvodnja in uporaba barv	mehur	benzidin, 2-naftilamin, 4-aminobifenil
	proizvodnja auramina	mehur	auramin in drugi aromatski amini, ki se uporabljajo v teh procesih
	proizvodnja paraklortotoluidina	mehur	paraklortotoluidin in njegove moče kisle soli
Usnje	proizvodnja obutve	obrazni sinusi, levkemija	prah usnja, benzen
Les in njegovi proizvodi	proizvodnja pohištva	obrazni sinusi	lesni prah

Proizvodnja pesticidov in herbicidov	proizvodnja in pakiranje pesticidov na bazi arzena	pljuča	spojine arzena
Gumarstvo	proizvodnja gume	levkemija, mehur	benzen, aromatski amini
	vulkanizerstvo	levkemija	benzen
	mletje, mešanje	mehur	aromatski amini
	proizvodnja sintetskega lateksa, vulkanizacija, proizvodnja kablov	mehur	aromatski amini
	proizvodnja gumenih open	levkemija	benzen
Proizvodnja azbesta	proizvodnja izolacijskih materialov (cevi, plošče, tekstil, obleka, azbest cement)	pljuča, pleuralni in peritonealni mezoteliom	azbest
Kovine	proizvodnja aluminija	pljuča, mehur	policiklični aromatski ogljikovodiki, izparevanje katrana
	topilnica bakra	pljuča	spojine arzena
	proizvodnja kromatov	pljuča, obrazni sinusi	6 valentne spojine kroma
	kromiranje izdelkov	pljuča, obrazni sinusi	6 valentne spojine kroma
	livarne železa in jekla	pljuča	
	predelava niklja	pljuča, obrazni sinusi	spojine niklja
	proizvodnja in obdelava kadmija: baterije, legure, pigmenti, elektroobloge, topilnice cinka, proizvodnja polivinilklorida	pljuča	kadmij in njegove spojine
	čiščenje in strojna obdelava berilija (proizvodnja, ki vsebuje berilij)	pljuča	berilij in njegove spojine
Ladjedelništvo, proizvodnja opreme za motorna vozila, vlake in vzdrževanje cestišč	delavci v ladjedelništvu, avtomobilski in vlakovni industriji in cestarji	pljuča, plevralni in peritonealni mezoteliom	azbest
Industrija bencina	delavci v industriji koksa	pljuča	benzo(a) piren
	delavci, ki delajo z bencinom	pljuča, mehur, skrotum	proizvodnja karbonizacije premoga, beta-naftilamin
	delavci na plinskih postajah	mehur	alfa/beta naftilamin
Gradbeništvo	delavci na izolacijah in postavljanju cevi	pljuča, plevralni in peritonealni mezoteliom	azbest
	krovci, asfalterji	pljuča	policiklični aromatski ogljikovodiki
Ostali	zdravstveni delavci	koža, levkemija	ionizirno sevanje
	pleskarji gradbeništvo, avtoličarji), varilci	pljuča	

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OCCUPATIONAL CANCER

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Abstract

Cancer is a complex pathological process, which originates from a modified genome. There are various causes for malign transformation, including chemical, physical and biological causes as well as age, gender and genetic factors.

The incidence of cancer in Slovenia is increasing. The mortality caused by cancer has increased relatively, because the mortality due to other diseases has been reduced. Cancers caused by exposure to agents in the workplace, such as lung cancer, have a high mortality rate. Occupational lung cancer represents 54–75% of all occupational cancers. The most common forms of occupational cancer also include nasal cavity and paranasal sinus cancer, throat cancer, bladder cancer, kidney cancer, gastrointestinal cancer and thyroid cancer.

According to global information provided by the International Labour Organization, there are 666,000 cases of terminal occupational cancer each year. In the EU, deaths caused by occupational cancer represent 53% of all work-related deaths.

Exposure to UV radiation in sunlight (outdoor work) and exposure to environmental tobacco smoke constitute almost a half of all exposures.

In our environment, there are about 4 million chemicals with harmful short-term and long-term health consequences. The most common carcinogens in the working environment are nickel, cadmium, arsenic, chromium, beryllium and asbestos. Risk of occupational cancer is the highest in the chemical, mining, metal, leather, agriculture and wood industries. There is no precise data concerning the proportion of occupational cancers in Slovenia. This paper demonstrates the proportion of the most represented cancers and potential exposure or risk.

Introduction

Tumour (neoplasm) is a localised, abnormally growing mass of tissue or a mass of autonomous cells, which performs no physiological role in the body. Tumours can occur in practically every tissue or organ in the body. Some tumours have the characteristic to move from the place of formation to another place in the body; this is called metastasizing, which accelerates the uncontrolled growth of the tumour. When this happens, the disease is called cancer.

Cancer is a complex pathological process, which originates from a modified genome. On the cellular level it is uncontrolled cell reproduction due to a defective control of cellular parting and the defect of cell necrosis. Clinically, it is shown in over one hundred diseases with various local and systemic markers which have a common effect - change in the genes of somatic cells and a common end - death in the case of not treating the disease or unsuccessful treatment.

The causes of malign transformation can be:

- inner: gender, age, genetic factors;
- outer: biological (DNA and RNA viruses), chemical and physical.

Cancer can develop in any life period, however it is most common after 50 years of age due to the piling of changes in somatic cells, weakening of the immune system and weakening of the mechanisms for repairing DNA damages. In cancer occurrence also various long-term stimuli are of importance, which constantly stimulate the processes of cell regeneration with their reproduction: chronic infections, mechanical irritation.

Some genetic disorders in the family often lead to cancer or it occurs as a complication of a manifest genetic disease. A genetic disorder can mean the first stage in neoplastic transformation. Each of the mutations contributes to destabilisation of the genome and accelerates the neoplastic transformation.

Since 1775, when Pott connected scrotum cancer occurrence in chimney sweeps with soot, more than 100 chemical substances likely causing cancerous growth have been found. Chemical carcinogens can pick different genes as their target, most often they cause the mutation of *ras* gene. Chemical carcinogens are various exogenous substances (xenobiotics) or endogenous products of metabolism (for example reactive oxygen compounds), they can be inorganic or organic substances.

Inorganic substances affect the membrane structures and macromolecules. During the process free radicals can emerge, damaging the cell (for example, metals, cobalt, nickel, metallic compounds, silicate compounds, asbestos, non-metals, arsenic ...)

Organic compounds are divided into direct and indirect carcinogens. Direct carcinogens, i.e. medications - alkylating substances do not need activation from the metabolism (very active electrophiles) to be activated. Indirect carcinogens are found in the organism in a non-active form and become active only after a change in the metabolism, when they develop the electrophile centre and therefore become the final carcinogens: polycyclic aromatic hydrocarbons, aromatic amines, azo dyes and natural phytopathological and microbe products.

The biological factors consist of numerous viruses which can change a normal cell into a cancerous cell in various animal and plant species. We separate oncogenic viruses with DNA and RNA, which change the cell by installing their genetic information into the host genome.

Two types of radiation are especially dangerous to DNA damage among physical factors: non-ionizing UV rays and ionizing rays. The energy of ionizing radiation can cause point mutations, chromosomal aberrations and chromosomal translocations. Non-ionizing radiation works especially through molecule stimulation, while ionizing radiation causes DNA strand break [5,9].

Occurrence of cancerous diseases

The occurrence of malignant tumours is a result of the loss of control of cell division and proliferation. Spontaneously or under the effect of various physical, chemical or biological factors a change in the structure of DNA cell molecules occurs (changes in nucleotide allocation, strand breaks, etc.) which is called mutation. Such a cell can lose its primary function and through the process of reparation the organism tries to repair such change by removing the modified DNA molecule or destroying the transformed cell before its division. If the cell division occurs before the reparation (especially in cells splitting quickly), the damaged DNA is used as pattern for further DNA duplication. Pathological cells proliferate and paraneoplastic nodules occur, some of which will develop into a tumour.

Cancerogenesis can be roughly divided into three stages:

- initiation - the consequence of irreversible change of genetic material of the DNA cell due to an interaction with carcinogenic material; during the DNA duplication mutations are accumulating, the result of which is uncontrolled expression of proto-oncogenes and/or inactivation of tumour-suppressor genes. The degree of methylation of these genes is also changed; in the promoter regions with proto-oncogenes the degree of methylation is decreased, with tumour-suppressor genes it is increased.
- promotion - as a result of the fact of some other carcinogen (not the one which caused the changes in genetic material), the so-called promoter, the stimulation of development of the primarily modified cell occurs; cells with mutations are duplicated, by which new mutations accumulate and their number grows proportionately to the number of cell divisions.
- progression - it is characterised by accelerated growth, invasiveness and the occurrence of metastases; malignant characteristics are expressed: the tumour vascular system is formed (the vascular phase) which provides more a powerful anti-tumour response due to the intrusion of the cells of the immune system and metastasising.

Cancer is caused by various mutations in proto-oncogenes and tumour-suppressor genes, leading to intensive cell divisions.

Various types of tumours (neoplasms) demand different combinations of characteristics for the development, however all tumour cells have a few common characteristics:

- intensive divisions (neoplasia) - because of the mutations of the components in cell signalisation the cells have a decreased dependence or complete independence from growth factors for growth, survival and division, however in some cases the cells themselves produce growth factors that stimulate their own divisions, which is called autocrine growth stimulation;
- genetic instability - the accumulation of mutations, which hinder the exact duplication of the genetic material, repairing the mistakes and changes in the chromosome level (for example breaks);
- independence from contact inhibition - tumour cells are independent from contact inhibition which means that the migration and proliferation of cells is not prevented despite the forming of contacts with neighbouring cells;
- “immortality” - due to the reactivation of telomerase the unlimited number of divisions can expire, because the telomerase constantly maintain the length of telomerase regions at the ends of chromosomes;
- immunity to apoptosis - due to mutations of the components of the cellular cycle’s control points, the process of the programmed cellular death does not start despite the disorders;
- angiogenesis - the cells encourage the growth of blood vessels, which enables the supply of food and oxygen (O_2), the supply of carbon dioxide (CO_2), metabolites and metastasis;
- lesser adhesiveness - the cancer cells are abnormally invasive, mostly due to irregularities in contact proteins in the cell-extracellular matrix and cell-cell contacts, as for example, the loss of E cadherin in

intercellular contacts of the epithelium cells. Moreover, these irregularities contribute to the changes in the cytoskeleton and the shape of cells, which is why the tumour cells are often rounder than normal cells;
- the secretion of proteases - the secretion of proteases also contributes to invasiveness; the proteases dissolve proteins in the interstitial fluid, which therefore enables the penetration to other tissues;
- metastasis - cancer cells can often penetrate into foreign tissues and divide.

The mechanisms therefore show that one single mutation does not suffice for cancer to develop, several different mutations are needed. This is evidenced also in epidemiological studies of cancer incidence in relation to age, where the incidence increases exponentially in relation to age [10], which coincides with the fact that mutations in the organism accumulate with age.

Chemical carcinogens are divided according to the manner in which they affect the structure of the DNA on substances which are:
- dependent on metabolic activation, which cause their carcinogenic functioning through metabolites occurring with different enzyme components of biotransformation in the organism,
- independent from the metabolic activities which in their primary structure have active parts of molecules affecting the DNA.

Many known carcinogens of the living and working environment in the organism behave as carcinogen promoters, which lead to metabolic activation and initiate oncogenesis. The reactive form of the chemical substance is electrophilic; with its contact and interaction with the DNA it causes the promutagen effect [4,5,6,7,8,9,10,11,12].

General epidemiological markers

Chart 1: The incidence of cancer and mortality due to cancer in the period between 2008 and 2012 and the prevalence at the end of 2012 [2,15].

The incidence of cancer diseases (new cases in the period of one year) in Slovenia (average between 2008 and 2012)

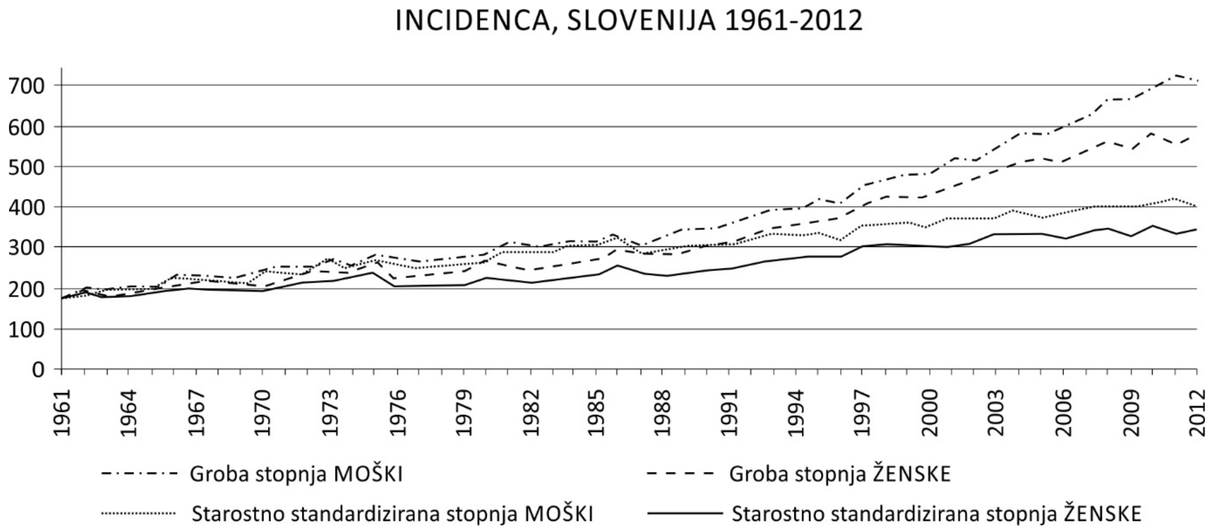
	Men	Women	Both genders
	6,997	5,902	12,899

Mortality rate (average in Slovenia in a one-year period between 2008-2012)

	Men	Women	Both genders
	3,242	2,577	5,818

The number of live people with cancer diagnosis in Slovenia at the end of 2012 (prevalence)

	Men	Women	Both genders
	39,340	50,455	89,795



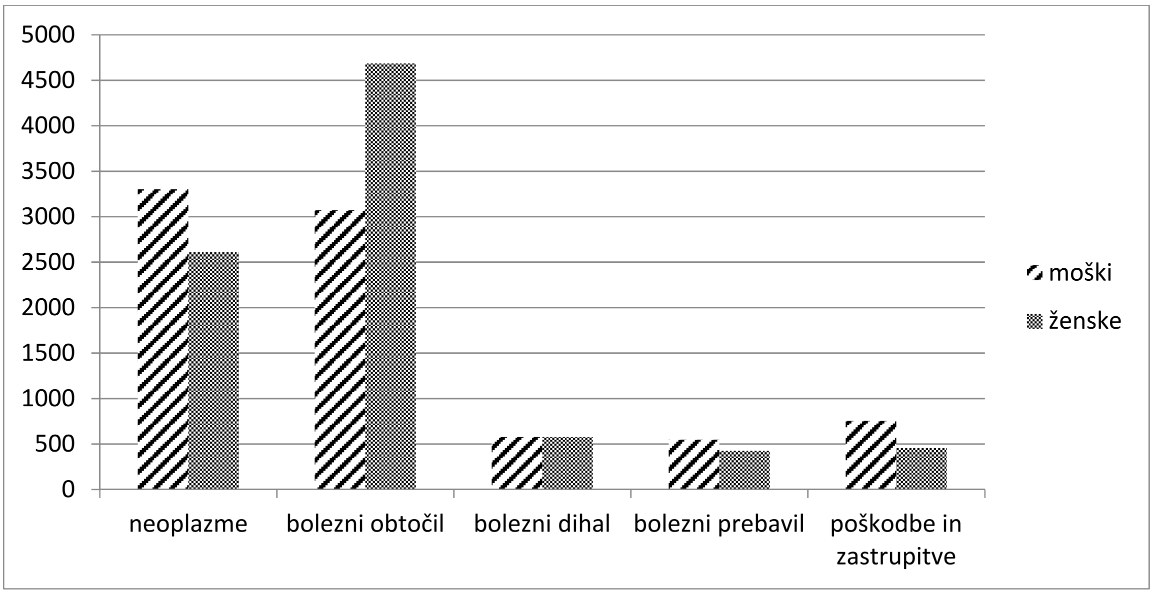
[Translation of chart]

Crude Death rate MEN — Crude Death rate WOMEN

Age-standardized incidence rate MEN — Age-standardized incidence rate WOMEN

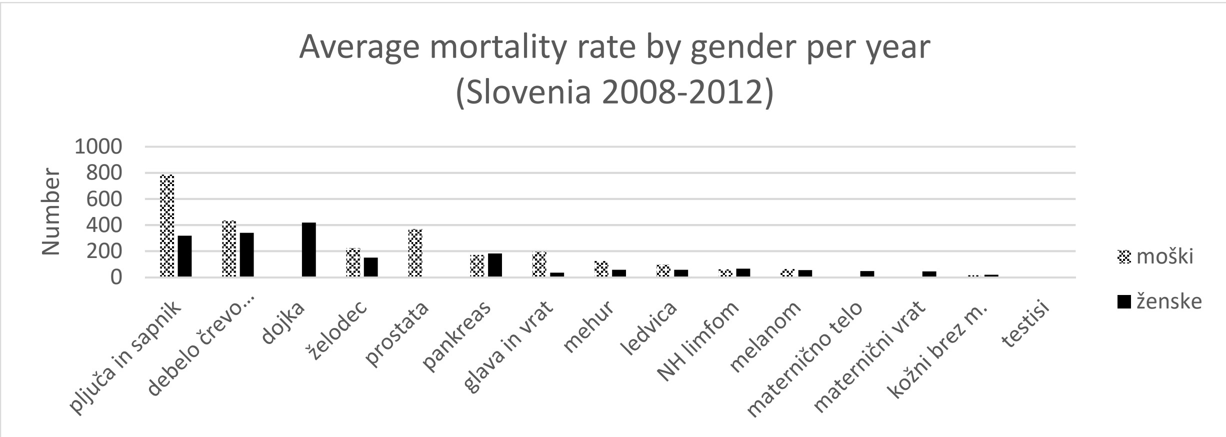
Graph 1: The incidence of cancer in Slovenia in both genders and the age-standardised rate in both genders in the observed period between 1961 and 2012 [2].

The rough as well as age-standardized incidence rate of all cancers in both genders in the observed period from 1961 to 2012 in Slovenia increases (in men more than in women).
The rough mortality rate is also increasing, in the past 10 years by 1.6% per year, while in the age-standardized rate for all cancers in both genders is decreasing. Yearly, the age-standardized mortality rate decreases by 0.8% (in men more than women)



Graph 2: Causes of mortality according to the five most important reasons and gender in Slovenia in 2014 [2].

In 2014, the leading cause of mortality in women was circulatory diseases, the second was neoplasms, followed by respiratory diseases, gastrointestinal diseases, injuries and poisoning. The leading cause of death in men was neoplasms, the second was circulatory diseases, followed by injuries, poisoning, gastrointestinal diseases and respiratory diseases.
The frequency of cancer increases rapidly with age, because cancer is extremely rare in childhood and adolescence and in early adulthood. With middle age the frequency increases rapidly. In childhood the most frequent cancer is leukaemia, between 20 and 34 years of age testicular cancer and cervical cancer, between 35 and 49 years of age the most frequent cancer in men is oral cavity and lung cancer, while in women breast and cervical cancer. Colon and rectum cancer is the most frequent cancer disease in both genders between the age of 50 and 74, in advanced age prostate cancer is most common in men and breast cancer, colon and rectum cancer and gastric cancer in women.
In men, most new cases of cancer, 31.4% and 31.8%, occur in the age groups of 65-74 and 50-64 years old, in the third place at 28.8% is the 75 years old and older group. The age group 35-49 years follows with 5.9%, the age group 20-34 years with 1.7% and in the last place is the age group 0-19 years with 0.4%.
In women, most new cases of cancer are in the age group 75 years old and older with 34.0%, following is the age group 50-64 years with 29.3% and in the third place is the age group 65-74 years with 22.7%. Next is the age group 35-49 years with 10.9%, the age group 20-34 years with 2.7% and in the last place the age group 0-19 years with 0.4%.
The most common cancer in men is prostate cancer, the second is colon and rectum cancer, third skin cancer without melanoma and lung cancer. The most common cancer in women is breast cancer, followed by skin cancer, colon and rectum cancer and lung cancer [2,15].

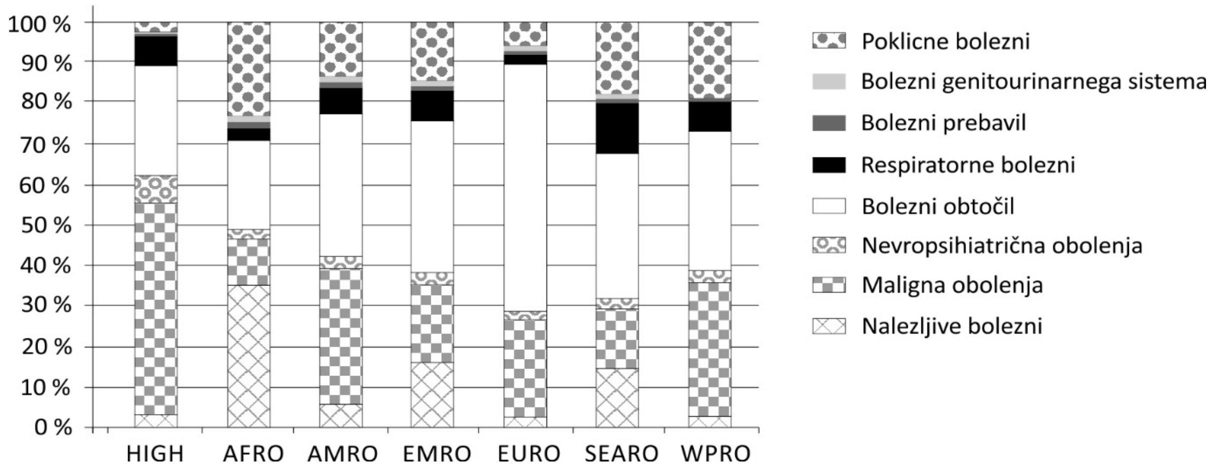


Graph 3: The average mortality rate due to cancer by gender per year in Slovenia in the period between 2008-2012 [2].

In men, during the observed period the highest mortality was due to lung cancer and trachea cancer, followed by colon and rectum cancer and prostate cancer. In women, the highest mortality rate was due to breast cancer, followed by colon and rectum cancer, lung cancer and trachea cancer [2,15].

Occupational Cancer

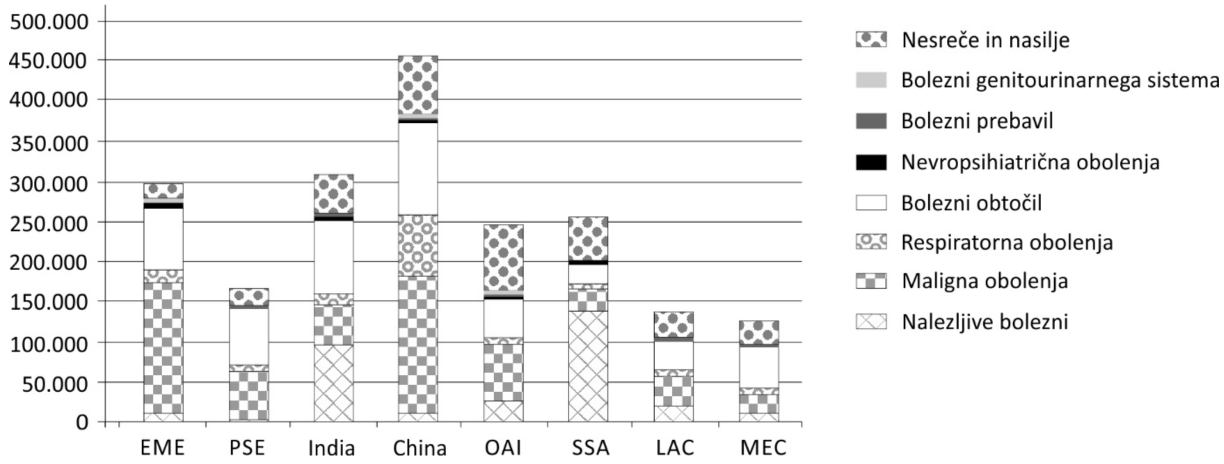
According to WHO/IARC every year 8.2 million people die of cancer in the world. Every year 14 million new cases of cancer are discovered. According to evaluations, by the year 2035 cancer mortality will increase by 78 percent and cancer incidence by 70 percent. In the EU28 there were 1.314 million deaths due to cancer in 2013.
There is no doubt that cancer is the greatest cause of occupational death in countries with high income (WHO classification), including the EU. Lung cancer represents 54-75 percent of all occupational cancers. Epidemiological studies show it is estimated that occupational exposure cause 5.3-8.4 percent of all cancers and 17-29 percent of all deaths due to lung cancer in men. Out of 102,500 deaths due to occupational cancer in the EU28, asbestos is the cause of 30,000 to 47,000 deaths, and the numbers are still growing.
The mortality caused by cancer has increased relatively, because the mortality due to other diseases has been reduced. Cancers caused by exposure to agents in the workplace, such as lung cancer, have a high mortality rate. The ten top occupational carcinogens cause approximately 85 percent of all deaths due to occupational disease.
In 1981 Doll and Peto estimated that exposure to factors in the workplace causes 4 percent of all deaths due to cancer and 12.5 percent of deaths due to lung cancer. These numbers were underestimated considering current knowledge and the gradually increasing number of carcinogens recognized by the IARC. Approximately 17-29 percent of all cases of lung cancer in men is caused by occupational exposure, occupational cancer represents 54-75 percent of all occupational cancers.
According to the newest global data of the ILO (data from 2010 and 2011), every year approximately 666,000 cases of death elated to occupational cancer are recorded [8,10,11,16].



THE WORLD BANK REGIONS EME - Marketing Economy, FSE - Former Socialist Economy, IND - India, CHN - China, OAI - Other Asian Countries, SSA - Sub-Saharan Africa, LAC - Latin America and the Caribbean, MEC - Middle-Eastern Countries

Graph 4: The global estimated occupational mortality, absolute numbers [14].

The graph shows that the highest mortality rate due to occupational cancer is in China and in the area of the Marketing Economy and the lowest in Middle-Eastern Countries and in the area of Latin America and the Caribbean.



HIGH - High-Income Countries, AFRO - African Region, AMRO - American Region (low and medium-income countries), EMRO - Eastern Mediterranean Region (low and medium-income countries), EURO - European Region (low and medium-income countries), SEARO - South-Eastern Asian Region (low and medium-income countries), WPRO - Western-Pacific Region (low and medium-income countries)

Graph 5: The burden caused by occupational cancer and other occupational diseases according to WHO regions in 2014 [14].

The graph shows that in 2014 the burden caused by occupational cancer was the highest in high-income countries, followed by the countries in Western-Pacific Region and the American Region. The lowest burden was in the countries of the African Region.

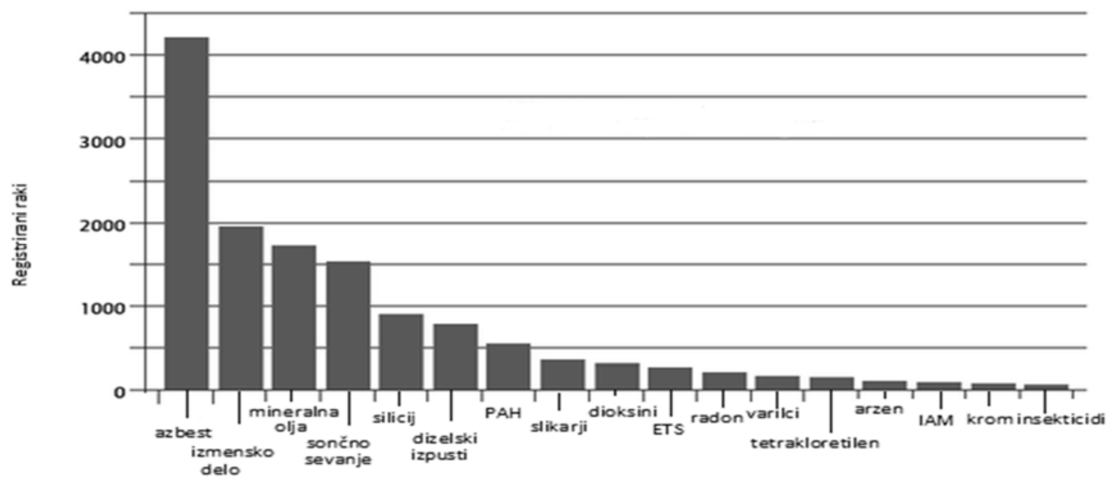
The ILO's global assessments show that every year in high-income countries according to the WHO classification, involving among others the USA, Canada, most countries of the European Union, Japan, Australia, New Zealand and Singapore, 212,000 deaths occur due to occupational cancer, according to the WHO's mortality rate data from 2011. In the recent report for the Greek presidency at the Conference on Occupational Safety and Health in 2014, there were 102,500 deaths in the EU due to occupational cancer.

The former global estimations on occupational cancers by the ILO showed that 32 percent of all world deaths related to occupation, were cancer-related. However, occupational cancer is quickly becoming globalized and in many industrialized countries the percent of deaths due to occupational cancer among all occupational deaths is approaching the percentage in high-income countries. For example in the EU, occupational cancer related death already reaches as high as 53 percent of all occupational deaths.

Occupational carcinogens affect 1 out of 5 workers in the EU according to the EU Carex data (databases of carcinogen exposure) or 23 percent of employees are exposed to carcinogens. The latest data according to a recent study is 43 percent in Canada and 37.6 percent in Australia.

Most often the workers were exposed to ultraviolet radiation in the sunlight (during regular work outside) and tobacco smoke from the environment (ETS) (in restaurants and other workplaces), where these two kinds represented almost one half of all exposures.

From the beginning of the 90s exposure to environmental tobacco smoke in the workplace was considerably reduced because of bans and other restrictions. Other relatively frequent exposures, which have probably been reduced, include lead, ethylene dibromide (an additive used in leaded gas), asbestos and benzene [14].



Graph 6: The most common carcinogens in occupational exposure in Great Britain [14].

In Great Britain, the most common carcinogen that workers are occupationally exposed to is asbestos, followed by shift work, mineral oils, solar radiation, silicon, diesel exhausts and PAH and others.

Chart 2: The share of deaths caused by the main correctable factors of environmental and lifestyle risk, contributing to cancer mortality [9].

The factors of danger	**The share of all cancer-related deaths %**
Smoking	16
Improper diet and lack of physical activity	30
Alcohol	3
Dietary supplements	<1
Reproductive factors and sexual habits	7
Occupation	4
Environmental pollution	1 to 4
Industrial products	<1
Medicines and medical products	1
Ionizing radiation of the natural background and UV radiation	3
Infections	9
Unknown	?

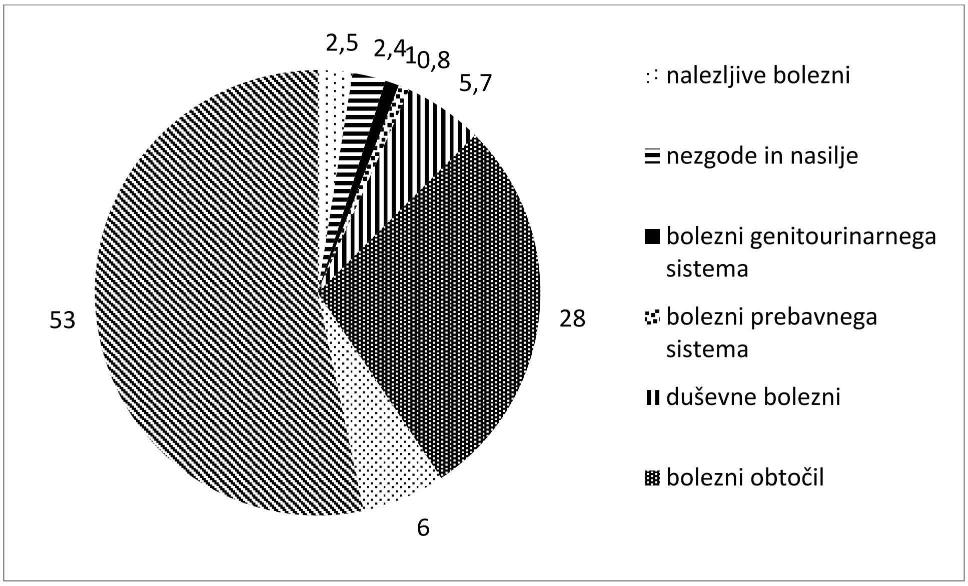
More than half of death-related deaths are caused by factors related to lifestyle. The most threatening ones are those associated with the western way of life: obesity, too nutritious food with little fibre and a sitting lifestyle, along with habits such as excessive drinking of alcohol and smoking. Among the microorganisms causing cancer, in Slovenia the most important ones are Helicobacter Pylori, causing gastric cancer and some human papillomaviruses, causing cervix cancer, rectum cancer and mucosa cancer in the mouth, the pharynx and larynx. Approximately one third of the adult population in Slovenia is infected with the above-mentioned viruses. Not all infected people get cancer, however there were approximately 3500 people living among us in 2005, having cancer caused by these infections.

Occupational exposure and environmental pollution only take the 5th and 6th place on the scale of known factors of danger. Environmental pollution can affect people's health in different ways. In medicine there are many diseases and conditions known, which are a consequence of inhalation, ingestion or other contact with dangerous substances in the environment. These are mostly acute poisonings, which are a consequence of unintentional exposure to high concentrations of dangerous substances in the working as well as living environment. Long-term exposure to lower concentrations of some substances can cause chronic changes [14,16].

Determining occupational carcinogens and their carcinogenicity

In our environment there are approximately 4 million natural and synthetic chemicals essential to everyday life, however many of them have harmful health consequences - short-term, poisonings, as well as long-term, such as cancer. The possible carcinogenicity is determined with basic research (these are short-term experiments on cell cultures and bacteria and long-term experiments on animals) and analytic epidemiological research (cohort studies as well as case and control studies).

The primary weakness of traditional epidemiology is the fact that it only works as a "warning system", because through this research we discovered occupational carcinogens only many years after the beginning of exposure (mostly 10-30 years). Because of that we cannot estimate the possible harmful consequences of newer substances, while at the same time we could be seeing the consequences of substances no longer in use today or already under strict supervision. Findings in the field of molecular biology are used more and more in the epidemiological research. This research enables better control and preventive measures before the emergence of irreparable damage. We are not equally sensitive to carcinogens. Certain phenotypes are connected to the emergence of certain types of cancer. Experimental research also plays a great role in discovery, however they are overtaken by epidemiological research. With 800 chemical tested on animal, the research has shown that 65% cause tumours in at least one animal species. When making assumptions about the danger to people based on animal testing, we must consider that larger doses and other ways of entering the body are used on animals than what people are exposed to, and also the fact that not all animal species are equally sensitive. Recent studies show that the number of carcinogens is underestimated in epidemiological studies and overestimated in experimental studies [9,11,14]. The National Institute of Occupational Health (NIOH) estimates that the risks are related to: age, gender, positive family anamnesis, lifestyle (diet, smoking, alcohol), medical condition and exposure to carcinogen factors in the working environment.



Graph 7: Yearly work-related deaths in the EU28 and other developed countries [14]

The majority of work-related deaths, as many as 53%, are caused by cancer in the EU28 and other developed countries. In the second place with 28% are diseases of the circulatory system, in the third place with 6% are respiratory diseases, in the fourth place with 5.7% are mental illnesses. They are followed by infectious diseases, accidents and violence, diseases of the genitourinary system and diseases of the digestive system.

An occupational carcinogen according to Occupational Safety and Health Administration (OSHA) is every substance or combination of substances (products) causing the increase of incidence of benign and/or malign neoplasms or significantly shorten the latent period during the exposure and the emergence of carcinoma as a result of any exposition (inhalation, ingestion or dermal exposure) and which leads to the induction of the tumour in other localizations, not being the place of its functioning.

They are split into three groups:

- chemical carcinogens (benzene, vinyl chloride, asbestos fibres...);

- physical carcinogens (UV light, ionizing radiation);
- biological carcinogens (virus of hepatitis B and C).

Besides the before-mentioned groups certain occupational circumstances, for example working as a house painter or welder, can also be associated with an increased risk for an incidence of certain types of cancer. Recent studies have also started to include the analysis of movement of work patterns, especially working at night, and their possible effects on the incidence of occupational cancer.

APPENDIX

Chart 3: Deaths caused by occupational cancer in 2011 [14]

Country	Deaths caused by occupational cancer
Andorra	17
Austria	1,820
Belgium	2,079
Bulgaria	1,445
Croatia	742
Cyprus	179
Czech	2,238
Denmark	1,242
Estonia	292
Finland	1,135
France	12,035
Germany	17,706
Gibraltar	5
Greece	2,131
Greenland	14
Guernsey	13
Hungary	1,808
Ireland	928
The Isle of Man	18
Italy	10,609
Jersey	23
Latvia	491
Lithuania	694
Luxembourg	98
Malta	75
Monaco	21
The Netherlands	3,721
Poland	7,501
Portugal	2,371
Romania	4,233
San Marino	0
Slovakia	1,150
Slovenia	442
Spain	9,807
Sweden	2,103
The United Kingdom	13,330
Together in the EU	102,517

The chart shows an approximate incidence of 102,500 deaths caused by occupational cancer in the countries in the EU. This assessment does not consider the assessment of the level of exposure in every country and is based on the data at the European level.

Chart 4: The most important carcinogens of the working environment [4]

	Carcinogen factors to people	**The organ it affects**	**Source or exposition**
1.	Nickel	Nose, nasal cavities, the bronchi, lungs	Metallurgy, alloys, catalysts
2.	Cadmium	Lungs, prostate	Dyes and pigments production
3.	Arsenic and compounds	Lungs, skin, liver	Glass, metals, pesticides
4.	Chromium (6 valent)	Nasal cavities, the bronchi, lungs	Galvanizing metals, dyes and pigments production
5.	Beryllium	Lungs, bones	The airline industry, metals
6.	Asbestos	Lungs, serous membranes-pleura, peritoneum	Insulation, filters, asbestos-cement products and asbestos-textile products
7.	Hematite	Lungs	Miners in iron ore mines
8.	Vinyl chloride	Liver	Plastics, monomer
9.	Tar, paraffin	Skin, lungs, bladder	Fuel
10.	Benzene, toluene, xylene	Leukaemia	Organic solvents, fuels, rubber manufacturing
11.	Ethylene oxide	Leukaemia	Sterilization, chemical intermediator
12.	Mineral oils	Skin	Lubricants
13.	Yperite	Pharynx, lungs	Warfare agents
14.	2-Naphthylamine	Bladder	Dyes and pigments industry
15.	Bis-ether Chloromethylethylether	Lungs	Chemical semi-finished products and by-products
16.	Oil from fossil fuels	Skin	Lubricants, fuels
17.	Soot	Skin, lungs	Pigments
18.	The fog of strong inorganic acids with sulphur	Lungs	Metals
19.	Coal tar pitch	Skin, lungs, bladder	Construction material, electrodes
20.	Wood dust	Nasal cavity	Wood industry, firewood
21.	Benzidine	Bladder	Dyes and pigments production, laboratories
22.	4-Aminobiphenyl	Bladder	Rubber manufacture

Chart 5: Agents and expositions from the living environments which also exist in the working environment and are carcinogen to people (1A group) [4]

	Carcinogen factors to people	**The organ they affect**	**Source or exposition**
1.	UV radiation (the sun) (1992)	Skin	Workers working outside
2.	Radon and its progeny (1988)	Lungs	Miners, workers in Kras caves
3.	Chronic infection with hepatitis B (1993)	Liver	Health workers
4.	Chronic infection with hepatitis C (1993)	Liver	Health workers
5.	Schistosoma haematobium infection	Bladder	
6.	Human papillomaviruses (type 16 and 18) (1995)	Cervix	
7.	Cigarette smoke	Lungs, bladder, respiratory system	Waiters
8.	Alphatoxin (1993)	Liver	Food production
9.	Erionite	Lungs, pleura	

Chart 6: Which occupations are most exposed to occupational cancer [7]

Industry	**Occupation, process**	**Localization, kind**	**Possible causal agent**
Farming, forestry, fishing	Winegrowers using arsenic-based insecticides	Lungs, skin	Arsenic compounds
	Fishermen, sailors, agriculturists	Skin, lips	UV radiation
Mining, stone quarries	Arsenic mines	Lungs, skin	Arsenic compounds
	Iron ore mines (hematite)		Radon and its progeny
	Asbestos mines	Lungs, pleural and peritoneal mesothelioma	Asbestos
	Uranium mines	Lungs	Radon and its progeny
	Talc mines and mills	Lungs	Asbestos-forming fibres containing talc
Chemical industry	Manufacture workers using bis (chloromethyl) ether and chloromethyl methyl ether	Lungs	Bis (chloromethyl) ether and chloromethyl methyl ether
	Vinyl chloride production	Angiosarcoma of the liver	Vinyl chloride monomer
	Isopropyl-alcohol production	Facial sinuses	
	Chromatid pigments production	Lungs, facial sinuses	6 valent chromium compounds
	Production and use of dyes	Bladder	Benzidine, 2-naphthylamine, 4-aminobiphenyle
	Auramine production	Bladder	Auramine and other aromatic amines used in these processes
	Production of para chloro toluidine	Bladder	Para chloro toluidine and its strong acidic salts

leather	Footwear production	Facial sinuses, leukaemia	Leather dust, benzene
Wood and its products	Furniture production	Facial sinuses	Wood dust
Pesticide and herbicide production	Producing and packaging of arsenic-based pesticides	Lungs	Arsenic compounds
Rubber production	Rubber manufacture	Leukaemia, bladder	Benzene, aromatic amines
	Vulcanization	Leukaemia	Benzene
	Milling, mixing	Bladder	Aromatic amines
	Synthetic latex production, vulcanization, cable production	Bladder	Aromatic amines
	Rubber membranes production	Leukaemia	Benzene
Asbestos production	Insulation material production (pipes, panels, textile, asbestos, cement)	Lungs, pleural and peritoneal mesothelioma	Asbestos
Metals	Aluminium production	Lungs, bladder	Polycyclic aromatic carbohydrates, tar evaporation
	Copper smelter	Lungs	Arsenic compounds
	Chromate production	Lungs, facial sinuses	6 valent chromium compounds
	Chromium plating products	Lungs, facial sinuses	6 valent chromium compounds
	Ferrous metal foundries	Lungs	
	Nickel processing	Lungs, facial sinuses	Nickel compounds
	Cadmium production and processing: batteries, alloys, pigments, electro pads, zinc smelters, polyvinylchloride production	Lungs	Cadmium and its compounds
	Cleaning and mechanical treatment of Beryllium (production involving Beryllium)	Lungs	Beryllium and its compounds
Shipbuilding, motor vehicle, train and road maintenance equipment production	Workers in shipbuilding, car industry, train industry and road workers	Lungs, pleural and peritoneum mesothelioma	Asbestos
Gasoline production	Workers in coke industry	Lungs	Benzo (a) pyrene
	Workers working with gasoline	Lungs, bladder, scrotum	Coal carbonization production, beta-naphthylamine
	Workers in gas stations	Bladder	Alpha/beta naphthylamine
Construction	Workers in insulation and pipe instalment	Lungs, pleural and peritoneum mesothelioma	Asbestos
	Roofers, asphalt workers	Lungs	Polycyclic aromatic carbohydrates
Others	Health workers	Skin, leukaemia	Ionizing radiation
	Painters, construction, car painters, welders	Lungs	

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OCENJEVANJE TVEGANJA ZA NASTANEK POKLICNE BOLEZNI

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POVZETEK: Zaradi pomanjkljivih predpisov po letu 1991 v Sloveniji ni v pričakovanem obsegu potekala verifikacija poklicnih bolezni. Edina izjema so bile azbestne poklicne bolezni. Ocenjuje se, da tudi zato v številnih delodajalčevih listinah »izjava o varnosti z oceno tveganja« ni ocenjeno tveganje za nastanek poklicnih bolezni. Da bi spodbudila ocenjevanje tveganja za njihov nastanek, je Zveza svobodnih sindikatov Slovenije (ZSSS) zato v letu 2016 v okviru projekta, sofinanciranega na podlagi javnega razpisa Zavoda za zdravstveno zavarovanje Slovenije (ZZZS) za leti 2015 in 2016, med drugim v sodelovanju s Kliničnim inštitutom za medicino dela, prometa in športa iz Ljubljane natisnila publikacijo z naslovom »Izbrane/pomembnejše poklicne bolezni« in jo brezplačno razdelila vsem, ki v Sloveniji za delodajalce ocenjujejo tveganje na delovnih mestih. Da bi se zmanjšala pogostnost poklicnega raka, je ZSSS v letu 2016 izvajala tudi kampanjo za določitev evropskih obvezujočih mejnih vrednosti za najmanj 50 najpogostejših karcinogenov na delovnem mestu.

Ključne besede: poklicne bolezni, izjava o varnosti z oceno tveganja, poklicni rak

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Zakon o varnosti in zdravju pri delu (ZVZD-1[1]) med drugim določa, da mora delodajalec pisno oceniti tveganje oziroma verjetnost nastanka ter resnost posledic ne le za nezgode pri delu ampak tudi za poklicne bolezni in bolezni v zvezi z delom. Inšpekciji dela mora takoj prijaviti ne le vsako nezgodo pri delu s smrtnim izidom oziroma nezgodo pri delu, zaradi katere je delavec nezmožen za delo več kot tri delovne dni, kolektivno nezgodo, nevarni pojav ampak tudi vsako ugotovljeno poklicno bolezen. Delodajalci niso inšpekciji dela v letu 2014 prijavili niti enega, v letu 2015[2] pa en primer poklicne bolezni[3]. Zavod za pokojninsko in invalidsko zavarovanje Slovenije (ZPIZ) v postopkih ugotavljanja delovne invalidnosti letno prizna od 25 do 50 poklicnih bolezni, po ocenah Kliničnega inštituta za medicino dela, prometa in športa pa bi jih morali pričakovati od 800 do 1000[4].

Inšpektorat RS za delo razmeroma učinkovito zbira statistiko o nezgodah pri delu[5], zato se ustvarja vtis, da so nezgode pri delu večje tveganje od poklicnih bolezni. Po podatkih Zavoda za pokojninsko in invalidsko zavarovanje (ZPIZ)[6] je bila poškodba pri delu vzrok invalidnosti v 2,4 % in poklicne bolezni

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[1] UL RS 43/2011

[2] http://www.id.gov.si/si/o_inspektoratu/javne_objave/letna_porocila/

[3] Inšpektoratu pa niso bile prijavljene azbestne poklicne bolezni, ki so bile edine poklicne bolezni, za katere je v Sloveniji v letu 2015 obstajal predpis o postopku za njihovo verifikacijo. Komisija za odpravljanje posledic dela z azbestom (pri Ministrstvu za delo, družino, socialne zadeve in enake možnosti) poroča, da je bilo v letu 2015 verificiranih 17 plakov oziroma bolezni plevre, 7 azbestoz in 23 mezoteliomov oziroma pljučnih rakov – od tega 2 okoljska.

[4] Izbrane/pomembnejše poklicne bolezni, Ocenjevanje tveganja za poklicne bolezni, ISBN 978-961-6708-26-5, ZSSS, 2016

[5] V letu 2015 so delodajalci na inšpektorat prijavili skupaj 9483 nezgod pri delu, od tega 116 nezgod, ki so se zgodile na poti na delo ali z dela, 24 smrtnih nezgod, 431 težjih in 8901 lažjo nezgodo, 8 kolektivnih nezgod ter 3 smrtne nezgode, v katerih so delavci umrli zaradi posledic bolezni. Pristojni inšpektorji so v letu 2015 raziskali 87 nezgod pri delu, od tega 12 smrtnih, 56 težjih, 18 lažjih in 1 kolektivno nezgodo. Na področju rudarstva se je po podatkih rudarske inšpekcije v letu 2015 zgodilo 151 nezgod pri delu, od tega 143 lažjih in 8 težjih. Rudarska inšpekcija smrtnih nezgod v letu 2015 ni zabeležila.

[6] www.zpiz.si

v 0,2 % primerov. Resnica pa je ravno obratna. Po mednarodnih ocenah naj bi v Sloveniji letno samo zaradi poklicnega raka umrlo 440 ljudi[7]. Za primerjavo: v letu 2015 se je po podatkih Inšpektorata RS za delo na delovnem mestu ali delovnem okolju v času opravljanja dela dogodilo 24 smrtnih nezgod pri delu.

Republika Slovenija je z Aktom o notifikaciji nasledstva MOD[8] v svoj pravni red prevzela Konvencijo št. 121 o dajatvah za nesreče pri delu in poklicne bolezni[9]. Po njej je dolžna zagotoviti vsem delavcem v primeru bolezni in invalidnosti, ki so posledice poškodbe pri delu ali poklicne bolezni, zdravniško nego, zdravljenje in druge storitve, ki so nujne za ponovno vzpostavitev zdravstvene sposobnosti za delo. Če je mogoče pa tudi denarno nadomestilo oziroma dajatve, ki zagotavljajo ustrezno minimalno materialno raven za delavce in vzdrževane družinske člane. Država je dolžna predpisati zavarovanje za primer poškodbe pri delu in poklicne bolezni. Minimalni priporočeni seznam poklicnih bolezni MOD je v prilogi konvencije. Države morajo določiti nacionalni seznam in predpisati pogoje, pod katerimi se štejejo za poklicne[10].

V Republiki Sloveniji obvezno zavarovanje za primer poškodbe pri delu in poklicno bolezen predpisujeta dva zakona:

1. Zakon o pokojninskem in invalidskem zavarovanju (ZPIZ-2)[11],
2. Zakon o zdravstvenem varstvu in zdravstvenem zavarovanju (ZZVZZ)[12].

V slovenskem pokojninsko-invalidskem sistemu je invalidsko zavarovanje za poškodbo pri delu in poklicno zavarovanje združeno z invalidskim zavarovanjem za poškodbo in bolezen izven dela. V primeru poklicnega vzroka je v enotnem invalidskem zavarovanju določen zgolj višji obseg pravic delovnega invalida. Prispevni stopnji sta za delodajalca 8,85 % in za delavca 15,50 %. V obveznem zdravstvenem zavarovanju pa prispevek za zavarovanje za primer poškodbe pri delu in poklicne bolezni v višini 0,53 % plačujejo zgolj delodajalci[13]. Z njim se letno zbere 77 milijonov evrov, ki pa se porabijo nenamensko.

Na videz torej Slovenija izpolnjuje svoje obveznosti na podlagi ratifikacije konvencije MOD št. 121. Dejansko pa zaradi ravnodušnosti in podcenjevanja vseh slovenskih vlad od osamosvojitve Slovenije leta 1991 dalje ni bilo predpisa, ki bi omogočal pravno veljavno verifikacijo poklicnih bolezni. Predvsem pa kljub neprestanim pozivom sindikatov in stroke ni bilo ustrezne politične volje državnih organov. Pravna podlaga je v resnici velik del tega obdobja celo obstajala, vendar državni organi niso izvajali nadzora nad njenim izvajanjem.

Po drugi svetovni vojni so problematiko poklicnih bolezni urejali naslednji predpisi:

1946 Odredba o profesionalnih obolelostih, ki se štejejo po predpisih o socialnem zavarovanju za nezgodo pri delu (Uradni list, št. 98/1946)

[7]Takala J.: Eliminating occupational cancer in Europe and globally, ISBN 1994 4446, D/2015/10.574/51, ETUI, 2015

[8] UL RS 54/1992 – MP

[9] Uradni list SFRJ št. 27/1970

[10] Priporočeni seznam poklicnih bolezni Evropske komisije: Commission Recommendation 2003/670/EC of 19 September 2003 concerning the European schedule of occupational diseases (ni prevoda v slovenščino)

[11] UL RS 96/2012, 39/2013, 102/2015

[12] UL RS 9/1992

[13] Zakon o prispevkih za socialno varnost (ZPSV), UL RS 5/1996

1958 Zakon o invalidskem zavarovanju (Uradni list FNRJ, št. 49/1958)

1958 Seznam poklicnih bolezni v smislu 46. člena Zakona o invalidskem zavarovanju, objavljen skupaj z zakonom kot njegova priloga oziroma sestavni del (Uradni list FLRJ, št. 49/1958)

1975 Družbeni dogovor o seznamu poklicnih bolezni (Uradni list SFRJ, št. 40/1975) – razveljavljen leta 1983

1976 Sklep SPIZ o izvajanju družbenega dogovora o seznamu telesnih okvar in družbenega dogovora o seznamu poklicnih bolezni (Uradni list SRS, št. 1/1976)

1983 Samoupravni sporazum o seznamu poklicnih bolezni (Uradni list SFRJ, št. 38/1983) - razveljavljen šele leta 2003

1997 Pravilnik o določitvi poklicnih bolezni zaradi izpostavljenosti azbestu (Uradni list RS, št. 26/1997) - razveljavljen od 2007

2002 Pravilnik o preventivnih zdravstvenih pregledih (Uradni list RS, št. 87/2002, 29/2003, 124/2006, 43/2011) je v 15. členu določil, da pooblaščeni zdravnik v 30 dneh po usmerjenih obdobnih pregledih posreduje delodajalcu poimenski seznam delavcev, na katerem med drugim sporoči tudi ugotovljene poklicne bolezni in sume na poklicne bolezni.

2003 Pravilnik o seznamu poklicnih bolezni (Uradni list RS, št. 85/2003), ki ga je izdal Minister za delo, družino in socialne zadeve, je določil, da se z dnem uporabe tega pravilnika preneha uporabljati samoupravni sporazum o seznamu poklicnih bolezni (Uradni list SFRJ, št. 38/1983). V členu 6 tega pravilnika pa je določba, da se za poklicne bolezni iz 48. točke seznama poklicnih bolezni, ki je sestavni del tega pravilnika, uporablja Pravilnik o določitvi poklicnih bolezni zaradi izpostavljenosti azbestu (Uradni list RS, št. 26/1997). Pravilnik o seznamu poklicnih bolezni iz l. 2003 je razveljavil 428. člen ZPIZ-2. V skladu z 424. členom bi moral minister, pristojen za zdravje, izdati nadomestni predpis najkasneje do 1. 1. 2014. A ga do l. 2016 še ni.

2003 Seznam poklicnih bolezni je bil priloga leta 2013 razveljavljenega Pravilnika o seznamu poklicnih bolezni (UL RS 85/2003). Še vedno velja na podlagi 424. člena ZPIZ-2.

2007 Pravilnik o pogojih za določitev bolezni zaradi izpostavljenosti azbestu in merilih za določitev višine odškodnine (Uradni list RS, št. 61/2007, 92/2008)

2013 Pravilnik o prijavah na področju varnosti in zdravja pri delu (Uradni list RS, 54/2013) – obrazec za prijavo poklicne bolezni v prilogi 3 je brez rubrike o vrsti poklicne bolezni, ki se prijavlja

Ta zaporedni seznam predpisov kaže, da je, čeprav ga državni organi niso uveljavljali, do leta 2003 veljal samoupravni sporazum iz leta 1983 s seznamom 46 poklicnih bolezni. Po njem je bilo do leta 1990 letno verificiranih praviloma do 800 poklicnih bolezni letno, po tem letu pa je verifikacija praktično zastala. Če je zdravnik specialist medicine dela pred letom 1990 posumil, da gre za poklicno bolezen, je delavca napotil na Klinični inštitut za medicine dela prometa in športa, kjer se je izvedla diagnostika oz. verifikacija. Verifikacijski pogoji so veljali kot del doktrine in niso bili zapisani (z izjemo za vibracijske bolezni). Izvedenskega mnenja Kliničnega inštituta nihče ni izpodbijal. Po letu 1990 izvedensko mnenje inštituta ni imelo več pravne veljave.

Zveza svobodnih sindikatov Slovenije (ZSSS) je ob 28. aprilu 2016, svetovnem dnevu varnosti in zdravja pri delu in mednarodnem delavskem spominskem dnevu znova podobno kot zadnjih četrt stoletja pozivala ministrico za zdravje k sprejemu pravilnika, ki bo v skladu s 424. členom Zakona o pokojninskem in invalidskem zavarovanju (ZPIZ-2) končno določil poklicne bolezni in dela, na katerih se pojavljajo te bolezni, pogoje, ob katerih se štejejo za poklicne bolezni, in postopek ugotavljanja, potrjevanja in prijavljanja poklicnih bolezni. Zakonski rok za njegov sprejem je bil 1. 1. 2014. Ministrica je 23. 9. 2016 končno imenovala delovno skupino za pripravo predloga Pravilnika o poklicnih boleznih, ki je oktobra 2016 prvič obravnavala izhodišča za novi pravilnik. Novi pravilnik bo zagotovo moral določiti postopek verifikacije poklicnih bolezni, ki bo finančno neodvisen od delodajalca. Izvajalci medicine dela, ki za delodajalca izvajajo preventivne zdravstvene preglede in naj bi na njih ugotavljali sum poklicne bolezni, so namreč od delodajalca še vedno finančno odvisni. Njihove storitve namreč ne plača obvezno zdravstveno zavarovanje ampak delodajalec.

Takšno je torej normativno stanje na področju poklicnih bolezni, ki se zagotovo odraža tudi v ocenjevanju tveganja za nastanek poklicnih bolezni v skladu z Zakonom o varnosti in zdravju pri delu (ZVZD-1). Žal v Sloveniji doslej ni bilo sredstev za raziskavo na nacionalni ravni o tem, katera tveganja so ocenjena v delodajalčevih listinah "izjava o varnosti z oceno tveganja". Izkustvo pa nakazuje, da tudi številni največji delodajalci v svojih ocenah tveganja nimajo ocenjenega tveganja za nastanek niti ene same poklicne bolezni.

Zveza svobodnih sindikatov Slovenije (ZSSS) je v svojih pozivih vladi, ministrom za delo in zdravje vedno poudarjala, da nepriznanje poklicne bolezni pomeni kršitev človekovih in delavskih pravic poklicno obolelih. Če poklicne bolezni niso priznane, ni podlage za določanje preprečevalnih ukrepov, zato posledično pri nas brez dvoma poklicno obolevajo vedno novi delavci. Tudi Inšpektorat RS za delo v svojem letnem poročilu opozarja da v Evropski uniji narašča število poklicnih bolezni, povezanih z nevarnimi kemičnimi snovmi na delovnih mestih in bi torej morali temu področju tudi v Sloveniji nameniti posebno skrb. Evropska raziskava ESENER 2 kaže, da se Slovenija uvršča med države z nizko ozaveščenostjo delodajalcev o tveganjih zaradi nevarnih kemičnih snovi[14].

Da bi preprečila poklicno obolevanje delavcev smo zato v Zvezi svobodnih sindikatov Slovenije (ZSSS) v zadnjih dveh letih:

1. pozvali Vlado in ministrico za zdravje k sprejetju Pravilnika o poklicnih boleznih,
2. predlagali ministrstvu za delo sprejem nacionalne strategije do 2020 na področju varnosti in zdravja pri delu, ki naj določi med kazalnike ravni varnosti in zdravja pri delu tudi število delavcev, ki so na svojem delovnem mestu izpostavljeni tveganjem za nastanek poklicne bolezni (hrup, nevarne kemikalije …),
3. pozvali Evropsko komisijo in Vlado RS k dopolnitvi Direktive 2004/37/ES o varovanju delavcev pred nevarnostmi zaradi izpostavljenosti rakotvornim ali mutagenim snovem pri delu, da bodo določene mejne vrednosti za vsaj 50 najbolj pogostih karcinogenov na evropskih delovnih mestih,
4. izdali priročnika za usposabljanje delavskih zaupnikov za varnost in zdravje pri delu s posebnim poudarkom na ozaveščanju o potrebnosti ocenjevanja tveganja za nastanek poklicnih bolezni[15]:
    - Žepni priročnik za delavske zaupnike za varnost in zdravje pri delu[16], 2014,
    - Priročnik za delavske zaupnike za varnost in zdravje pri delu: Učinkovito ocenjevanje tveganja[17], 2016,

[14] https://osha.europa.eu/sl/surveys-and-statistics-osh/esener/2014

[15] Publikacije so nastale s sofinanciranjem na podlagi javnih razpisov Zavoda za zdravstveno zavarovanje Slovenije (ZZZS) za sofinanciranje projektov zdravja na delovnem mestu v letu 2013 in 2014 (UL RS 35/2013) in v letu 2015 in 2016 (UL RS 8/2015)

[16] ISBN 978-961-6708-24-1

[17] ISBN 978-961-6708-25-8

5. v sodelovanju s Kliničnim inštitutom za medicino dela, prometa in športa izdali publikacijo z naslovom »Izbrane/pomembnejše poklicne bolezni, Ocenjevanje tveganja za nastanek poklicnih bolezni[18]«, 2016.

Da bi spodbudili ocenjevanje tveganje za nastanek poklicnih bolezni bomo publikacijo »Izbrane/pomembnejše poklicne bolezni, Ocenjevanje tveganja za nastanek poklicnih bolezni« brezplačno razdelili vsem, ki v Sloveniji za delodajalce pripravljajo strokovne podlage za oceno tveganja.

[18] ISBN 978-961-6708-26-5

ASSESSING THE RISKS OF THE OCCURRENCE OF OCCUPATIONAL DISEASE

Lučka Böhm

ABSTRACT: Due to insufficient regulations after 1991 in Slovenia, the verification of occupational diseases was not performed in the expected extent. The only exceptions were occupational diseases caused by asbestos. It is thought that among many employers' documents, "the statement on safety with the estimation of risk" does not include risk assessment regarding the occurrence of occupational diseases. To encourage risk assessment of their occurrence The Association of Free Trade Unions of Slovenia (ZSSS) in 2016 within the project funded on the basis of a public call for tender by the Health Insurance Institute of Slovenia (ZZZS) for 2015 and 2016, also cooperating with the Clinical Institute for Occupational, Traffic and Sports Medicine Ljubljana, printed a publication titled "Selected/Important Occupational Diseases (Izbrane/pomembnejše poklicne bolezni)" and handed it out for free to everyone assessing workplace risks for their employers in Slovenia. To reduce the frequency of occupational cancer, the ZSSS in 2016 also carried out a campaign to determine the European binding limits for at least 50 most common carcinogens in the workplace.

Keywords: occupational diseases, the statement on safety with risk assessment, occupational cancer

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The Occupational Health and Safety Act (ZVZD-1[19]) determines that the employer must, in written form, assess the risk or probability of occurrence and the severity of the consequences not only for occupational accidents but also for occupational diseases and work-related diseases. He must immediately report to the work inspection every accident with a fatal outcome or occupational accident, which caused the worker to be incapable of work for more than 3 work days, a collective accident, a dangerous occurrence as well as every diagnosed occupational disease. Employers did not report even one case of occupational disease in 2014,[20] and only one case in 2015[21]. The Pension and Disability Insurance Institute of Slovenia (ZPIZ) acknowledges 25 to 50 cases of occupational diseases per year in their processes of verifying occupational disabilities, while the Clinical Institute for Occupational, Traffic and Sports Medicine estimates there should be approximately 800 to 1000[22].

The Labour Inspectorate of the Republic of Slovenia more or less efficiently collects the statistics on occupational accidents[23], which is why an impression is being made that occupational accidents

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[19] OFFICIAL GAZETTE of RS 43/2011

[20] http://www.id.gov.si/si/o_inspektoratu/javne_objave/letna_porocila/

[21] Asbestos-related occupational diseases were not reported to the inspectorate, although they were the only occupational disease for which in Slovenia in 2015 there existed a regulation on the procedure for their verification. The Committee for the Removal of Consequences of Working with Asbestos (The Ministry of Labour, Family, Social Affairs and Equal Opportunities) reports that in 2015, 17 cases of plaques or pleural diseases were verified, 7 cases of asbestosis and 23 cases of mesothelioma or lung cancers - 2 of which were environmental.

[22] Izbrane/pomembnejše poklicne bolezni, Ocenjevanje tveganja za poklicne bolezni, ISBN 978-961-6708-26-5, ZSSS, 2016

[23] In 2015 employers reported in total 9,483 occupational injuries to the Inspectorate, of which 116 were accidents which happened on the way to or from work, 24 fatal accidents, 431 serious and 8,901 slight accidents, 8 collective accidents and 3 fatal accidents in which the workers died of consequences of a disease. Competent inspectors in 2015 investigated 87 occupational accidents of which 12 had a fatal outcome, 56 were serious, 18 were slight and 1 was a collective accident. In the field of mining, according to the mining inspection, there were 151 occupational accidents that occurred in 2015, of which 143 were slight and 8 serious. The mining inspection did not report fatal accidents in 2015.

represent a higher risk than occupational diseases. According to the data of The Pension and Disability Insurance Institute of Slovenia (ZPIZ)[24] an occupational injury was the cause of disabilities in 2.4% of cases and occupational diseases in 0.2% of cases. The truth is the opposite. By international estimations every year in Slovenia 440 people die of occupational cancer[25]. For comparison: in 2015 according to the Labour Inspectorate of the Republic of Slovenia 24 fatal accidents occurred in the workplace or in the work environment during the work hours.

The Republic of Slovenia with its Act on Notification of Succession to MOD[26] took into its legal order Convention No. 121 concerning the benefits for occupational accidents and occupational diseases[27]. According to the Convention we have a duty to provide all workers with health care and other services necessary for re-establishing a medical capability for work in case of a disability or disease which is a consequence of an occupational accident or occupational disease. If possible, we must also provide monetary compensation or benefits, which ensure an adequate minimal material level for the workers and their family members. The country is under obligation to obtain insurance in case of occupational injury and occupational disease. The minimum recommended list of occupational diseases of MOD is enclosed in the annex of the Convention. The countries must determine a national list and determine the conditions under which they are considered occupational[28].

In the Republic of Slovenia compulsory health insurance in case of occupational injury and occupational disease is regulated by two Acts:

3. The Pension and Disability Insurance Act (ZPIZ-2)[29],
4. Health Care and Health Insurance Act (ZZVZZ)[30].

In the Slovene pension-disability system, disability insurance for occupational injuries and occupational insurance is combined with disability insurance for injuries or diseases outside of work. In case of occupational causes there is only a greater extent of rights of a worker with disabilities in the united disability insurance. The contribution rates for an employer are 8.85% and for the employee 15.50%. In compulsory health insurance, the contribution for insurance in case of occupational injury or occupational disease is 0.53% and only paid by the employers[31]. The 77 million Euro raised yearly are spent as non-assigned contributions.

Seemingly, Slovenia is performing its duties on the basis of the ratification of MOD convention No. 121. In reality, due to the indifference and underestimation of all Slovenian governments since the emancipation of Slovenia in 1991, there has been no regulation enabling legally valid verification of occupational diseases. Especially, despite the constant appeals of unions and experts there was no appropriate political will from the country's authorities. The legal basis in reality has existed for a large part of this period; however the authorities did not control its execution.

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[24] www.zpiz.si

[25] Takala J.: Eliminating occupational cancer in Europe and globally, ISBN 1994 4446, D/2015/10.574/51, ETUI, 2015

[26] UL RS 54/1992 - MP

[27] Uradni list SFRJ št. 27/1970

[28] The recommended list of occupational diseases by the European Committee: Commission Recommendation 2003/670/EC of 19 September 2003 concerning the European schedule of occupational diseases

[29] UL RS 96/2012, 39/2013, 102/2015

[30] UL RS 9/1992

[31] Social Security Contributions Act (ZPSV), UL RS 5/1996

After the Second World War the problems of occupational diseases were regulated by the following acts:

1946 The Decree on Occupational Diseases Considered by the Regulation on Social Insurance for Occupational Accidents (Off. Gazette No. 8/1946).

1958 Pension Insurance Act (Off. Gazette No. 49/1958).

1958 The list of Occupational Diseases from article 46 of the Pension Insurance Act, published with the act as its annex or part of it (Off. Gazette No. 49/1958).

1975 The Social Arrangement on the List of Occupational Diseases (Off. Gazette No. 40/1975) – nullified in 1983.

1976 The Decree of SPIZ on the Implementation of the Social Arrangement on the List of Physical Injuries and the Social Arrangement on the List of Occupational Diseases (Off. Gazette No. 1/1976).

1983 The Autonomous Agreement on the List of Occupational Diseases (Off. Gazette No. 38/1983) – not nullified until 2003.

1997 Rules on the Determination of Occupational Diseases Resulting from Exposure to Asbestos (Off. Gazette No. 26/1997) - nullified since 2007.

2002 Rules concerning preventive medical examinations of workers (Off. Gazette No. 29/2003, 124/2006, 43/2011) determines in article 15 that the authorized physician must forward to the employer a list of employee names, including the diagnosed occupational diseases and suspicions of occupational diseases within 30 days after the directed periodic check-ups.

2003 Rules concerning the list of occupational diseases (Off. Gazette No. 85/2003), published by the Minister of Labour, Family, and Social Affairs state that from the day these rules become valid, the autonomous agreement on the list of occupational diseases ceases to apply (Uradni list SFRJ, št. 38/1983). Article 6 of the Rules includes a provision in relation to occupational diseases defined in item 48 of the list of occupational diseases, which is part of these regulations; the Rules on the determination of occupational diseases resulting from exposure to asbestos are used (Off. Gazette No. 26/1997). The Rules concerning the list of occupational diseases from 2003 were nullified by article 428 of ZPIZ-2. In accordance with article 424, the minister responsible for health should enact substitute regulations no later than 1st of January 2014. However, these regulations have not yet been enacted in 2016.

2003 The list of occupational diseases was an appendix to the Rules concerning the list of occupational diseases, nullified in 2013 (UL RS 85/2003). It still applies on the basis of article 424 of ZPIZ-2.

2007 Rules on the determination of occupational diseases resulting from exposure to asbestos and the standards for determining the compensation (Uradni list RS, št. 61/2007, 92/2008).

2013 Rules on reports in the field of health and safety at work (Off. Gazette No. 54/2013) - the form used to report an occupational disease in appendix 3 does not contain a column stating the type of disease being reported.

This successive list of regulations shows that, even though not being used by the authorities, up until 2003 the autonomous agreement from 1983 with a list of 46 occupational diseases was in use. Up until 1990 approximately 800 occupational diseases were verified per year, after 1990 the verification practically stood still. If a doctor specialist in occupational medicine before 1990 suspected that he is dealing with an occupational disease, he directed the worker to the Clinical Institute of Occupational, Traffic and Sports Medicine, where the diagnostics of verification took place. The verification conditions were a part of the doctrine and were not written (with the exception of vibration diseases). The expert opinion of the Clinical Institute was not challenged by anyone. After 1990 the expert opinion of the Clinical Institute did not have legal grounds any more.

The Association of Free Trade Unions of Slovenia (ZSSS) on 28 April 2016, the World Day of Occupational Safety and Health and the International Workers' Memorial Day, appealed to the Minister of Health (as they have been for the past 25 years) to pass a regulation law which would finally determine the occupational diseases and the workplaces in which these diseases occur, the conditions under which they are considered occupational diseases and the procedures of determining, verifying and reporting occupational diseases in accordance with article 424 of the Pension and Disability Insurance Act (ZPIZ-2). The statutory deadline was 1 January 2014. On 23 September 2016 the Minister finally formed a working group to prepare the proposition of the Rules regarding Occupational Diseases, which were addressed by the working group for the first time in October 2016. The new rules will definitely have to determine the procedure of verification of occupational diseases, which will be financially independent from the employer. Occupational medicine practitioners, performing preventive medical check-ups and who should be establishing the suspicion of occupational diseases, are now still financially dependent on the employers. Their services are not paid for by the compulsory health insurance but by the employer.

Therefore, this is the normative state in the field of occupational diseases, which definitely reflects on the assessment of risk of the occurrence of occupational diseases in accordance with the Occupational Health and Safety Act (ZVZD-1). Sadly, up until now there were not sufficient funds in Slovenia for research on the national level concerning the risk evaluated in the employer's documents "The Statement on Safety with a Risk Evaluation". Experience shows that many of the largest employers do not include the risk of even one occupational disease in their risk evaluations.

The Association of Free Trade Unions of Slovenia (ZSSS) in their appeals to the government always stressed to the Ministers of Health and Labour that not recognizing an occupational disease means a violation of human rights as well as working rights of person with an occupational disease. If occupational diseases are not recognized, there are no grounds for determining prevention measures, and consequently there is no doubt that workers are still becoming ill. The Labour Inspectorate of the Republic of Slovenia also warns in their annual report that the number of occupational diseases related to dangerous chemicals in the workplaces is increasing in the European Union, and we should therefore pay special attention to this field in Slovenia as well. The European research ESENER 2 shows that Slovenia is one of the countries with a low employer awareness about the risks of dangerous chemicals[32].

To prevent occupational diseases in workers, in the last two years the Association of Free Trade Unions of Slovenia (ZSSS) has:

6. appealed to the Minister of Health to pass a law on the Rules concerning occupational diseases,
7. suggested to the Minister of Labour to accept a national strategy in the field of occupational safety and health by 2020 which should determine, in addition to the indicators of occupational safety and health levels, also the number of workers exposed to risks of the occurrence of an occupational disease in the workplace (noise, dangerous chemicals ...),
8. appealed to the European Commission and the Government of the Republic of Slovenia to complement Directive 2004/37/ES on the protection of workers from dangers caused by the exposure to carcinogen or mutagen substances at work, so to determine the borderline values of at least 50 most common carcinogens in European workplaces,

[32] https://osha.europa.eu/sl/surveys-and-statistics-osh/esener/2014

9. published two manuals for qualifying the workers' trustees for occupational safety and health with a special emphasis on raising the awareness on the necessity of evaluating the risks of the occurrence of occupational diseases[33]:
   - A pocket manual for the workers' trustees for occupational safety and health[34], 2014,
   - A pocket manual for the workers' trustees for occupational safety and health: Effective Risk Evaluation[35], 2016,
10. Published in cooperation with the Clinical Institute for Occupational, Traffic and Sports Medicine a publication titled "Selected/Important Occupational Diseases, The Evaluation of Risk for the Occurrence of Occupational Diseases[36]", 2016.

To encourage the evaluation of the risk of the occurrence of occupational diseases, the publication "Selected/Important Occupational Diseases, The Evaluation of Risk for the Occurrence of Occupational Diseases" will be distributed free of charge to everyone preparing expert bases for risk evaluation for employers in Slovenia.

[33] The publications were published with funding based on the public call for tender by the Health Insurance Institute of Slovenia (ZZZS) for funding projects related to occupational health in 2013 and 2014 (UL RS 35/2013) and in 2015 and 2016 (UL RS 8/2015)

[34] ISBN 978-961-6708-24-1

[35] ISBN 978-961-6708-25-8

[36] ISBN 978-961-6708-26-5

SRBSKA UREDBA O POKLICNIH RAKAVIH OBOLENJIH

Petar Bulat

Izvleček

Srbija ima dolgo tradicijo diagnosticiranja in preprečevanja poklicnega raka. Splošno merilo za določitev poklicnih bolezni sega v leto 1992, ko je bil izdan Pravilnik za poklicne bolezni, ki je bil nato posodobljen leta 1997 in potrjen leta 2003. Čeprav so merila bolj ali manj nespremenjena v več kot 20-letnem obdobju, se pojavnost poklicnih bolezni vztrajno zmanjšuje od 13,65 primerov na 100.000 zaposlenih v letu 2000 na 0,23 v letu 2015. Registrirani primeri raka kot poklicne bolezni so izjemno redki. V zadnjih petih letih je bilo registriranih le šest primerov. Med njimi so bili štirje primeri papiliarnega tiroidnega raka, en pljučni in en kožni rak. Pet od šestih primerov je povezanih z izpostavljenostjo ionizirajočemu sevanju in štirje primeri od petih so povezani z izpostavljenostjo medicinskega osebja ionizirajočemu sevanju.

Ohlapna merila za registracijo raka kot poklicne bolezni in zanemarljivo majhna pojavnost registriranega raka kaže, da obstaja težava pomanjkljivega poročanja o poklicnih boleznih in še zlasti poklicnem raku.

Ključne besede: Poklicna bolezen, rak kot poklicna bolezen, registracija poklicnih bolezni

UVOD

V Srbiji obstaja dolga tradicija oblikovanja meril na področju usposobljenosti za delo ter meril za ugotavljanje poklicnih bolezni. Z leti so se na področju ugotavljanja in prijave poklicnih bolezni nakopičile težave, ki jih je potrebno takoj nasloviti. Med trenutne težave spada: določanje poklicnih bolezni in njihovo beleženje, seznam poklicnih bolezni (odprt ali zaprt seznam), merila za ugotavljanje, financiranje diagnostičnih postopkov ter obveščanje o poklicnih boleznih.

Gotovo je najpomembnejše določanje poklicnih bolezni, saj v Srbiji urejata poklicne bolezni dva zakona:

- Zakon o pokojninskem in invalidskem zavarovanju
- Zakon o zdravstvenem zavarovanju

Oba zakona po svoje določata poklicne bolezni, kar pomeni, da ima srbski pravni sistem dve veljavni definiciji. Po Zakonu o pokojninskem in invalidskem zavarovanju je poklicna bolezen: „Določena bolezen pridobljena med zavarovalnim obdobjem, ki jo povzroča daljši neposredni vpliv ali postopek in delovni pogoji na delovnem mestu ali pri opravljanju dela.“ [1]. Zakon o zdravstvenem zavarovanju določa poklicno bolezen kot „Bolezen, ki jo povzroča daljša izpostavljenost nevarnostim na delovnem mestu.“ [2].

Shranjevanje podatkov o poklicnih boleznih urejata dva (ali celo trije) zakoni: Zakon o zdravstvenem zavarovanju (Zakon o shranjevanju podatkov v zdravstveni negi) [3] in Zakon o varstvu pri delu in varovanju zdravja [4]. Glede na Zakon o zdravstvenem varstvu, je za organizacijo in izvajanje zbiranja podatkov in spremljanja epidemiološkega stanja na področju poklicnih bolezni odgovoren Inštitut za poklicno medicino Srbije. Vendar pa Zakon o vodenju evidence v zdravstvenem varstvu za celoten postopek shranjevanja podatkov o poklicnih boleznih pooblašča Inštitut za javno zdravje Srbije Glede na določila Zakona o varstvu pri delu in varovanju zdravja, je za vodenje evidence poklicnih bolezni zadolžen Direktorat za varstvo pri delu in varovanje zdravja, ki je pod jurisdikcijo Inšpektorata za delo.

Poleg Zakona o pokojninskem in invalidskem zavarovanju, ureja področje poklicnih bolezni tudi Pravilnik o potrjevanju poklicnih bolezni, uzakonjen leta 2003 (identičen uredbam iz leta 1997) [5]. Glede na Pravilnik in določila Zakona o pokojninskem in invalidskem zavarovanju, spada srbski seznam v kategorijo zaprtih (kar pomeni, da so lahko kot poklicne bolezni opredeljene le tiste, ki so na seznamu 56 bolezni v registru). Glede na priporočila EU iz leta 1990 [6] (ki še vedno veljajo) bi morale imeti države članice tako imenovane odprte/zaprte sezname (seznam poklicnih bolezni z možnostjo preverjanja, ali se pri bolezni, ki sicer ni na seznamu, dokaže jasna povezava med boleznijo in ogroženostjo na delovnem mestu). Srbski pravilnik določa le splošna merila za preverjane poklicnih bolezni. Splošna merila so pripeljala do dejstva, da ima vsaka organizacija, ki se ukvarja s preverjanjem poklicnih bolezni svoja interna merila. Zakonodaja torej ni predvidela niti drugega mnenja in preverjanja poklicnih bolezni niti vira financiranja diagnostičnih postopkov, potrebnih za potrjevanje poklicnih bolezni.

Poleg težav, povezanih s financiranjem potrjevanja poklicnih bolezni, se pojavljata še dve težavi, povezani z diagnosticiranjem poklicnih bolezni:

- Nejasna vloga specialista za medicino dela
- Vloga splošnega zdravnika

Ni jasno določeno, ali lahko specialist za medicino dela potrdi poklicno bolezen, kakšna je njegova vloga v postopku potrditve poklicne bolezni in kdo plača stroške njegovih storitev.
Dopolnila pravilnikov, ki predvidevajo, da stroške financiranja varovanja zdravja pri delu krijejo izključno delodajalci in ga izločajo iz zdravstvenega zavarovanja, prenašajo breme zgodnjega diagnosticiranja in odkrivanja poklicnih bolezni na splošne zdravnike, ki nimajo zadostne usposobljenosti in znanja na področju poklicnih bolezni, da bi opravljali to nalogo.

Seznam poklicnih bolezni - merila za potrjevanje poklicnega raka
Na srbskem seznamu poklicnih bolezni je 56 bolezni:

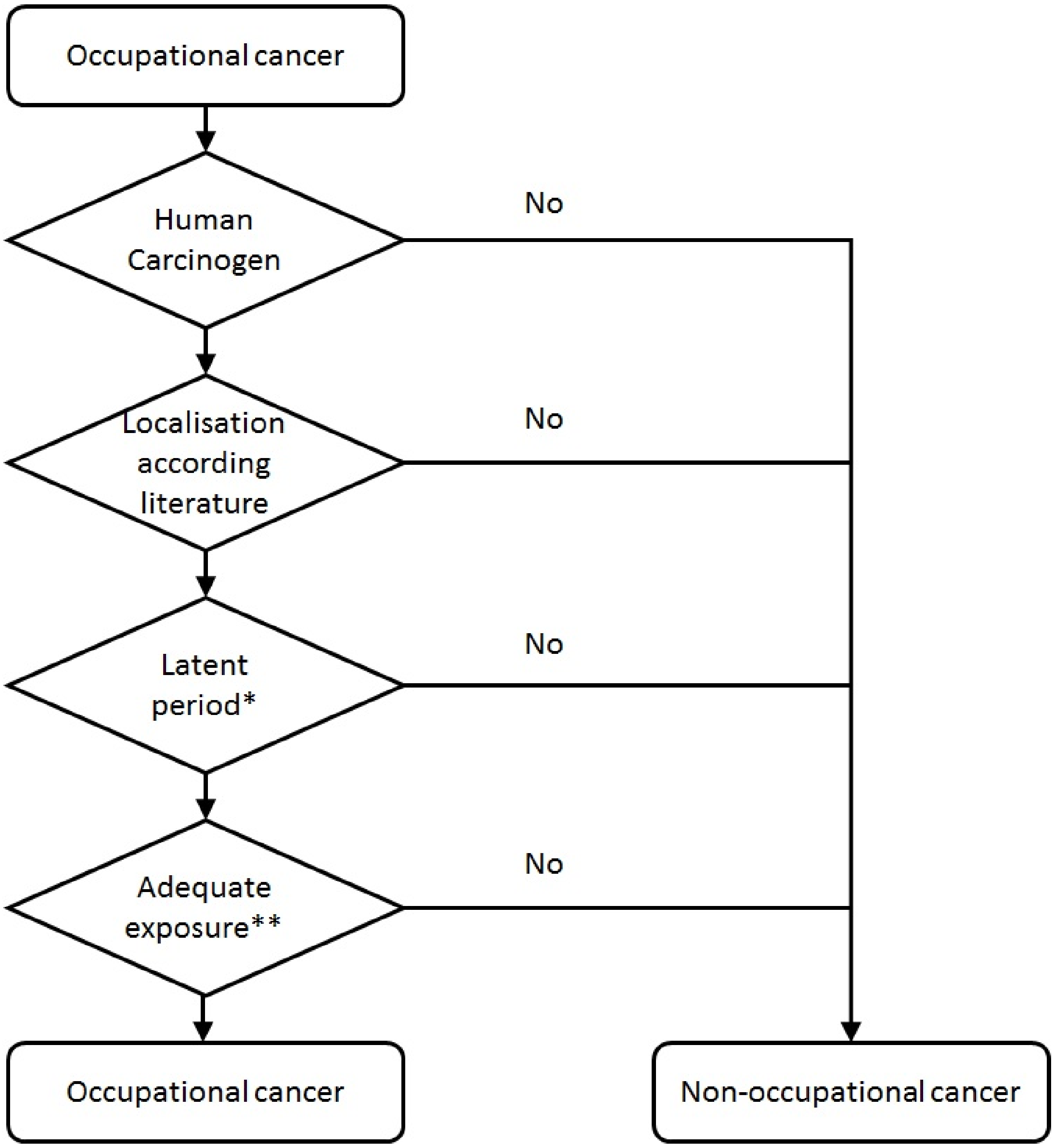
- Bolezni, ki jih povzročajo kemikalije (30)
- Bolezni, ki jih povzročajo fizične nevarnosti (9)
- Bolezni, ki jih povzročajo biološke nevarnosti (4)
- Pljučne bolezni (10)
- Kožne bolezni (2)
- Maligne bolezni (1)

Za vsako bolezen na seznamu obstajata dva kompleta potrditvenih meril:

- Merila za izpostavljenost:
- Klinična diagnostična merila

V primeru potrjevanja poklicnega raka, je Pravilnik o poklicnih boleznih precej splošen in ima prav tako dve merili. V merilih za izpostavljenost je navedeno: „Delo in delovna mesta, pri katerih lahko pride zaposleni v stik s karcinogeni“. Klinična diagnostična merila so veliko boljša in verjetno najboljši del celotnega pravilnika. V kliničnih diagnostičnih merilih je navedeno: Klinična predstavitev primera raka, ki ga je povzročilo ionizirajoče sevanje, ultravijolični žarki ali kemične rakotvorne snovi, ki so na seznamu Mednarodne agencije za raziskavo raka (IARC) kot človeški karcinogeni (skupina 1). Ta del meril za preverjanje zagotavlja samodejno posodabljanje srbskega seznama. Vendar pa ta del ni dovolj specifičen in zato je Srbski inštitut za varstvo pri delu in varovanje zdravja razvil interna merila za preverjanje poklicnega raka. Interna merila so razvita v obliki diagrama poteka, kar pomeni, da je njihova uporaba preprosta v vsakem posameznem primeru (grafikon 1). Preverjanje se začne na spletni strani IARC z ugotavljanjem karcinogenosti zadevnih kemikalij. Če so razvrščene v 1. skupino človeških rakotvornih snovi, se preverjanje nadaljuje z naslednjim korakom, v nasprotnem primeru pa se konča s sklepom, da to ni poklicni rak. Naslednji korak prav tako temelji na spletni strani IARC, kjer moramo preveriti, ali je lokalizacija zadevnega primera raka v skladu s podatki IARC. Če je rezultat tega koraka pozitiven, se preverjanje nadaljuje z naslednjim korakom, v nasprotnem primeru pa se konča s sklepom, da to ni poklicni rak. Pri tretjem koraku pregledamo podatke delodajalca glede izpostavljenosti karcinogenom, pri čemer začnemo z razpoložljivo dokumentacijo. Če je latentni čas med prvo izpostavljenostjo in izbruhom bolezni ustrezen, lahko nadaljujemo z zadnjim korakom. Če je latentno obdobje znatno krajše, kot navajajo objavljeni podatki, lahko zaključimo analizo primera z ugotovitvijo, da to ni poklicni rak. V zadnjem koraku primerjamo posredovane podatke z literaturo in ugotovimo, ali lahko vzpostavimo povezavo med izpostavljenostjo in rakom. Če pridobljeni podatki izpolnjujejo minimalna merila izpostavljenosti, določena za rakasta obolenja, je primer potrjen kot poklicna bolezen.

Slika 1. Diagram pretoka za preverjanje poklicnega raka



* Minimalno latentno obdobje, navedeno v literaturi
** Minimalna kumulativna izpostavljenost, navedena v literaturi

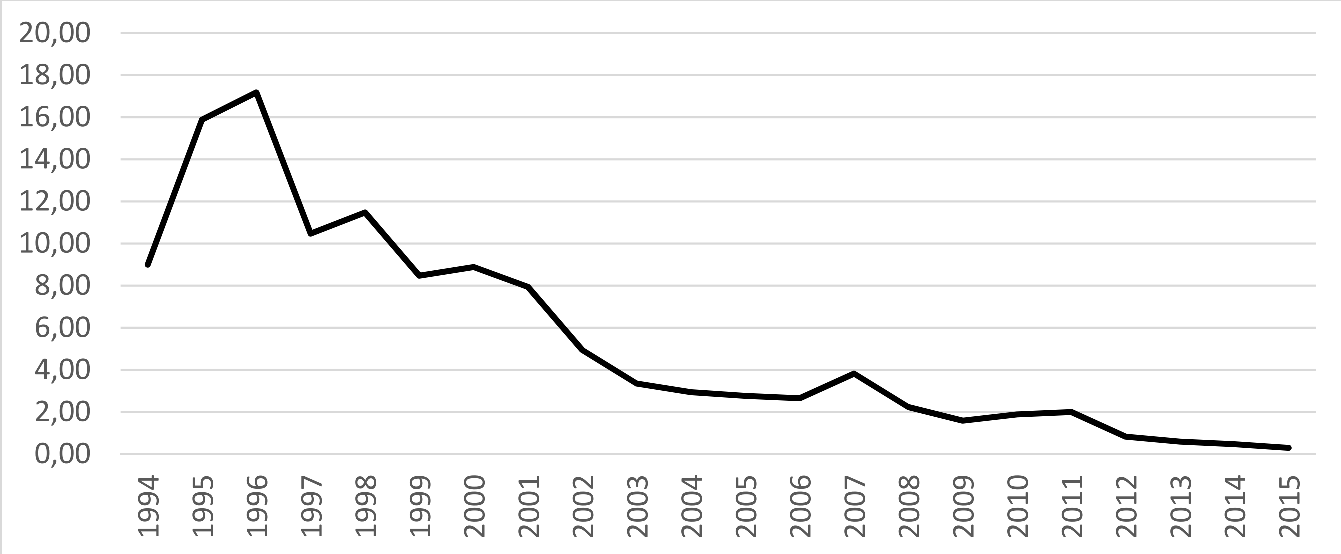
METODE

Pri analizi poklicnega raka je bila uporabljena podatkovna zbirka o preverjenih poklicnih boleznih od leta 1994. Po pretvarjanju podatkov iz formata Access mdba v obliko SPSS/PC sav, je bila opravljena analiza. Ker so v podatkovni zbirki tudi bolniki iz Črne gore, so bili v prvem koraku odstranjeni bolniki z bivališčem v Črni gori. Pri preostalih podatkih je bila opravljena osnovna statistična analiza (izbira podatkov, pogostnost in analiza navzkrižne tabele). Pri ugotavljanju pojavnosti poklicnih bolezni so bili uporabljeni podatki o delojemalcih Statističnega urada Republike Srbije.

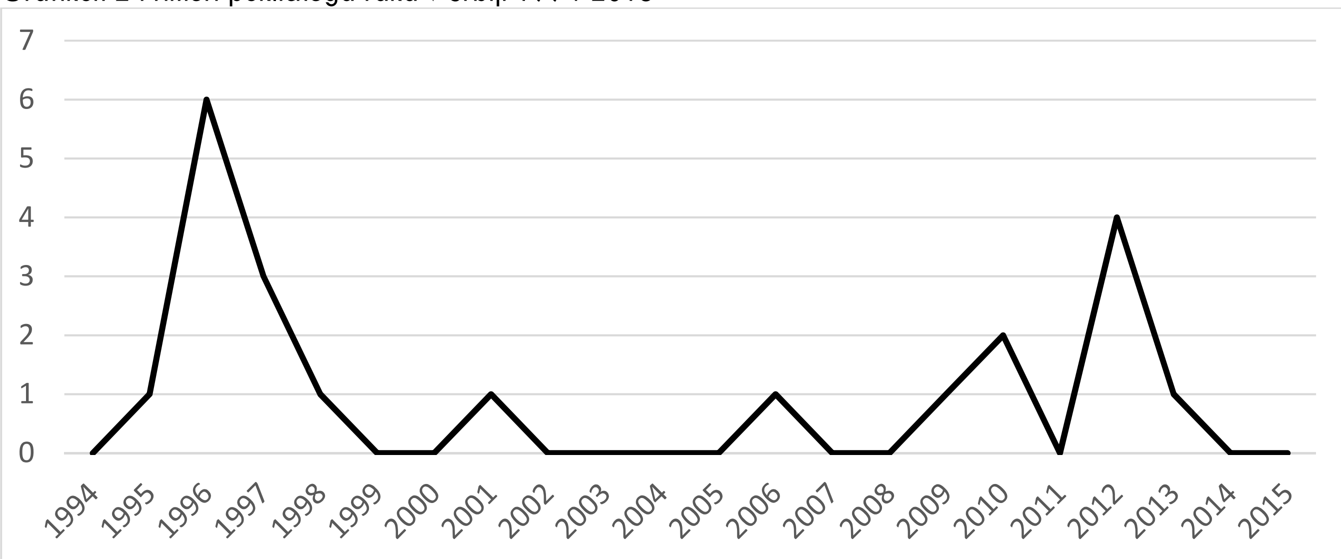
REZULTATI

Podatki o pojavnosti poklicnih boleznih v Srbiji kažejo od leta 1996 nenehno zmanjševanje (grafikon 1 Poklicne bolezni v Srbiji, pojavnost v letih 1994-2015). Od leta 2009 se je pojavnost znižala pod 2 primera na 100.000 zaposlenih. Posledično je nizka tudi pojavnost poklicnega raka. V 22-letnem obdobju je zabeleženih le 21 potrjenih primerov poklicnega raka. Med potrjenimi primeri poklicnega raka je 8 pljučnih rakov (noben mezoteliom), 5 rakov ščitnice in 3 primeri raka dojke ter 5 primerov raka drugačnega izvora. Največja pojavnost poklicnega raka je bila zabeležena v letu 1996, ko je bilo potrjenih 6 primerov poklicnega raka (grafikon 2 Primeri poklicnega raka v Srbiji 1994-2015)

Grafikon 1 Poklicne bolezni v Srbiji, pojavnost v letih 1994-2015 (na 100.000 zaposlenih).



Grafikon 2 Primeri poklicnega raka v Srbiji 1994-2015



RAZPRAVA

Pojavnost poklicnih bolezni v Srbiji je nenavadno nizka, če jo primerjamo z drugimi državami. Kot smo navedli zgoraj, je po letu 2009 padla pojavnost poklicnih bolezni pod 2 primera na 100.000 zaposlenih. V sosednji Hrvaški prav tako opažajo zmanjševanje števila primerov poklicnih bolezni. V letu 2015 je bila pojavnost 8,54 [7] kar je veliko višje kot v Srbiji (0,23 v letu 2015). Ob tem moramo pripomniti, da je v Nemčiji stopnja pojavnosti v letu 2015 94,3 (na 100.000 redno zaposlenih) [8]. Primerjava s podatki EU za leto 2001 [9] prav tako kaže, da je bila pojavnost v EU12 37,0 v primerjavi s srbskimi 7,94 (v letu 2001), kar kaže na znatno težavo pri preverjanju poklicnih bolezni v Srbiji.

Primeri poklicnega raka predstavljajo zanemarljiv del poklicnih bolezni v Srbiji. Kot smo že navedli, je bilo v zadnjih 22 letih zabeleženih le 21 potrjenih primerov poklicnega raka. Pripomniti moramo, da so vsi primeri poklicnega raka prijavljeni v zdravstvenih ustanovah, poleg tega pa so vsi povezani z ionizirajočim sevanjem. Po drugi strani pa je v Srbskem registru raka v obdobju od leta 2009 do 2013 prijavljenih 110 primerov mezotelioma in 28.285 primerov pljučnega raka. Glede na to, da lahko po navedbah v literaturi približno 20 % primerov pljučnega raka pripišemo poklicnemu raku [10] in da je 85-90 % vseh primerov mezotelioma, povezanih z azbestom, lahko izračunamo, da je bilo v obdobju 2009-2013 5657 primerov pljučnega raka vsaj 90 primerov mezotelioma. V obdobju 2009-2013 je bil v podatkovni zbirki poklicnih bolezni zabeležen le en primer pljučnega raka. Ti podatki kažejo, da je poročanje o poklicnem raku v Srbiji očitno pomanjkljivo, čeprav je država sprejela relativno sodobna merila za preverjanje poklicnega raka. Eden od vzrokov za pomanjkljivo poročanje je tudi vedno manjša vloga medicine dela kot panoge in specialistov za medicino dela v Srbiji. Ker Zakon o varstvu pri delu in varovanju zdravja [4] ne predpisujeta obveznih storitev medicine dela za delodajalca in ker zdravstveno zavarovanje ne pokriva storitev medicine dela, so ostali splošni zdravniki edina odgovorna skupina za prepoznavanje poklicnih bolezni v Srbiji. Splošni zdravniki sprejmejo v Srbiji na dan povprečno 37 bolnikov, zato je očitno, da se nimajo časa posvetiti vzroku bolezni. Poleg tega moramo omeniti, da na področju splošne medicine primanjkuje izkušenj s področja poklicnih bolezni in še zlasti poklicnega raka. Drugi razlog pomanjkljivega poročanja je nejasnost pri financiranju postopka postavljanja diagnoze pri poklicnih boleznih in dvomljiv postopek poročanja. V srbskem Pravilniku o poklicnih boleznih [5] ni jasno navedeno, niti kdo je odgovoren za potrditev poklicnih bolezni, niti kdo na koncu postopka plača stroške. Med vzroki za pomanjkljivo poročanje poklicnega raka je tudi pomanjkanje registrov izpostavljenosti karcinogenom in podatkov o izpostavljenosti. Zadnji vzrok pomanjkljivosti poročanja o poklicnih boleznih je zavarovanje – slednje ne obstaja za poklicne bolezni, kar pomeni, da ni kritja stroškov nadomestila za bolnika in načina, ki bi preprečil navzkrižje interesov delodajalca.

ZAKLJUČEK

Ohlapna merila za registracijo raka kot poklicne bolezni in zanemarljivo majhna pojavnost registriranega raka kaže, da obstaja težava pomanjkljivega poročanja o poklicnih boleznih in še zlasti poklicnem raku. Uradne osebe, zadolžene za varstvo pri delu in varovanje zdravja, morajo pravočasno ukrepati in s tem omogočiti vzpostavitev vzdržnega sistema za preverjanje poklicnih bolezni in poklicnega raka.

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ŽIVLJENJEPIS PRVEGA AVTORJA

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Rojen 9. avgusta 1961 v Beogradu. Osnovna in srednja šola zaključena v Beogradu Vpis na Medicinsko fakulteto v Beogradu leta 1980, študij zaključil leta 1986 s povprečno oceno 9,28. Zagovor magistrske naloge leta 1991 v Centru za multidisciplinarne študije Univerze v Beogradu. Doktorska disertacija na Medicinski fakulteti v Beogradu leta 1994. Specialistični izpit iz medicine dela opravljen z odliko leta 1992 na Medicinski fakulteti v Beogradu. Zagovor super specializacijske teze iz poklicne toksikologije leta 2000 na Medicinski fakulteti v Beogradu. Poleg strokovnega izobraževanja v domovini se je udeležil tudi številnih tečajev v tujini (Torino, Pavia, Wageningen, Dresden, Amsterdam) in je bil povabljen kot gostujoči doktorski raziskovalec v Gent (Belgija).
Od leta 1989 dela na Medicinski fakulteti v Beogradu kot član profesorskega zbora na Inštitutu za medicino dela, najprej kot študijski asistent, nato kot asistent od leta 1992 in kot docent od leta 1995. Izredni profesor je postal leta 2000, od marca leta 2009 pa je redni profesor. Od oktobra 2012 dela kot prodekan za klinične študije na Medicinski fakulteti v Beogradu.
Vzporedno z akademsko kariero je delal tudi na strokovnem področju, začel je leta 1989 kot klinični zdravnik na Inštitutu za medicino dela, nato kot specialist leta 1992, vodja oddelka za poklicno toksikologijo med leti 1995 in 2009 in pomočnik direktorja inštituta med leti 2001 do 2009. V obdobju od maja 2011 do oktobra 2012 je zasedel položaj pomočnika ministra za zdravje in prevzel odgovornost za področje mednarodnega sodelovanja in evropske integracije.
Petar Bulat je član Državnega sveta za varstvo pri delu in varovanje zdravja in član odbora Mednarodne organizacije za zdravje na podeželju. Od leta 2001 je član Kolegija Ramazzini. Sodeluje z mnogimi mednarodnimi organizacijami. Sekretar znanstvenega odbora Mednarodne komisije za zdravje na podeželju za področje varstva pri delu in varovanja zdravja. V obdobju med 2006 in 2015 je bil podpredsednik Evropskega združenja izobraževalnih ustanov za medicino dela. Predstavnik Ministrstva za zdravje na področju medicine dela pri Mednarodni zdravstveni organizaciji.
Avtor 25 strokovno pregledanih člankov v mednarodnih revijah.

SERBIAN REGULATION ON OCCUPATIONAL CANCER

Petar Bulat

Abstract
Serbia has a long standing tradition in diagnostics and prevention of occupational diseases. General criteria for recognition of occupational diseases has roots in 1992 Rulebook on occupational diseases which was updated 1997 and confirmed in 2003. Even if the criteria are more less the same for more than 20 years, occupational diseases incidence is constantly decreasing from 13,65 cases per 100.000 employed in year 2000 to 0,23 in 2015. Registered cases of occupational cancer are also extremely rare. In last five years only six cases have been registered. Among those five cases there were four cases of papillary thyroid cancer, one lung cancer and one skin cancer. Five out of six cases were related with ionizing radiation exposure and four out of five were in medical staff exposed to ionizing radiation.
Broad criteria for occupational cancer registration and negligible incidence of registered cancer cases indicate that there is significant problem of underreporting of occupational diseases and especially of occupational cancer.

Key words: Occupational disease, Occupational cancer, Registration of occupational diseases

INTRODUCTION

Serbia have a long tradition in developing criteria for fitness for work assessment and criteria for occupational disease verification. But, over the years, there has been an accumulation of problems in the field of verification and registration of occupational diseases that require immediate actions to address them. Current problems include: the definition of occupational disease, their recording, the list of occupational diseases (open or closed list), criteria for verification, funding of diagnostic procedures and occupational disease notification.
Certainly the most important issue is the definition of occupational disease since in Serbian legal system occupational diseases are regulated by two laws:

- Law on Pension and Disability Insurance
- Law on Health Insurance

Both laws have their own definitions of the occupational diseases so Serbian legal system, there are two valid definitions. According to the Law on Pension and Disability Insurance of occupational disease are: "Certain illnesses incurred during the insurance period, caused by longer direct influence of processes and working conditions in the workplace, or in the jobs performed." [1]. Health Insurance Act defines an occupational disease as a "Disease caused by prolonged exposure to the workplace hazards." [2].
Recording of occupational diseases is also regulated in two (or even three) laws: the Health Care Law (Law on Records in Health Care) [3] and the Law on Safety and Health at Work [4]. According to the Health Care Law organization and implementation of data collection and monitoring the epidemiological situation in the field of occupational diseases is the task of Institute of Occupational Health of Serbia. However, the Law on Records in the health care, whole process of recording of occupational diseases entrusted to Institute of Public Health of Serbia. According to the Law on Safety and Health at Work recording of occupational diseases is task of Directorate for Safety and Health at Work with certain jurisdiction of labor inspectorate.
In addition to the Law on Pension and Disability Insurance, the area of occupational diseases is regulated with "Rules on occupational diseases verification" enacted in 2003 (identical to the Regulations of 1997) [5]. According to the Regulations and the definition in the Law on Pension and Disability Insurance, Serbian list belongs to the category of closed lists (which means that only diseases that are listed in Regulation, 56 of them, could be verified as occupational ones). According to the recommendations of the EU in 1990 [6] (which is still in force) member states should have the so-called open / closed list (the list of occupational diseases with the possibility to verify as occupational disease which is not on the list if it is established a clear link between the disease and occupational hazard). The Serbian regulation lays down only general criteria for verifying occupational diseases. General criteria have led to the fact that every organization that deals with the verification of occupational diseases might have its own internal criteria. Also, the legislation did not envisaged right on second opinion in

verification of occupational diseases nor a source of financing of diagnostic procedures for the occupational disease verification.

Apart from problem of financing of occupational disease verification there are two more problems in the diagnosis of occupational diseases:
- Unclear role of occupational medicine specialist
- The role of general practitioners

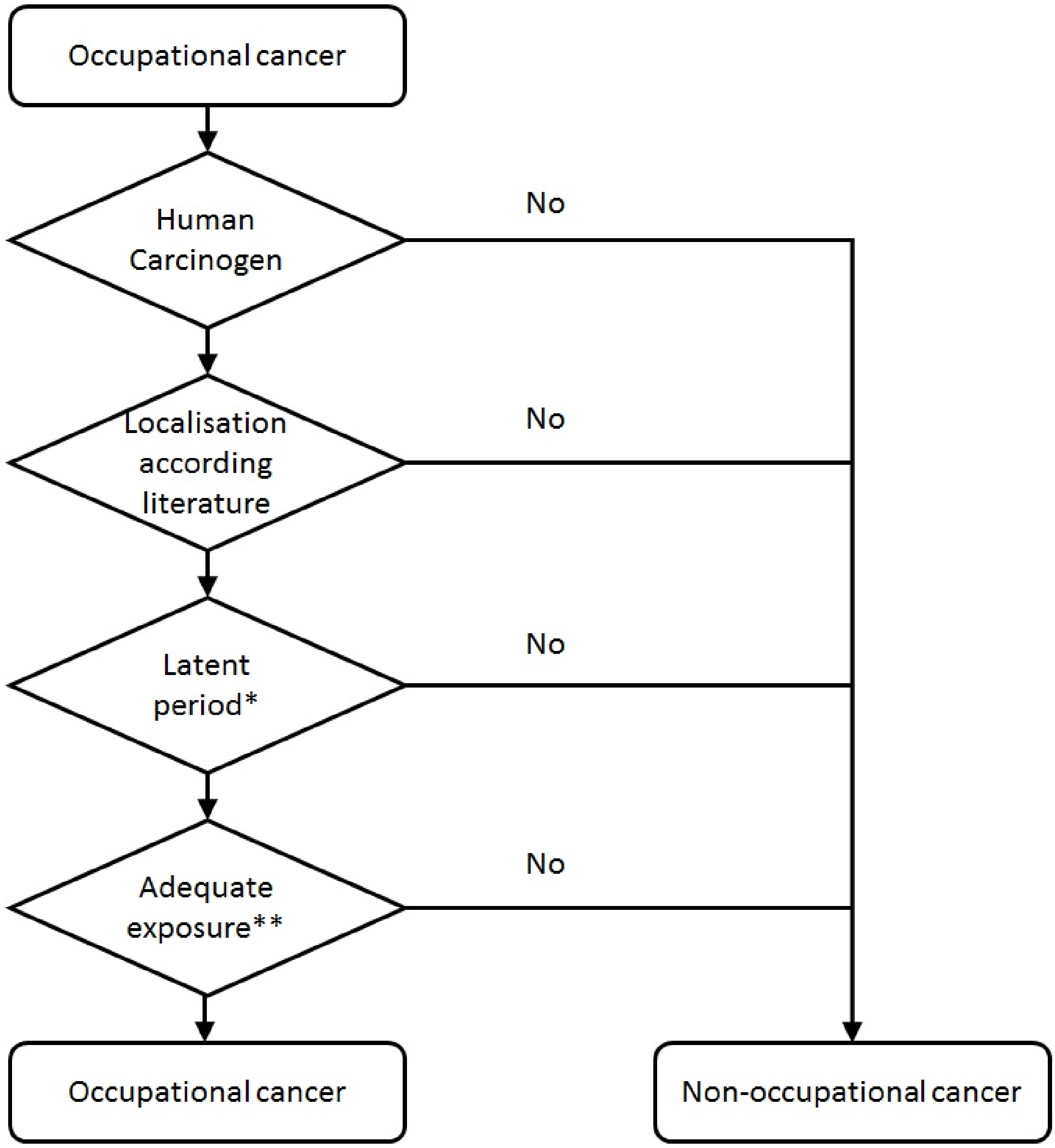
It is not clear whether an occupational medicine specialist can verify occupational disease or not, what is its role in the process of verification of an occupational disease and who bears the costs of its service. Amendments to the regulations, which envisage exclusive financing of occupational health by the employer and excludes it from financing by Health Insurance, transferred the burden of early diagnosis and recognition of occupational diseases to the general practitioners who do not have sufficient training and knowledge in the field of occupational diseases to perform that task.

List of occupational diseases-criteria for occupational cancer verification
Serbian list of occupational diseases includes 56 diseases:
- Diseases caused by chemicals (30)
- Diseases caused by physical hazards (9)
- Diseases caused by biological hazards (4)
- Lung diseases (10)
- Skin diseases (2)
- Malignant diseases (1)

For each disease listed there are two sets of verification criteria:
- Exposure criteria
- Clinical diagnostic criteria

In case of occupational cancer verification Regulation on occupational disease verification is rather general and also have two criteria. Within exposure criteria it is stated: “Jobs and workplaces on employee had contact with carcinogens”. Clinical diagnostic criteria are much better, and probably the best part of whole Regulation. In clinical diagnostic criteria, it is stated: “Clinical presentation of cancer case caused by ionizing radiation or ultraviolet rays or chemical carcinogens listed by International Agency for Research on Cancer (IARC) as human carcinogens (Group 1). This part of verification criteria provides automatic update of Serbian list. However, this part is not sufficiently specific so Serbian Institute of Occupational Health developed internal criteria for verification of occupational cancer. Internal criteria are developed in form of flowchart, so it is easy to implement it in each individual case (Graph 1). The verification starts by checking on IARC website on carcinogenicity status of chemical of interest. In case that it is classified as human carcinogen group I verification continues to the next step otherwise it is finished with conclusion that it is not occupational cancer. The next step is also based on data from IARC website, where we must explore if the localization of cancer case of interest is in accordance with IARC data. In case that result of this step is positive we could proceed to a next step otherwise verification is finished with conclusion that it is not occupational cancer. In the third step, we are examining data provided by employer on carcinogen exposure start with available literature data and in case appropriate latency time between first exposure and cancer onset we could proceed to the last step. In case that latent period is significantly shorter than in published data we finish case analysis with decision that it is not occupational cancer case. In the last step, we are comparing provided exposure data with literature data to check whether we could establish a connection between exposure and cancer case. In case that provided data fulfil minimal exposure criteria cancer case is verified as occupational cancer.

Figure 1. Flow chart-occupational cancer verification



* Minimal latent period described in literature data
** Minimal cumulative exposure described in literature data

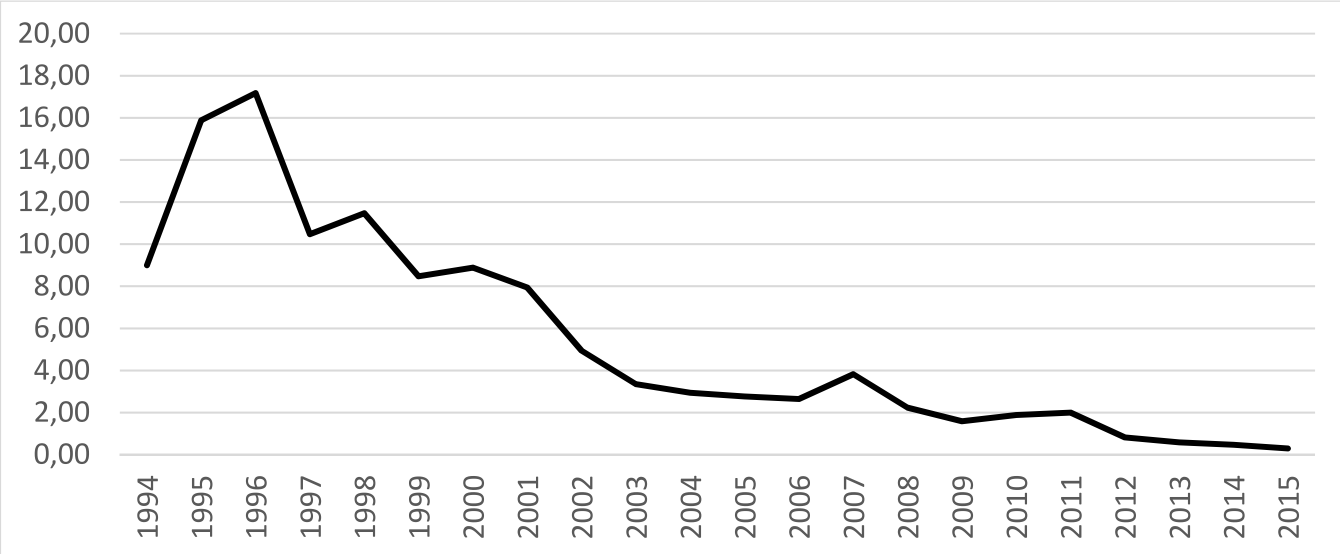
METHODS

Database on verified occupational diseases from 1994 has been used in analysis of occupational cancer. After data transformation from access mdba format to SPSS/PC sav format, data analysis has been performed. Since database had data from patients from Montenegro, in the first step cases with place of origin from Montenegro were excluded. On remaining data, basic statistics has been performed (data selection, frequency and crosstab analysis). For occupational disease incidence rate employment data were used from Statistical Office of the Republic of Serbia.

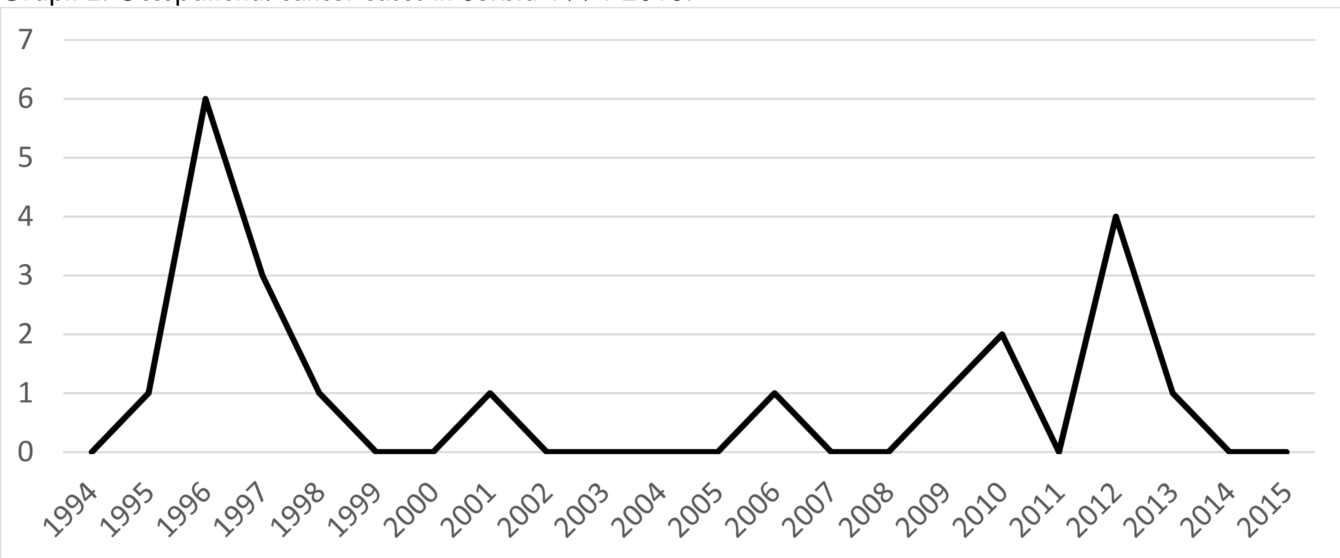
RESULTS

Data on occupational disease incidence rate in Serbia from 1996 indicate continuous incidence drop (Graph 1. Occupational disease in Serbia incidence rate 1994-2015). From 2009 incidence rate dropped below 2 cases per 100.000 employees. Consequently, incidence of occupational cancer is also rather low. In period of 22 years there were only 21 verified occupational cancer. Among the verified occupational cancers there were 8 cases of lung cancer (none mesothelioma), 5 cases of thyroid gland cancer and 3 cases of breast cancer other 5 cases were of different origin. The highest incidence of occupational cancer has been registered in 1996 when 6 occupational cancer cases has been verified (Graph 2. Occupational cancer cases in Serbia 1994-2015.).

Graph 1. Occupational disease in Serbia incidence rate 1994-2015 (per 100.000 employed).



Graph 2. Occupational cancer cases in Serbia 1994-2015.



DISCUSSION

Incidence of occupational diseases in Serbia is unusually low comparing to the other countries. As already mentioned, since 2009 occupational disease incidence rate per 100.000 employed felt below 2. In neighboring Croatia, which also has decreasing trend of Occupational diseases, in 2015 incidence rate was 8.54 [7] which enormously higher than Serbia's 0.23 in 2015. But it should be mentioned that in Germany incidence rate in 2015 was 94.3 (per 100.000 full time employees) [8]. Also, comparison with EU data for 2001 [9] which indicate that incidence rate in EU12 was 37.0 versus Serbia's 7.94 (in 2001) indicate a significant problem in occupational disease verification in Serbia.

Occupational cancer cases took negligible part of occupational disease incidence in Serbia. As already mentioned, in last 22 years there were only 21 verified case of occupational cancer. It should be noted that all cases are from health care institutions and that all verified cancer cases are linked to ionizing radiation. On the other hand, data from Serbian cancer registry indicates that from 2009 till 2013 there were 110 registered mesothelioma cases and 28285 lung cancer cases. Having in mind that literature data indicates that around 20% of lung cancer cases are attributable to occupational cancer [10] and that 85-90% of all mesothelioma cases are linked to asbestos one might calculate that in period 2009-2013 there were 5657 occupational lung cancer cases and at least 90 mesothelioma cases. Only one lung cancer case has been recorded in database on verified occupational diseases in period 2009-2013. Those data indicate that, even if Serbia developed rather modern criteria for occupational cancer verification, there is a huge underreporting of occupational cancer. One cause of underreporting might be diminished role of occupational health as discipline and occupational health specialist in Serbia. Since occupational safety and health law [4] do not envisage obligatory occupational health services for employer and since health care insurance does not cover occupational health services it seems that general practitioners are only responsible group in Serbia for recognition occupational diseases. General practitioners in Serbia on average receive 37 patients per day and it is obvious that they do not have time to focus on casualization of disease. Also, it should be mentioned that there is lack of general practice expertise in the field of occupational diseases and especially occupational cancer. The second cause of underreporting is unclear financing of occupational disease diagnostic procedures and doubtful process of reporting. According to Serbian regulation on occupational diseases [5] it is not clear who is responsible for verification of occupational disease nor who will pay the cost of it at the end of process. Among the causes of occupational cancer underreporting lack of carcinogen exposure registers as well as lack of exposure data has also significant role. The last cause of underreporting of occupational disease is lack of occupational disease insurance which will cover the survivor benefits costs and prevent employers conflict of interest.

CONCLUSION

Broad criteria for occupational cancer registration and negligible incidence of registered cancer cases indicate that there is significant problem of underreporting of occupational diseases and especially of occupational cancer. Occupational health and safety officials should undertake prompt reaction to establish a sustainable system for verification of occupational diseases and occupational cancer.

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Born on August 9, 1961 in Belgrade. Elementary and secondary school finished in Belgrade. Medical Faculty in Belgrade he enrolled in 1980 and ended in January 1986 with an average score of 9.28. Master's thesis defended in 1991 at the Center for Multidisciplinary Studies, University of Belgrade. Doctoral dissertation defended at the Medical Faculty in Belgrade in 1994. Specialist exam in occupational health passed with honors in 1992 at the Medical Faculty in Belgrade. Super specialization thesis in occupational toxicology defended in 2000 at the Medical Faculty in Belgrade. In addition to professional training in the country, he attended several courses abroad (Torino, Pavia, Wageningen, Dresden, Amsterdam) and was a postdoctoral fellow in Ghent (Belgium).
He works at the Medical Faculty in Belgrade as part of the teaching base at the Institute of Occupational Medicine since 1989, first as a teaching assistant and then as an assistant in 1992 and assistant professor in 1995. Becomes Associate Professor in 2000, as of March 2009 is a full professor. From October 2012 he worked as vice dean for clinical teaching at the Medical Faculty in Belgrade.
In parallel with the university career he built a professional career, starting from the clinician at the Institute of Occupational Medicine in 1989, through a specialist in 1992, Head of the Department for Occupational Toxicology from 1995 to 2009, to the Assistant Director of the Institute from 2001 to 2009. In the period from May 2011 to October 2012 he was Republic of Serbia Assistant Minister of Health responsible for international cooperation and European integration.
Petar Bulat is a member of the National Council for Safety and Health at Work, as well as the board member of the International Organization for Rural Health. Since 2001, member of the collegium Ramazzini. He has been engaged in many international organizations. Secretary of the Scientific Committee on Rural Health International Commission on Occupational Health. In the period from 2006 to 2015. he was the vice president of the European Association of the Schools of Occupational Medicine. A representative of the Ministry of Health in the field of Occupational Medicine in the World Health Organization.
He is author of 25 peer reviewed papers in International journals.

STROKOVNJAK ZA VARSTVO PRI DELU KOT OSNOVA ZA IZVAJANJE IN VZDRŽEVANJE SISTEMOV OSH

prof. Jasmina Chaloska, prof. Ljuben Dudeski, mag. Trajce Velkovski

Izvleček:

Strokovnjaka za varstvo pri delu zaposli pooblaščenec delodajalca za izvajanje nalog s področja varnosti. Kljub obvezni odgovornosti delodajalcev za imenovanje strokovnjaka za varstvo pri delu, morajo le ti določiti število, vrsto in stopnjo izobrazbe strokovnih delavcev, ki so odvisni od organizacije, vrste in obsega procesa zaposlovanja, števila zaposlenih, števila izmen ali števila ločenih delovnih enot.

Na splošno so delodajalci odgovorni za izbiro strokovnjaka za varstvo pri delu, ki mora izvajati in vzdrževati sistem VPD v njihovih podjetjih. Vprašamo pa se lahko, ali obstaja v odvisnosti od dejavnosti, podjetje ali oseba, ki lahko obvlada tak kompleksni sistem. Kakšna bo morala biti njena/njegova izobrazba, izkušnje, organizacijske veščine, sposobnost ekipnega dela? Ali smo sposobni izdelati profil strokovnjaka, ki po svojih sposobnostih ustreza zahtevam, povezanim z varnim obratovanjem.

V tem prispevku avtorji s pomočjo analize trenutnega stanja na področju izobraževanja za VPD v Makedoniji ocenjujejo stanje na trgu dela in priporočajo dejavnosti za izboljšanje v prihodnosti.

Ključne besede: strokovnjaki za varstvo pri delu, izobraževanje, izobraževalni model

UVOD

Stanje na področju varstva pri delu in varovanja zdravja posamezne države je povezano z gospodarskimi razmerami, delovnimi pogoji in zaposlovanjem.

Glede na podatke Državnega statističnega urada je bilo v prvem četrtletju leta 2016 v Republiki Makedonije delovno sposobnih 945.821 oseb, od tega 714.435 zaposlenih in 231.386 brezposelnih.

Stopnja aktivnosti v tem obdobju je 56,4, stopnja zaposlenosti 42,6, medtem ko je stopnja brezposelnosti 24,5.

Tabela 1 prikazuje razmere v zadnjih treh letih, na osnovi razmerja aktivnih gospodarskih družb in števila zaposlenih.

Tabela 1 Pogoj za uvrstitev aktivnih gospodarskih družb po številu zaposlenih

Gospodarske družbe	2013	2014	2015
Število aktivnih gospodarskih družb	**71.290**	**70.659**	**70.139**
Gospodarske družbe z 1 - 9 zaposlenimi	85 %	85,2 %	80,2 %
Gospodarske družbe brez zaposlenih	6,2 %	5,6 %	10,4 %
Gospodarske družbe z 10 - 19 zaposlenimi	4,2 %	4,4 %	4,3 %
Družbe z 20-49 zaposlenimi	2,5 %	2,6 %	2,8 %
Družbe s 50 - 249 zaposlenimi	1,8 %	1,8 %	1,9 %
Družbe z več kot 250 zaposlenimi	0,3 %	0,3 %	0,3 %

Viri: Državni urad za statistiko Republike Makedonije

Iz predstavljenih podatkov lahko sklepamo, da predstavljajo večino aktivnih gospodarskih družb mikro in majhna podjetja.

V preteklosti je Republika Makedonija uvedla vrsto reform, katerih namen je bil boljši in bolj učinkovit razvoj majhnih in srednjih podjetij ter zmanjšanje nezaposlenosti.

V tabeli 2 je prikazana struktura aktivnega prebivalstva po spolu in izobrazbi.

Tabela 2 Aktivno prebivalstvo po izobrazbi

Izobrazba	Delovna sila		Zaposleni		Nezaposleni	
	2015/I	2016/I	2015/I	2016/I	2015/I	2016/I
	Skupaj					
Skupaj	**959 388**	**945 821**	**697 248**	**714 435**	**262 140**	**231 386**
Brez izobrazbe	(3399)	(4972)	(1721)	(3064)	(1678)	(1908)
Nepopolna osnovna izobrazba	28 497	18 752	18 500	14 894	9 997	(3859)
Osnovna izobrazba	194 230	186 569	133 504	128 706	60 726	57 862
3-letna srednja izobrazba	79 771	69 694	55 393	53 901	24 378	15 793
4-letna srednja izobrazba	434 285	421 961	314 973	315 229	119 312	106 732
Poklicna izobrazba	23 025	18 590	18 445	16 314	(4580)	(2276)
Visoka (univerzitetna) izobrazba	196 182	225 283	154 713	182 327	41 469	42 956

Viri: Državni urad za statistiko Republike Makedonije

Če gledamo delovno aktivno prebivalstvo, ima večina brezposelnih osnovno in srednjo izobrazbo, kar kaže na veliko skupino nekvalificiranih delavcev.

Poleg tega so tisti, ki predolgo čakajo na zaposlitev, izločeni iz trga dela, kar pomeni, da se ne zavedajo tveganj, povezanih z varstvom pri delu in varovanjem zdravja. Zato je pomembno, da poskrbimo za ukrepe s področja varstva pri delu in varovanja zdravja, ki bodo zagotovili izobraževanje delavcev na področju razvoja kulture preprečevanja.

Strateška opredelitev Makedonije za pridružitev EU pa jasno kaže potrebo po bolj dejavni politiki na področju varstva pri delu in varovanja zdravja, katere cilj je izboljšanje delovnih pogojev ter zmanjšanje poškodb in poklicnih bolezni.

Strategija s področja varstva pri delu in varovanja zdravja mora zagotoviti dejavnosti, ki bodo izboljšale zakonodajo, sodelovanje pri izobraževanju, povečanje sposobnosti strokovnjakov za varstvo pri delu in dosledno izvajanje vseh ukrepov za varno delovanje.

ANALIZA STANJA PRI IZOBRAŽEVANJU NA PODROČJU VARSTVA PRI DELU IN VAROVANJA ZDRAVJA

Temelj razvoja na tem področju so izobraževalni programi s področja varstva pri delu in varovanja zdravja. V Republiki Makedoniji so visokošolske izobraževane ustanove s študijskimi programi za varstvo pri delu in varovanje zdravja na vseh ravneh.

Prva interdisciplinarna študija na področju varstva pri delu je potekala leta 1989 na Fakulteti za strojništvo Univerze sv. Cirila in Metoda v Skopju, pri njej pa je sodelovalo 349 študentov, od katerih je 132 inženirjev diplomiralo s področja varstva pri delu.

V tabeli 3 je prikazano stanje na makedonskih univerzah glede izvajanja študijskih programov s področja VPD.

Tabela 3 Stanje na makedonskih univerzah glede izvajanja študijskih programov s področja VPD.

Univerza: Sv. Cirila in Metoda v Skopju							
Fakulteta: Fakulteta za strojništvo, Skopje; Naslov: Karpos II poštna številka 464 1000 Skopje							
Študijski cikel	**Naziv programa**	**Leto prve akreditacije**	**Trajanje študija (v semestrih)**	**Število kreditov**	**Pridobljen naziv (natančen naziv)**	**Število vpisanih študentov (skupno število od prve**	**Število študentov z diplomo (skupno število po prvi akreditaciji)**
I Cikel študija	**VPD**	**1989**	**8**		**Inženir varstva pri delu**	**349**	**132**
II Cikel študija	**Upravljanje sistemov za varstvo pri delu in varovanje zdravja**	**2012**	**4**	**120**	**Magister tehničnih znanosti s področja varstva pri delu in varovanja zdravja**	**43**	**10**
III Cikel študija	**Doktorski študij**	**2012**	**6**		**Doktor tehničnih znanosti**	**2**	
Univerza: Mednarodna slovanska univerza "Gavrilo Romanovič Derzavin"							
Fakulteta: Fakulteta za varnostni inženiring; Naslov: Ul. Maršal Tito 77 2220, Sveti Nikole							
I Cikel študija	**Varnost pri delu**	**2012 /2013**	**6**	**180**	**Diplomirani inženir varstva pri delu**	**240**	**54**
II Cikel študija	**Varnost pri delu**	**2012 /2013**	**4**	**120**	**Magister varstva pri delu**	**114**	**25**
III Cikel študija							

Univerza: Univerza Goce Delčev Štip							
Fakulteta: Strojna fakulteta Štip; Naslov: Ul. Krste Misirkov No. 10-A, Post. code 201, Stip - 2000							
I Cikel študija							
II Cikel študija	Inženirsko delovno okolje	2011	2	60	Magister tehničnih znanosti	21	2
III Cikel študija							

Kurikul študijskega programa je bil razvit za vse tri izobraževalne cikle: dodiplomski, diplomski in doktorski.

Zaradi izjemne multidisciplinarnosti strokovnega področja spada v študijski program znanje iz različnih področij in oblikuje profil profesionalnega inženirja, ki se lahko sooči z izzivi sodobnega poslovanja.

V te študijske smernice je treba zajeti večje število študentov, ki bo ustrezalo potrebam trga dela. **Paradoksalno je, da inženirji varstva pri delu ne morejo delati kot strokovnjaki s področja varstva pri delu zaradi omejujočega predpisa, ki zahteva 5 let delovnih izkušenj pred opravljanjem strokovnega izpita. Na ta način se podcenjuje akademski študij v primerjavi z izpitom iz VPD, mladi visoko izobraženi strokovnjaki pa ne morejo delati na področju, za katerega so se izobraževali.**

Poleg izobraževanja kakovostnega inženirskega osebja, je zaradi kompleksnosti področja, potrebno nameniti posebno skrb tudi izobraževanju specialistov s področja medicine dela. V zadnjih letih je Oddelek za medicino dela na medicinski fakulteti vpisal 18 kandidatov na specialistični študij medicine dela. Sicer pa je v Republiki Makedoniji 70 specialistov medicine dela, ki so aktivno udeleženi v sistemu VPD.

Zaradi naraščajoče ozaveščenosti mlajše populacije o pomembnosti zdravja in varnosti, mora biti to področje predstavljeno tudi v programih osnovnega in srednjega izobraževanja. Študentje se bodo tako že zelo zgodaj zavedali tveganja pri delu in spoznali potrebo po razvijanju kulture varnega dela.

Zato mora biti področje varstva pri delu in varovanja zdravja del zakonsko predpisanih izobraževalnih programov osnovnega in srednjega izobraževanja.

Skladno z Zakonom o varstvu pri delu in varovanju zdravja, zagotavlja Republika Makedonija kontinuirano izobraževanje strokovnjakov za varstvo pri delu. Strokovnjaki s tem poglabljajo svoje znanje na tem področju in dodajajo novo vrednost sistemom, izvajanju VPD in organizacijam, v katerih delajo. Zakon o VPD opredeljuje izvajanje izobraževanja in merila za učitelje in udeležence.

Pomemben del neformalnega izobraževanja bi moral poudariti vlogo Makedonskega združenja za varnost, saj v okviru njihovih programov nenehno potekajo izobraževanja za strokovnjake s področja varstva pri delu, ki so usmerjeni na trajnostni razvoj varstva pri delu in varovanja zdravja v naših podjetjih. Lani je potekalo 34 izobraževanj s področja rudarstva, gradbeništva, nadlegovanja na delovnem mestu, osebne zaščitne opreme, metod za oceno tveganja v različnih delovnih pogojih, kemična nevarnost, nevarnost ionizirajočega sevanja, ergonomski delovni pogoji, delo na prostem.

PROFIL STROKOVNJAKA ZA VARSTVO PRI DELU

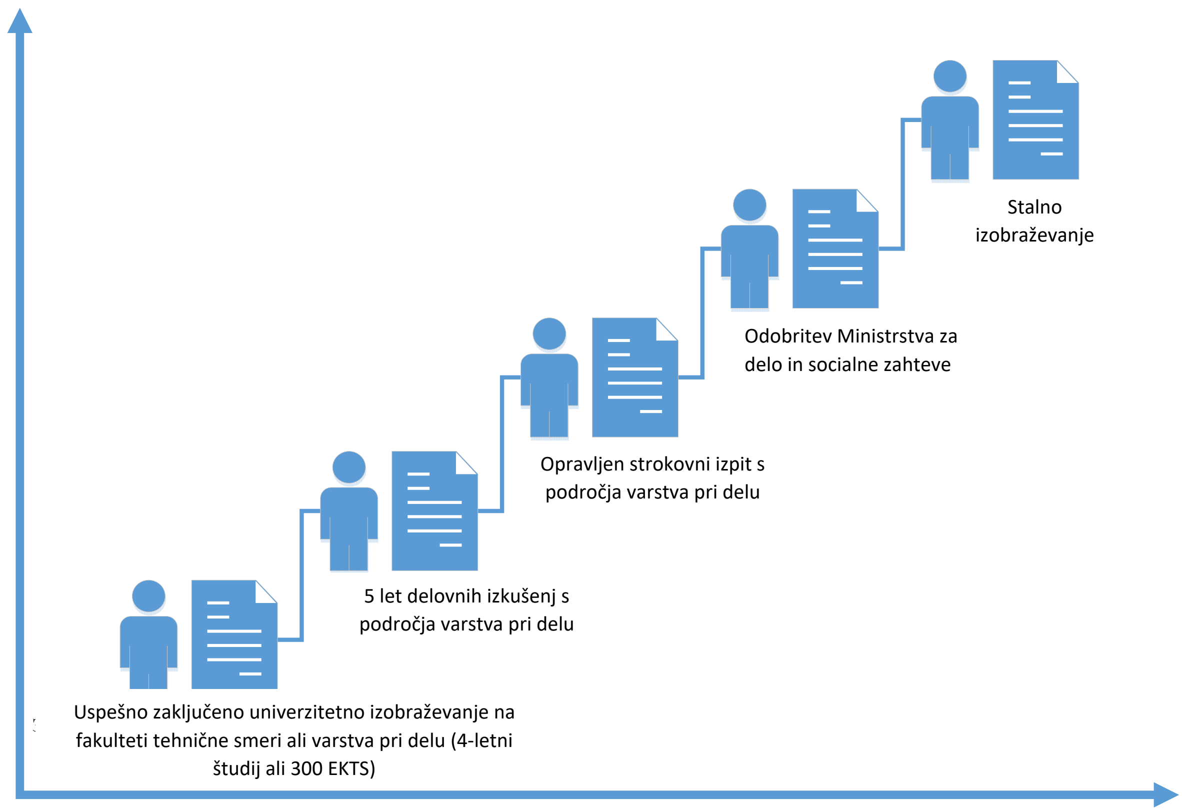
Če mora delodajalec v skladu z zakonskimi obveznostmi zagotoviti ukrepe iz VPD, mora imenovati enega ali več strokovnjakov za varnost in jih tudi sam izbrati. Vendar pa se lahko vprašamo, ali obstaja v odvisnosti od dejavnosti, podjetje ali oseba, ki lahko obvlada tak kompleksni sistem. Kakšna bo morala biti njena/njegova izobrazba, izkušnje, organizacijske veščine, sposobnost skupinskega dela? Ali smo sposobni izobraziti profil strokovnjaka, ki po svojih sposobnostih ustreza zahtevam, povezanim z varnim delom.

Odgovor na zgornja vprašanja lahko najdemo, če pogledamo v sistem izbire in imenovanja strokovnjakov za varstvo pri delu. Raziskave kažejo, da je strokovnjak običajno naključno izbrana oseba, ki ji podelijo obveznost za varstvo pri delu kljub ostalim delovnim zadolžitvam. Jasno je, kako strokovno se lahko opravi ta dodatna naloga, ki naj bi zagotovila izvajanje ukrepov za preprečevanje in zmanjšanje tveganj na delovnih mestih! V takih okoliščinah lahko govorimo le o nujnem izvajanju, ne pa tudi o preventivi in vzdrževanju!

Če ima delodajalec na izbiro visoko izobraženo in profesionalno osebje, bo lahko izbral najprimernejše za svojo dejavnost. Postavlja se vprašanje, kako strokovno usposobiti odgovorno osebo in ji zagotoviti potrebno znanje in veščine. Rešitev te težave moramo iskati pri tistih, ki so najbolj odgovorni za izobraževanje in usposabljanje - visokošolskih ustanovah s študijskimi programi za varstvo pri delu in varovanje zdravja.

Slika 1 kaže trenutni sistem za imenovanje strokovnjakov za varstvo pri delu v Republiki Makedoniji.

Slika 1. Trenutni sistem za imenovanje strokovnjakov za varstvo pri delu v Republiki Makedoniji.



V skladu z zakonom s področja VPD v Makedoniji, je lahko strokovnjak za varstvo pri delu oseba, ki ima univerzitetno diplomo iz varstva pri delu, tehnične smeri ali druge 4-letne smeri ali 300 ECTS in opravljen strokovni izpit iz varstva pri delu na Ministrstvu za delo in socialne zadeve. Pogoj za opravljanje izpita iz varstva pri delu so 5-letne izkušnje s tega področja. Zaradi te zahteve diplomirani inženirji in magistri varstva pri delu ne morejo opravljati izpita iz varstva pri delu in delati kot strokovnjaki na tem področju. Po drugi strani pa Ministrstvo za delo in socialne zahteve odobri to zahtevo drugim kandidatom le na osnovi izjave delodajalca o delovnih izkušnjah. Tako stanje diskriminira osebe, ki so posvetile celotno izobraževanje temu posebnemu področju. Trenutno stanje je tako, da je izpit iz varstva pri delu, ki je sestavljen iz elektronske podatkovne zbirke vprašanj in študije primera (razdeljen v teoretični in praktični del) bolj pomemben od večletnega akademskega izobraževanja na tem specifičnem področju.

Tabela 3 prikazuje, da v Republiki Makedoniji že obstaja specializirano osebje na področju varstva pri delu in varovanja zdravja, ki se lahko odzove na vse izzive v kompleksnem sistemu VPD. Osebje, ki opravlja študije na področju VPD, pridobi splošne sposobnosti:

- sposobnost dela v interdisciplinarnih ekipah
- sposobnost analiziranja težav ter oblikovanje in sinteza rešitev
- prepoznavanje potrebe po vseživljenjskem izobraževanju in sposobnost njegovega izvajanja
- sposobnost uporabe znanja v praksi
- sposobnost iskanja novih idej in rešitev s pomočjo uporabe znanstvenih metod
- sposobnost kritičnega razmišljanja
- sposobnost ustvarjanja inovativnih pristopov
- sposobnost sprotnega (pravočasnega) sprejemanja odločitev

Poleg splošnih, morajo kandidati razviti tudi posebne sposobnosti, kot so na primer:

- raziskovanje in predvidevanje potreb podjetij na področju VPD
- strokovno znanje s področij, ki jih obravnavajo študijski programi
- sposobnost povezovanja teoretičnega znanja s praktično uporabo
- sposobnost uporabe tehnik, znanja in sodobnih inženirskih orodij
- uporaba sistema za upravljanje VPD s pomočjo preventivnega pristopa, namenjenega trajnostnemu razvoju
- upravljanje podatkov s pomočjo integriranega informacijskega sistema
- opravljanje svetovalnih storitev, povezanih z izvajanjem, upravljanjem in vzdrževanem sistemov VPD.

PRIPOROČILA

Ob upoštevanju predstavljenih okoliščin, je potrebno vzpostaviti izobraževalni sistem za strokovnjake s področja varstva pri delu. Če struktura aktivnih gospodarskih subjektov, razvrščenih po številu zaposlenih (tabela 1), kaže, da ima več kot 80 % podjetij 1-9 zaposlenih, potem je očitno, da mora profil znanja strokovnjaka za varstvo pri delu v pooblaščeni ustanovi segati na širše poznavanje sistemov in različne dejavnosti s področja VPD. Pri tem bodo morale visokošolske izobraževalne ustanove posvetiti posebno pozornost profiliranju inženirskega kadra, ki bo delal na področju izvajanja in vzdrževanja sistemov VPD. Profil strokovnjaka za varstvo pri delu se lahko vzpostavi na naslednje načine:

- akreditirani akademski in strokovni študijski programi in specializirani strokovni študij
- Študijsko obdobje: dodiplomski študij 3-4 leta (180-240 ECTS), diplomski in specializirani študij 1-2 leti (60-120 ECTS)
- Pridobljeni naziv:Pridobljen naziv Diplomirani inženir varstva pri delu ali Magister varstva pri delu, specialist varnostnega področja
- Pooblastilo državne ustanove in
- stalno izobraževanje in usposabljanje.

Uvrstitev strokovnjaka za varstvo pri delu v Državni razvid poklicev bo pomagalo pri uveljavljanju tega delovnega profila na trgu dela. To področje potrebuje nujno posodobitev Državnega razvida poklicev, saj se pedagogi in osebe, ki profilirajo strokovnjake za varnost, priznavajo pod naslednjimi nazivi: profesor za varstvo pri delu, učitelj za področje varstva pri delu, izobraževalni asistent za varstvo pri delu, celo inšpektor in direktor za varstvo pri delu, vendar v nobenem primeru strokovnjak za varstvo pri delu.

ZAKLJUČEK

Strokovnjak za varstvo pri delu ima zelo kompleksno vodstveno in svetovalno funkcijo, ki je v sistemih VPD opredeljena s številnimi nalogami in odgovornostmi. V piramidi sistema VPD predstavlja strokovnjak za varstvo pri delu njeno osnovo.

To pomeni, da je za izvajanje in vzdrževanje sistema VPD zelo pomemben izobrazbeni profil strokovnjaka s stališča znanja, sposobnosti in veščin. Od njegove/njene izbire in imenovanja ter nenehnega izobraževanja je odvisna uspešnost izvajanja načrtovanih ukrepov za preprečevanje in zmanjševanje tvegana na delovnih mestih. Ne smemo dopustiti, da bi bil strokovnjak za varstvo pri delu naključno izbrana oseba, ki so ji dodeljene dodatne naloge in dejavnosti le zaradi izpolnjevanja zakonskih obveznosti.

Najpomembnejši dejavniki za oblikovanje strokovnega profila strokovnjakov so izobraževalni centri za formalno in nadaljnje izobraževanje. Zato je pomemben resen sistematični pristop do izobraževalnega sistema, iz katerega prihajajo inženirji, sposobni obvladovati vse izzive sodobnega poslovanja in ustvarjajo poklic, ki bo priznana na trgu dela kot nujno potreben za izboljšanje delovnih pogojev

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ŽIVLJENJEPIS PRVEGA AVTORJA

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Dr. Jasmina Chaloska je redna profesorica na Fakulteti za strojništvo Univerze sv. Cirila in Metoda v Skopju. Doktorski študij je končala na Fakulteti za strojništvo v Skopju leta 2002, predava pa naslednje predmete:

Ergonomija, proizvodni in storitveni procesi, poslovna informatika, računalniško podprti medicinski inženiring, proizvodne tehnologije z oblikovanjem in modeliranjem procesov za izdelavo plastike, računalniško modeliranje orodij za plastične mase, korporativna družbena odgovornost, varnost in tveganje pri delu itd. V svojem znanstvenem opusu je izdala več kot 150 člankov, strokovnih poročil, delov monografij in drugih. Je avtorica knjige ERGONOMIJA, ki je namenjena študentom in strokovnjakom s področja VPD.

Prof. Chaloska je članica Državnega odbora za varstvo pri delu in varovanje zdravja, državna kontaktna oseba Okvirnega programa Evropske unije za raziskave in inovacije HORIZONT ter vodja oddelka za varstvo pri delu Fakulteta za strojništvo v Skopju.

Med njene dejavnosti štejemo tudi vodenje in sodelovanje v mnogih projektih, ki so jih financirali: Evropska unija, Ministrstvo za izobraževanje in znanost, Ministrstvo za delo in socialne zadeve, Ministrstvo za gospodarstvo, USAID, GTZ, UNIDO, FP7, TEMPUS , EUREKA in drugi. Je vodja podiplomskega študijskega programa za vodenje sistemov varstva pri delu in varovanja zdravja.

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THE OCCUPATIONAL SAFETY EXPERT AS BASIS FOR IMPLEMENTATION AND MAINTENANCE OSH SYSTEMS

Prof. Jasmina Chaloska, Prof. Ljuben Dudeski, MSc Trajce Velkovski

Abstract:

The occupational safety expert is employed by the employer designee for performing professional tasks related to safety. Despite the mandatory liability of employers for the appointment of an occupational safety expert, they must determine the number, type and level of education of professionals depending on the organization, the nature and scope of the employment process, the number of employees, number of shifts or number of separate work units.

Overall, employers are responsible for the choice of occupational safety experts who need to implement and maintain system for OSH in their companies. Nevertheless, is there any company depending on the activity, respectively person who can meet the challenges of such a complex system? What should be his/her education, experience, organizational skills, ability to work in teams? Do we have capacity to build a profile of a professional person who professionally meet the need for safe operation?

In this paper, the authors by analyzing the current situation of education in OSH in Macedonia have addressed the situation in the labor market and recommendations for further activities to improve.

Keywords: occupational safety experts, education, educational model

INTRODUCTION

The situation in the field of occupational safety and health in each country is linked to the situation in the economy, working conditions and employment.

According to the State Statistical Office, in the first quarter of 2016 the labor force in the Republic of Macedonia numbered 945 821 persons, of which 714 435 employed, and 231 386 people were unemployed.

The activity rate in this period is 56.4, the employment rate was 42.6, while the unemployment rate is 24.5.

Table 1 shows the situation in the past three years of data on the proportion of active business entities by number of employees.

Table 1. The condition for the participation of active business entities by number of employees

Entities	2013	2014	2015
Number of active business entities	**71.290**	**70.659**	**70.139**
Businesses with 1-9 employees	85 %	85.2 %	80.2 %
Businesses without employees	6.2 %	5.6 %	10.4 %
Enterprises with 10-19 employees	4.2 %	4.4 %	4.3 %
Enterprises with 20-49	2.5 %	2.6 %	2.8 %
Enterprises with 50-249 employees	1.8 %	1.8 %	1.9 %
Enterprises with over 250 employees	0.3 %	0.3 %	0.3 %

Source: State Statistical Office of the Republic of Macedonia

From the data presented it can be concluded that the structure of active business entities most common are micro and small enterprises.

In the past Republic of Macedonia conducted a series of reforms aimed at better and more efficient development of SMEs and the reduction of the unemployment rate.

In table 2 the structure of active population by gender and educational attainment is shown.

Table 2. Active population by educational attainment

Educational attainment	Labour force		Employed		Unemployed	
	2015/I	2016/I	2015/I	2016/I	2015/I	2016/I
	Total					
Total	**959 388**	**945 821**	**697 248**	**714 435**	**262 140**	**231 386**
Without education	(3399)	(4972)	(1721)	(3064)	(1678)	(1908)
Incomplete primary education	28 497	18 752	18 500	14 894	9 997	(3859)
Primary education	194 230	186 569	133 504	128 706	60 726	57 862
3 years of secondary education	79 771	69 694	55 393	53 901	24 378	15 793
4 years of secondary education	434 285	421 961	314 973	315 229	119 312	106 732
Professional education	23 025	18 590	18 445	16 314	(4580)	(2276)
High (faculty) education	196 182	225 283	154 713	182 327	41 469	42 956

Source: State Statistical Office of the Republic of Macedonia

Of the active population according to education, most unemployed are with primary and secondary education, pointing to the existence of a large number of unskilled workers.

In addition, people that are waiting for employment too long are excluded from the labor market, which makes them unaware of the occupational risks in the workplace in terms of safety and health. It is therefore necessary to implement measures for occupational safety and health in order to emphases the training of the workers in terms of developing a culture for prevention.

However, the strategic commitment of Macedonia for EU integration clearly requires taking a more aggressive policy on occupational safety and health in order to improve working conditions and reduce injuries and occupational diseases.

Occupational safety and health strategy must provide activities aimed at improving legislation, instructional cooperation, capacity building of occupational safety experts and support for consistent implementation of all measures for safe operation.

SITUATIONAL ANALYSIS OF EDUCATION IN OCCUPATIONAL SAFETY AND HEALTH

Educational programs that involve the occupational safety and health are basis for development of the area. In the Republic of Macedonia, there are higher educational institutions with study programs in the field of safety and health at all levels.

The first interdisciplinary studies in the field of occupational safety are established in 1989 at the Faculty of Mechanical Engineering of the "Ss. Cyril and Methodius" University in Skopje, with the total number of 349 students, of whom 132 engineers graduated in occupational safety.

In table 3 the situation of the Universities in Macedonia conducting study programs OSH are shown.
Table 3. Situation of the Universities in Macedonia conducting study programs OSH

University: ,,Ss Cyril and Methodius,, in Skopje							
Faculty: Mechanical Engineering, Skopje; Address: Karpos II post code 464 1000 Skopje							
Cycle of studies	**The name of the program**	**The year of the first accreditation**	**Duration of studies (in semesters)**	**Number of loans**	**Acquired title (exact name)**	**Number of students enrolled (total number of the first accreditation)**	**Number of graduated students (Total number of the first accreditation)**
I Cycle Studies	**OSH**	**1989**	**8**		**Engineer occupational**	**349**	**132**
II Cycle Studies	**Management Systems for safety and health at work**	**2012**	**4**	**120**	**Magister of technical Sciences in the field of safety and health at work**	**43**	**10**
III Cycle Studies	**Doctoral School**	**2012**	**6**		**Doctor of Technical Sciences**	**2**	
University: International Slavic University "Gavrilo Romanovich Derzavin"							
Faculty: Faculty of safety engineering; Address St . „Marshal Tito" 77 2220, Sveti Nikole							
I Cycle studies	**Safety at work**	**2012 /2013**	**6**	**180**	**Graduated engineer for safety at work**	**240**	**54**
II Cycle of studies	**Safety at work**	**2012 /2013**	**4**	**120**	**Master of Safety at work**	**114**	**25**
III Cycle of studies							
University: University ,,Goce Delcev" Stip							
Faculty: Mechanical Faculty Stip; Address: St. „Krste Misirkov" No. 10-A, Post. code 201, Stip - 2000							
I Cycle studies							
II Cycle studies	**Engineering work environment**	**2011**	**2**	**60**	**MA in technical sciences**	**21**	**2**
III Cycle studies							

The curricula of the study program have been developed for all three cycles of education: undergraduate, graduate and doctoral studies.

Due to exceptional multidisciplinary field of study, programs include knowledge from different fields, building a profile of the most professional engineer who can meet the challenges of modern business.

However evident is the need to include a larger number of students in these study guidelines with regard to the needs of the labor market. **Paradoxically, now all completed occupational safety engineers are unable to work as occupational safety professionals because of restrictive requirement of work experience of 5 years for taking the professional exam. In this way, academic studies are undervalued in relation to the exam for OSH, and young highly educated personnel are prevented from working in the field that they are educated.**

Besides producing quality, engineering personnel, because of the complexity of the area, of particular concern is the enlargement specialists in the field of occupational medicine. In recent years, the Department of Occupational Health at the Faculty of Medicine enrolled 18 trainees in the field of occupational medicine. Otherwise, in the Republic of Macedonia, 70 specialists in occupational medicine are actively involved in OSH systems.

Because of increasing of the awareness in the youngest population about the importance of their own health and safety, this field has to be represented in the programs of primary and secondary education. Thus, students will be aware of the risks at work, which may face from an early age to recognize the necessity of developing a culture of safe operation (work).

For this purpose it is necessary the area of occupational safety and health at work to be included in the educational programs provided by the Law on Primary Education and Law on Secondary Education.

By the Law on Safety and Health at work, The Republic of Macedonia provided continuous education of professionals for safety at work. Thus, professionals enlarge their knowledge in the area, adding new value to systems, implementing OSH in their companies. The Law on OSH now, regulates the implementation of the trainings and the criteria for trainers and trainees.

An important part of informal education should emphasize the role of associations for safety in Macedonia that their programs continuously conduct education of occupational safety experts, aimed at sustainable development of occupational safety and health systems in our companies. In the past year 34 trainings are held, on topics of mining, construction, mobbing and stress, personal protective equipment, methodologies for risk assessment under varying operating (work) conditions, chemical hazards, ionizing radiation, ergonomic working conditions, outdoor work.

PROFILE OF AN OCCUPATIONAL SAFETY EXPERT

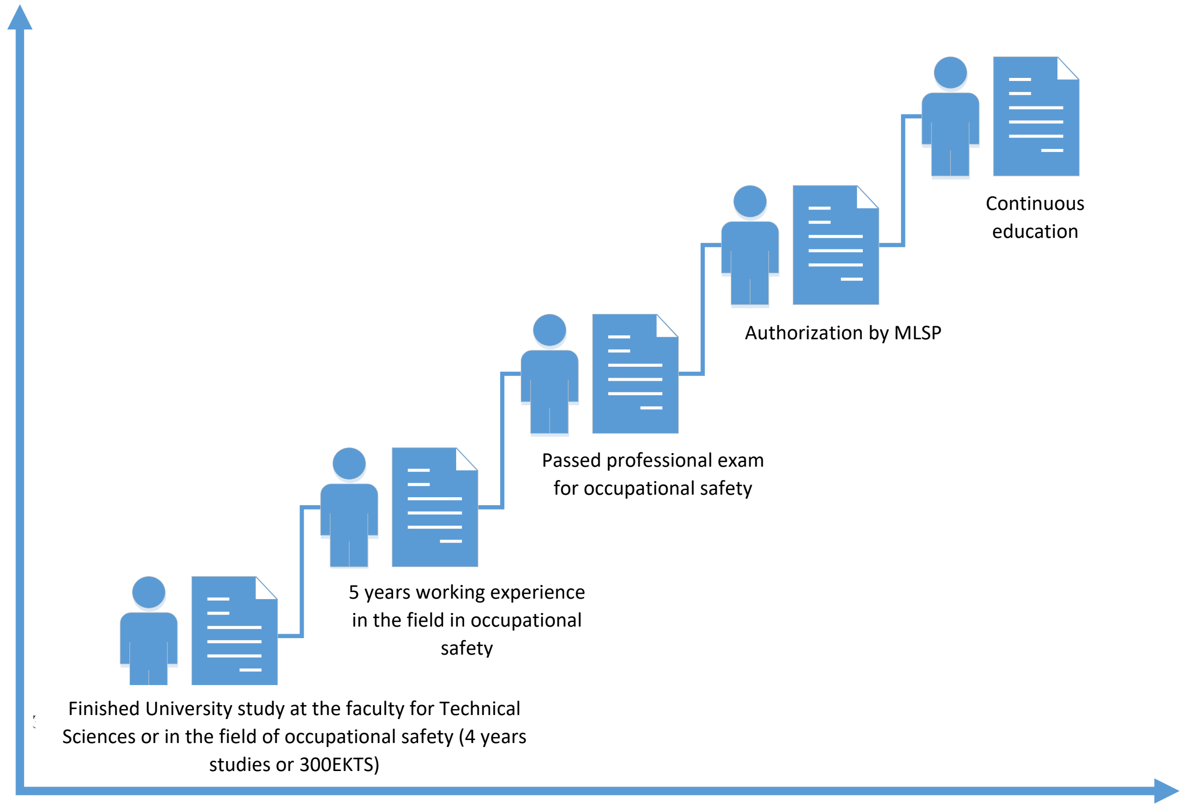
If the employer in accordance with the legal obligations to provide measures for OSH must appoint one or more experts for safety, it is his/her responsibility for choosing them. However, is there any company depending on the activity, respectively person who can meet challenges of such a complex system? What should be his/her education, experience, organizational skills, ability for teamwork? Do we have the capacity to build a profile of an expert professional that will address the needs for safe operation (work)?

The answer of these above-mentioned questions, certainly we can find if we look into the system of selection and appointment of the occupational safety expert. Studies shows that the expert is usually randomly selected person to whom obligations for occupational safety is granted function despite all other work tasks. It is clear, how much professionally this additional task can be carried out, for implementing measures for prevention and reduction of risks at work place! In this situation, we can speak only for necessary implementation, and not for prevention and maintenance!

When an employer have a choice of highly trained and professional staff, it is easy to choose the most appropriate for its activity. However, how to find the way to build professionally competent person with the necessary knowledge and skills? Of course, the answer of this problem we should look at the most responsible persons for education and training, higher educational institutions with study programs in the field of occupational safety and health.

Figure 1 shows the current system for appointing occupational safety expert in the country, in the Republic of Macedonia.

Figure 1. Current system for appointing occupational safety expert in the Republic of Macedonia.



Namely, according the Low on OSH in the Republic of Macedonia, an occupational safety expert can be a person who has a university degree in occupational safety, technical or other department for 4 years or 300 ECTS and passed exam for occupational safety at the Ministry of Labor and Social Policy. The condition for conducting the occupational safety exam is that the candidate must have at least 5 years experience in the field of applying. This requirement excludes the graduated engineers and masters for occupational safety to conduct the occupational safety exam and to work as occupational safety experts. On the other hand, MLSP approves this requirement for the other candidates only with provided statement by the employer of the employees work experience. This situation discriminates the people who dedicated their entire education to this specific area. In the current situation, the occupational safety exam, which consists electronic database of questions and case studies (divided into theoretical and practical part) is above the several years of academic education in the specific occupational safety program.

Table 3 shows that in the Republic of Macedonia there is already a specialized staff in the area of safety and health at work, that can respond to all challenges in complex systems for OSH. Staff completing studies in OSH acquire general competencies:

- Ability to work in interdisciplinary teams
- Ability to analyze problems and design and synthesis solutions
- A recognition of the need for, and an ability to engage in life-long learning
- Ability to apply knowledge in practice
- Capacity for generating new ideas and solutions through the application of research methods
- Ability of critical thinking
- Ability to generate innovative approaches
- Ability to make decisions in real time (in time)

Besides the general, the candidates have developed specific competences, such as:

- Research and anticipating the needs of companies in the area of OSH
- Expert knowledge of the areas studied by the study programs
- Ability to connect theoretical knowledge with their practical application
- Ability to use the techniques, skills, and modern engineering tools
- OSH Management System through preventive approach and aimed at sustainable development
- Manage the data through an integrated information system
- Perform consulting services related to the implementation, management and maintenance of systems for OSH

RECOMMENDATIONS

Given the presented situation, it is necessary to establish a system of education of occupational safety experts. If the structure of active business entities by number of employees (table 1), is that over 80% of businesses are with 1-9 employees, it is clear that the profile of an occupational safety expert in the authorized bodies must have a broader knowledge system in various OSH activities. To this end, higher education institutions will have to pay particular attention to the profiling of the engineering staff to work on implementation and maintenance of systems of OSH. A profile of an occupational safety expert can be build through:

- Accredited academic and professional study programs as well as specialized professional studies,
- Within the period of: undergraduate 3-4 years (180-240 ECTS) graduate and specialized studies 1-2 years (60-120 ECTS),
- Acquired title: Graduate engineer in the field of safety or Master in the field of safety, a specialist in the field of safety,
- Authorization of state institution, and
- Continuous education and training.

The introduction of the occupational safety expert in the National Classification of Occupation will help to facilitate the recognition of the profile at the labor market. This is an issue that requires an urgent update of the National Classification of Occupation since the educators and the peoples that are profiling the occupational safety experts are recognized, such as: Professor for occupational safety, Trainer for occupational safety, Teaching assistant for occupational safety, even Inspector and Director for occupational safety, but yet not occupational safety expert.

CONCLUSION

Occupational safety expert has a very complex executive and advisory functions expressed in OSH systems through a number of tasks and responsibilities. In the pyramid of systems for OSH, the occupational safety expert found its base.

Therefore, certainly it is very important the profile of the professional person in terms of knowledge, abilities and skills to implement and maintain the system for OSH. Since his/her selection and appointment, as well as continuous education depends on how successfully will implement the planned measures to prevent and reduce occupational risks. We must not allow the occupational safety expert to be randomly selected person with given additional function and activities in order to fulfil the legal obligation.

For the professional profile of the person the most responsible and professional actors are the centers for education and continuous education. It is therefore necessary serious systematic approach to education system that needs to produce engineers capable for dealing with all the challenges of modern business, and stuff that will be recognized in the labor market as a necessity to improve the working conditions.

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VLOGA GENETSKIH IN OKOLJSKIH DEJAVNIKOV PRI BOLEZNIH, POVEZANIH Z IZPOSTAVLJENOSTJO AZBESTU

Vita Dolžan, Metoda Dodič-Fikfak, Alenka Franko

Povzetek

Bolezni, povezane z izpostavljenostjo azbestu, sodijo med ene najbolj preučevanih poklicnih bolezni in predstavljajo velik problem tako v Sloveniji, kot tudi po vsem svetu. Izpostavljenost azbestu je povezana z razvojem azbestoze, plevralnih bolezni, kot so plevralni plaki, difuzne zadebelitve plevre in plevralni izliv, ter z več vrstami raka. Maligni mezoteliom je eden najbolj agresivnih in usodnih oblik raka, povezanih z izpostavljenostjo azbestu. Temeljne študije so izboljšale razumevanje molekularnih mehanizmov, povezanih z nastankom azbestnih bolezni in pokazale, da azbestna vlakna med drugim povečajo nastajanje škodljivih in genotoksičnih reaktivnih kisikovih in dušikovih spojin (ROS in RNS) v celicah in tkivih. Naše raziskave pa so pomembno prispevale k spoznanju, da imajo poleg izpostavljenosti azbestu, tudi genetski dejavniki, kot so polimorfizmi v genih, ki kodirajo antioksidativne encime in mehanizmi popravljanja DNA, lahko pomembno vlogo pri nastanku, napredovanju in odgovoru na zdravljenje azbestnih bolezni.

Ključne besede: azbestoza, genetsko pogojena dovzetnost, izpostavljenost azbestu, maligni mezoteliom

UVOD

Azbest in izpostavljenost azbestu

Azbest je komercialno ime za skupino naravnih vlaknastih silikatov, ki jih na osnovi fizikalne in kemične strukture delimo v dve glavni skupini, to je krizotil in amfibole [20, 3].
Zaradi posebnih fizikalnih in kemijskih lastnostih azbestnih vlaken, kot so odpornost na zelo visoke temperature odpornost na kemične snovi, električna neprevodnost, dobra zvočna izolacija in dobro tesnjenje, se je azbest pogosto uporabljal v gradbeništvu ter v proizvodnji industrijskih in potrošniških izdelkov.
Poklicna izpostavljenost azbestu se pojavlja pri kopanju azbestne rude, pri pridelavi in mletju azbestnih vlaken, v azbest-cementni industriji, v gradbeništvu, v proizvodnji strojev in izolacijskih materialov, pri gradnji in popravilu ladij, v avtomobilski industriji, v proizvodnji zavor in sklopk, pri popravilu avtomobilov, avtobusov, tovornjakov, železniških vagonov in letal, pri mešanju asfalta, odstranjevanju azbestnih odpadkov in materialov, v opekarnah, v tekstilni industriji ter v drugih industrijah in dejavnostih [20, 19]. Do nepoklicne izpostavljenost azbestu lahko pride tudi zaradi uporabe in nepravilnega odstranjevanja azbest-cementne strešne kritine, azbestne izolacije in drugih izdelkov, ki vsebujejo azbest. Okoljsko so azbestu izpostavljeni predvsem prebivalci v bližini tovarn, kjer azbest predelujejo ali uporabljajo (izpostavljenost onesnaženemu zraku, vodi in hrani). Azbestna vlakna je mogoče najti tudi v vodi, ki teče po azbest-cementnih ceveh, posebej če te nimajo oblog ali če so poškodovane. Azbestu so lahko izpostavljeni tudi družinski člani delavcev, ki delajo z azbestom in jih prinesejo domov z obleko, v laseh ali na koži [19].

Bolezni povezane z izpostavljenostjo azbestu

Azbest je priznan kot rakotvorna snov za ljudi [20]. Vzročno je povezan z malignim mezoteliomom plevre in peritoneja in s pljučnim rakom [16, 15].
Izpostavljenost azbestu je lahko povezana tudi z drugimi raki, kot so rak larinksa, ovarijev, pa tudi rak bukalne sluznice, farinksa in ledvic. Nedavno je bila tudi jasno dokazana povezava med izpostavljenostjo azbestu in rakom prebavil, zlasti rakom širokega črevesa [13].
Nekatere toksične lastnosti azbestnih vlaken, kot so zmožnost povzročitve vnetja in brazgotinjenja, so lahko povezane tudi z razvojem različnih ne-rakavih obolenj dihal, kot so azbestoza, plevralni plaki, difuzne zadebelitve plevre in plevralni izliv. Azbestoza je ena izmed najpogostejših bolezni, povezanih z izpostavljenostjo azbestu. Azbestoza je intersticijski pljučni proces, ki počasi, po daljši latentni dobi napreduje v difuzno pljučno fibrozo in je lahko povezana tudi s povečanim tveganjem za pljučnega raka [15].
Bolezni povezane z izpostavljenostjo azbestu, še vedno predstavljajo velik problem v Sloveniji in tudi drugod po svetu. Uporaba azbesta je bila v Sloveniji zakonsko prepovedana leta 1996, a zaradi dolge latentne dobe in obremenjenosti okolja z azbestom pričakujemo porast azbestnih bolezni, na primer malignega mezotelioma verjetno vsaj do leta 2030. Zaradi naraščajoče incidence in slabe prognoze potrebujemo nove pristope za zgodnejše odkrivanje azbestnih bolezni, še zlasti pri osebah, ki so bile poklicno in/ali okoljsko izpostavljene azbestu.

Molekularni mehanizmi povezani z nastankom azbestnih bolezni

Čeprav je patogeneza azbestnih bolezni še vedno slabo raziskana, so raziskave na celičnih kulturah in živalskih modelih pokazale, da imajo pomembno vlogo v teh procesih tudi reaktivne kisikove in dušikove spojine (ROS in RNS). Najpomembnejše reaktivne spojine v patogenezi azbestoze so superoksidni anion ($O_2^{\cdot -}$), vodikov peroksid (H_2O_2), hidroksilni radikal ($OH^{\cdot}$) in dušikov oksid (NO). Njihov nastanek lahko povzročijo sama azbestna vlakna, poleg tega pa ROS sproščajo tudi iz makrofagov, ki se aktivirajo s fagocitozo azbestnih vlaken. Azbestna vlakna lahko sprožijo tudi izražanje inducibilne sintaze dušikovega oksida (iNOS) ter s tem povečajo nastajanje NO v alveolarnih makrofagih in v epitelijskih celicah pljuč. ROS in RNS lahko povzročijo poškodbe vseh vrst biomolekul, vključno z deoksiribonukleinsko kislino (DNK), proteini in lipidi, zato domnevajo, da bi lahko imele pomembno vlogo pri nastanku in napredovanju bolezni povezanih z izpostavljenostjo azbestu [2].
V človeških tkivih so prisotni kompleksni obrambni mehanizmi, vključno z encimi, proteini in antioksidanti, ki ki odstranjujejo ROS in/ali sodelujejo pri preprečevanju poškodb celic. Prvo obrambno linijo proti ROS predstavljajo antioksidantni encimi superoksid dismutaze (SOD), katalaza (CAT) in glutation-peroksidaze (GPX). SOD katalizirajo dismutacijo $O_2^{\cdot -}$ v H_2O_2 in kisik (O_2), medtem ko CAT in GPX nadalje katalizirata razgradnjo H_2O_2 do vode (H_2O) in O_2, prva predvsem v citosolu, druga pa v mitohondrijih. Pri sesalcih so znani trije izoencimi SOD: citosolna baker-cink SOD (CuZnSOD ali SOD1),

ki je v citoplazmi in v katalitičnem centru vsebuje baker (Cu) in cink (Zn), mitohondrijska mangan SOD (MnSOD ali SOD2), ki je v mitohondrijih ter kot kofaktor vsebuje mangan (Mn), ter ekstracelularna SOD (ECSOD ali SOD3), ki je zunajcelično in v katalitičnem centru prav tako vsebuje Cu in Zn [6, 7].
Pri odstranjevanju ROS in njihovih citotoksičnih metabolitov, ki nastanejo z oksidacijo DNA in lipidov le-teh, sodelujejo tudi encimi iz družine glutation-S-transferaz (GST), ki katalizirajo vezavo (konjugacijo) z reduciranim glutationom. Pri sesalcih je opisanih sedem različnih družin GST, med njimi so najbolj proučevane družine Pi (GSTP1), Mi (GSTM1) in Theta (GSTT1) [10].

Genetski polimorfizmi antioksidantnih in metabolnih genov
Geni, ki nosijo zapis za antioksidantne in metabolne encime so polimorfni, kar pomeni da sta v populaciji pogosti vsaj dve različni obliki - alela teh genov. Takšni polimorfizmi so najpogosteje posledica spremembe enega samega nukleotida – tako imenovani polimorfizmi posameznih nukleotidov (SNP). SNP v kodirajočem zaporedju lahko privedejo do spremembe aminokisline in zmanjšane aktivnosti encima. Takšni polimorfizmi so na primer *GSTP1* Ile105Val in Ala114Val, *MnSOD* Ala–9Val in *EcSOD* Arg213Gly. Spremembe nukleotidnega zaporedja v promotorskem področju, kot na primer polimorfizem *CAT* −262C>T pa lahko vplivajo na raven izražanja gena in na količino proteina v celicah. Genetski polimorfizmi so lahko tudi posledica delecije gena, na primer *GSTM1* in *GSTT1*, ki vodi v popolno odsotnost encimske aktivnosti.

Genetski dejavniki in azbestne bolezni
Številne študije so raziskovale povezave med azbestnimi boleznimi, predvsem azbestozo in malignim mezoteliomom in različnimi genetskimi polimorfizmi kandidatnih genov [4-8, 11-12, 17]. V skladu z opažanji, da azbest stimulira nastajanje ROS ter izražanje iNOS in aktivira vnetne kaskade, so naše dosedanje raziskave pokazale, da polimorfizmi nekaterih genov za encime, ki odstranjujejo ROS in njihove toksične produkte, predstavljajo tveganje za nastanek azbestoze pri delavcih, poklicno izpostavljenih azbestu.
Pomembna ugotovitev teh naših predhodnih raziskav je, da ima delecija gena *GSTT1*, ne pa tudi *GSTM1*, lahko zaščitni učinek na pojav azbestoze [4]. Po dostopni literaturi povezava med azbestozo in delecijskim polimorfizmom *GSTT1* do sedaj sicer še ni bila ugotovljena, vendar pa nekatere študije ugotavljajo zaščitni učinek ničnega genotipa *GSTT1* na pojav raka pljuč [4, 14]. Pokazali smo tudi, da genotip *GSTP1*, ki nosi zapis za encim z visoko encimsko aktivnostjo in kapaciteto konjugacije, k čemur doprinese predvsem genotip *GSTP1* Ile105Val, poveča tveganje za razvoj azbestoze za 50 % [5].
Pomembna ugotovitev naših predhodnih raziskav je tudi, da genotip *MnSOD* –9 Ala/Ala poveča tveganje za azbestozo [7]. Rahlo povečano tveganje za razvoj azbestoze smo ugotovili tudi pri genotipu *CAT* −262 TT [6]. Ta rezultat je še zlasti zanimiv, saj so raziskave pokazale nižjo aktivnost CAT pri osebah s tem genotipom. Ker ima CAT osrednjo vlogo v primarni obrambi proti ROS, lahko nižja aktivnost CAT pri posameznikih z genotipom *CAT* −262 TT pojasni nekoliko povečano tveganje za azbestozo pri osebah s tem genotipom [6].

Gensko-okoljske interakcije in azbestne bolezni
Vedno več je dokazov, da na pojav mnogih bolezni delujejo tako dejavniki okolja kot tudi genetski dejavniki. Področje gensko-okoljskih interakcij je novo področje, ki vključuje tako genetiko, toksikologijo, higieno dela in okolja, medicino dela ter epidemiologijo. Večina epidemioloških okoljskih študij do sedaj je le redko upoštevala genetske dejavnike in tudi obratno, genetske epidemiološke raziskave so običajno vključevale zelo malo podatkov o okoljski izpostavljenosti in življenjskem stilu [9].
Čeprav velja, da je pri boleznih, ki so povezane z izpostavljenostjo nevarnim snovem in dejavnikom okolja, potrebno raziskati interakcije med genetskimi, epigenetskimi in okoljskimi dejavniki, takšnih študij pri azbestnih boleznih praktično ni. Takšne študije pa so možne na naši kohorti oseb, poklicno izpostavljenih azbestu, ker je bila pri njih zelo dobro opredeljena tako izpostavljenost azbestu na delovnem mestu in v življenjskem okolju, kot tudi kajenje [9].
Ker so interakcije med geni in okoljem zelo specifične, je namen tega prispevka predstaviti gensko-okoljske interakcije na primeru azbestoze, ki je ena izmed najbolj pogostih azbestnih bolezni in je povezana s povečanim tveganjem za nastanek pljučnega raka.

METODE

Preiskovanci

Naredili smo vgnezdeno raziskavo primerov s kontrolami. V raziskavo je bilo vključenih 262 preiskovancev z azbestozo (primeri) in 265 preiskovancev, pri katerih ni bila ugotovljena nobena bolezen, povezana z izpostavljenostjo azbestu (kontrole). Vsi preiskovanci so bili zaposleni v azbest-cementni tovarni Salonit Anhovo v Sloveniji in poklicno izpostavljeni azbestu. Primeri in kontrole so bili usklajeni po spolu in starosti.
Za vse preiskovance smo pridobili podatke o kajenju, ter izračunali trajanje kajenja in število škatel-let kajenja. Za vsakega delavca smo izračunali čas izpostavljenosti, ki je bil definiran kot meseci dejanske izpostavljenosti azbestu. Podatke o kumulativni izpostavljenosti azbestu smo za vsakega preiskovanca pridobili iz predhodne raziskave [3].

Diagnoza azbestoze

Diagnoza azbestoze ali "ne z azbestom povezane bolezni" je temeljila na Helsinških kriterijih [18] ter priporočilih American Thoracic Society [1]. Diagnozo so potrdili strokovnjaki dveh Interdisciplinarnih skupin strokovnjakov za verifikacijo poklicnih bolezni zaradi izpostavljenosti azbestu na Kliničnem inštitutu za medicino dela, prometa in športa. Vsaka skupina strokovnjakov je vključevala specialista medicine dela, pulmologa in radiologa.

Molekularno genetske analize

Vsakemu preiskovancu smo odvzeli vzorec kapilarne kri iz konic prstov na mini kartico FTA (Whatmann Bioscience), iz katerega smo nato izolirali genomsko DNK za genotipizacijo. Genske polimorfizme smo določali z metodami, ki so temeljile na pomnoževanju tarčnih odsekov genov *GSTM1*, *GSTT1*, *GSTP1*, *MnSOD*, *ECSOD*, *CAT* in *iNOS* z verižno reakcijo polimeraze (PCR).

Statistične analize

Vzročno povezavo med azbestozo in različnimi dejavniki smo proučevali z metodo logistične analize.
Pred ugotavljanjem interakcij med različnimi dejavniki (genskimi in okoljskimi), smo najprej analizirali vzročno povezavo med boleznijo (v našem primeru azbestozo) in posameznimi spremenljivkami, v našem primeru izpostavljenostjo azbestu, kajenjem in polimorfizmi posameznih genov. Za to smo najprej uporabili univariatno logistično regresijo, nato pa multivariatno statistično modeliranje, ki je upoštevalo genotipe, izpostavljenost azbestu ter možne moteče spremenljivke in modifikatorje učinka. Za testiranje slednjih smo najprej oblikovali preproste kategorične modele, ki so temeljili na stratifikaciji, nato pa v modele logistične regresije uvedli tudi umetne spremenljivke (»dummy variables«). Računali smo razmerja obetov (RO) in ustrezne 95% intervale zaupanja (95% IZ).

REZULTATI

Vpliv izpostavljenosti azbestu in kajenja na tveganje za azbestozo

Azbestoza je bila povezana z logaritmom kumulativne izpostavljenosti azbestu (RO = 3,21, 95% IZ = 2,43–4,23), medtem ko povezave s kajenjem nismo ugotovili (RO = 0,98, 95% IZ = 0,69–1,39).

Vpliv posameznih genskih polimorfizmov za tveganje za azbestozo

Vpliv posameznih genotipov na tveganje za azbestozo je bil preučevan v več predhodnih študijah in je prikazan v tabeli 1. Iz tabele je razvidno, da genotip *GSTP1*, ki nosi zapis za encim z visoko konjugacijsko kapaciteto in genotip *MnSOD* –9Ala/Ala pomembno povišata tveganje za razvoj azbestoze, medtem ko ima nični genotip *GSTT1* zaščitni učinek za razvoj te bolezni. Po prilagoditvi po spolu, starosti in kajenju se tveganje za azbestozo za preučevane genotipe ni spremenilo (podatki niso prikazani). Prilagoditev po kumulativni izpostavljenosti azbestu pa je nekoliko povečala tveganje za azbestozo za genotipa *ECSOD* 213Arg/Gly in *CAT* –262 TT (Tabela 1).

Tabela 1. Vpliv posameznih genskih polimorfizmov za tveganje za azbestozo

Genotip	**RO (95 % CI)**	**RO (95 % IZ) prilagojen po kajenju (kadarkoli / nikoli)**	**RO (95 % IZ) prilagojen po kumulativni izpostavljenosti azbestu**
***MnSOD* –9Ala/Ala vs. Ala/Val+Val/Val**	1,50 (1,01–2,24)	1,49 (1,00–2,23)	1,48 (0,96–2,28)
***ECSOD* Arg/Gly vs. Arg/Arg**	1,63 (0,62–4,27)	1,65 (0,63–4,32)	2,07 (0,72–5,94)
***CAT* −262 TT vs. CT+CC**	1,36 (0,70–2,62)	1,37 (0,71–2,66)	1,91 (0,93–3,91)
***GSTM1*-nični vs. prisoten**	1,01 (0,71–1,43)	0,99 (0,70–1,41)	0,97 (0,67–1,42)
***GSTT1*- nični vs. prisoten**	0,61 (0,40–0,94)	0,63 (0,41–0,97)	0,60 (0,38–0,96)
***GSTP1* visoka vs. srednja in nizka kapaciteta konjugacije**	1,49 (1,06–2,10)	1,50 (1,06–2,13)	1,36 (0,94–1,98)
***iNOS* LL vs. SL+SS**	1,20 (0,85–1,69)	1,17 (0,83–1,66)	1,19 (0,82–1,73)

Vir: Povzeto po [9]

Vpliv interakcij med genskimi polimorfizmi na tveganje za azbestozo
Analiza povezav med azbestozo in interakcij med posameznimi genotipi je pokazala, da polimorfizem *CAT* –262C>T modificira povezavo tako med polimorfizmom *MnSOD* Ala–9Val in azbestozo, kot tudi med polimorfizmom *iNOS* in azbestozo (p = 0,038; p = 0,031). Interakcij med drugimi genetskimi polimorfizmi nismo zaznali.

Vpliv interakcij med genskimi polimorfizmi in okoljskimi dejavniki na tveganje za azbestozo
Najprej smo preverili, ali obstaja povezava med genskimi dejavniki in kajenjem. V predhodnih analizah nismo ugotovili povezave med azbestozo in kajenjem, prav tako ni bilo povezave med azbestozo in ničnim genotipom *GSTM1* (Tabela 1). Rezultati preučevanja interakcij pa so pokazali, da nični polimorfizem *GSTM1* modificira povezavo med kajenjem in azbestozo (p = 0,007; p = 0,054). Ko smo kajenje stratificirali (razdelili v kategorije) glede na polimorfizem *GSTM1*, smo namreč ugotovili povečano tveganje za azbestozo le pri tistih kadilcih, ki imajo nični genotip *GSTM1* (torej delecijo gena), medtem ko je genotip "*GSTM1*- prisoten" deloval celo zaščitno.
Preverili smo tudi, ali obstaja povezava med genskimi dejavniki in delovnim okoljem, saj je dobro znano, da je nastanek azbestoze povezan z izpostavljenostjo azbestu. Pri računanju interakcij med genotipi in kumulativno izpostavljenostjo azbestu smo v preproste kategorične modele najprej uvedli kumulativno izpostavljenost, ki smo jo razdelili v dve kategoriji: ≤ 11,23 vlaken/cm^3-let in > 11, 23 vlaken/cm^3-let (pri čemer je 11,23 vlaken/cm^3-let povprečna kumulativna izpostavljenost azbestu pri kontrolah). Analiza je pokazala, da so genotipi *MnSOD*, *ECSOD*, *CAT* in *iNOS* modificirali povezavo med kumulativno izpostavljenostjo azbestu in azbestozo (p = 0,000, p = 0,015, p = 0,000, p = 0,000), vendar le v preprostih kategoričnih modelih. V modelih logistične regresije interakcije med genotipi in kumulativno izpostavljenostjo azbestu niso bile dokazane, razen za *iNOS* v modelu, kjer je bila logistično transformirana izpostavljenost azbestu uporabljena kot kontinuirna spremenljivka (p = 0,037).

RAZPRAVA

Naši dosedanji raziskave so pomembno prispevale k poznavanju genetskih dejavnikov, predvsem pa interakcij med genetskimi dejavniki ter interakcij med genetskimi ter okoljskimi dejavniki, ki lahko modificirajo posameznikovo dovzetnost za pojav azbestnih bolezni.
Na primeru azbestoze smo pokazali, da sami genetski dejavniki bodisi nimajo vpliva na razvoj bolezni, lahko pa tveganje za razvoj bolezni povečajo ali zmanjšajo. Naše ključne ugotovitve so bile, da genotip *GSTP1*, ki nosi zapis za encim z visoko kapaciteto konjugacije in genotip *MnSOD* –9Ala/Ala pomembno povišata tveganje za razvoj azbestoze, medtem ko ima nični genotip *GSTT1* zaščitni učinek

za razvoj te bolezni [5, 7]. Naša raziskava je bila prva, ki je preučevala povezavo med azbestozo in genotipi *GSTP1*. Čeprav druge do sedaj opravljene študije niso ugotovile povezave med ničnim genotipom *GSTT1* in azbestozo, pa nekatere študije ugotavljajo zaščitni učinek ničnega genotipa *GSTT1* na pojav raka pljuč [14]. Naše ugotovitve, da je nični genotip *GSTT1* s posledično odsotnostjo aktivnega encima povezan z manjšim tveganjem za azbestozo in da genotip *GSTP1*, ki nosi zapis za encim z visoko kapaciteto konjugacije predstavlja povečano tveganje za azbestozo, genotipi *GSTP1*, ki nosijo zapis za encime z nizko in ali srednjo encimsko katalitično aktivnostjo pa znižajo tveganje za azbestozo [4, 5], lahko razložimo s predhodno objavljenimi opažanji, da v posameznih primerih GST lahko katalizira tudi nastanek bolj reaktivenega konjugata glutationa, ki vodi v povečano tveganje za razvoj bolezni [10]. Podobno imajo lahko posamezniki z genotipom *MnSOD* –9Ala/Ala zaradi večje aktivnosti encima MnSOD posledično povečane vrednosti H_2O_2 in $OH^{\cdot}$ radikalov, za katere je znano da so vpleteni v patogenezo azbestoze.

Najbolj pomemben prispevek pa predstavlja naš pristop k opredelitvi gensko-genskih in gensko-okoljskih interakcij. Pokazali smo na močno interakcijo tako med polimorfizmoma *MnSOD* Ala –9Val in *CAT* –262C>T, kot tudi med polimorfizmoma *iNOS* in *CAT* –262C>T. Glede na to, da sta MnSOD in CAT del primarnega obrambnega sistema proti ROS in da katalizirata zaporedje reakcij v procesu detoksifikacije ROS, lahko razumemo to interakcijo kot biološko verjetno. Podobno je v naši raziskavi polimorfizem *CAT* –262C>T modificiral tudi povezavo med polimorfizmom *iNOS* in azbestozo. Upoštevaje, da ROS in NO sodelujeta pri nastanku citotoksičnih in mutagenih učinkov azbestnih vlaken [2] ter glede na dejstvo, da NO, ki nastane zaradi katalitične aktivnosti iNOS, lahko deluje kot zaščitni dejavnik zoper toksične učinke H2O2, ki ga detoksificira CAT, ter obratno, H2O2 zmanjša citotoksičnost NO [2], je tudi ta interakcija biološko verjetna.
V prispevku smo prikazali tudi pomen gensko–okoljskih interakcij v povezavi s tveganjem za azbestozo pri poklicno izpostavljenih osebah. Pomembne ugotovitve sedanje raziskave kažejo, da nični polimorfizem *GSTM1* modificira povezavo med kajenjem in azbestozo, ter da polimorfizem *iNOS* modificira povezavo med kumulativno izpostavljenostjo azbestu in azbestozo. Dodatne raziskave so potrebne, da bi razjasnili, ali genotipi *MnSOD, ECSOD, CAT*, in *iNOS* na povezavo med kumulativno izpostavljenostjo azbestu in azbestozo delujejo kot moteče spremenljivke ali kot modifikatorji učinka.
Rezultati te raziskave dokazujejo, da imajo poleg izpostavljenosti azbestu, lahko tudi genetski dejavniki, ki so vključeni v odstranjevanje ROS in RNS, pomemben vpliv na razvoj azbestoze in jih je potrebno upoštevati pri bodočem raziskovanju poklicnih/okoljskih bolezni povezanih z izpostavljenostjo azbestu.

ZAKLJUČKI

Razumevanje molekularnih mehanizmov, ki vodijo v patogenezo bolezni povezanih z izpostavljenostjo azbestu, se počasi izboljšuje. Naše študije so pokazale, da imajo poleg izpostavljenosti azbestu pri nastanku azbestnih bolezni pomembno vlogo tudi genetski dejavniki. Z analizo kandidatnih genov smo že identificirali nekatere genetske dejavnike tveganja za azbestne bolezni, predvsem polimorfizme antioksidativnih genov. Boljše razumevanje molekularnih mehanizmov nastanka in napredovanja teh bolezni omogoča detekcijo novih diagnostičnih in/ali prognostičnih označevalcev.
Naše dosedanje ugotovitve kažejo, da imajo poleg okoljske in/ali poklicne izpostavljenosti, tudi genetski dejavniki, kot tudi interakcije med različnimi genotipi, med genotipi in dejavniki življenjskega sloga, in med genotipi in okoljsko/ poklicno izpostavljenostjo pomemben vpliv na razvoj bolezni in bi te interakcije in vplive bilo nujno podrobneje raziskati.
Integracija epidemioloških, kliničnih in molekularno-genetskih podatkov bo lahko omogočila razvoj napovednih modelov, ki bodo uporabni v klinični praksi. Pri tem je pa je potrebno upoštevati etična načela, saj se poznavanje genetskih dejavnikov in gensko-okoljskih interakcij ne sme nikoli uporabiti za presejalno testiranje v smislu diskriminacije.

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ZAHVALA

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THE ROLE OF GENETICS AND ENVIRONMENT IN ASBESTOS RELATED DISEASES

Vita Dolžan, Metoda Dodič-Fikfak, Alenka Franko

Abstract
Asbestos-related diseases are among the most extensively studied occupational diseases and present a great problem in our country as well as all over the world. Asbestos exposure has been associated with the development of asbestosis, pleural diseases, such as pleural plaques, diffuse pleural thickening and pleural effusion, and several types of cancer. One of the most aggressive and fatal cancers associated with asbestos exposure is malignant mesothelioma. Recent studies have led to a better understanding of molecular mechanisms underlying the pathogenesis of asbestos related diseases, implicating also the asbestos-induced generation of damaging and genotoxic reactive oxygen and nitric species (ROS and RNS). We have significantly contributed to the body of evidence, showing that in addition to asbestos exposure, genetic factors such as polymorphisms in genes coding for antioxidative enzymes and DNA repair mechanisms may have an important role in the occurrence, progression and response to treatment of asbestos-related diseases.

Key words: asbestos exposure, asbestosis, genetic susceptibility, malignant mesothelioma

INTRODUCTION

Asbestos and asbestos exposure

Asbestos is a commercial name for a group of natural fibre silicates which are split into two main groups based on their physical and chemical structure, chrysotile and amphibole [20, 3].

Due to the special physical and chemical properties of asbestos fibres, such as resistance to high temperatures and chemical substances, electrical non-conductivity, good sound insulation and sealing, asbestos was often used in construction and the production of industrial and consumer products.

Occupational asbestos exposure occurs during asbestos ore digging, in the production and grinding of asbestos fibres, in the asbestos-cement industry, in construction work, in the production of machines and insulation materials, in building and repairing ships, in the car industry, in the production of brakes and clutches, during repair works on cars, buses, trucks, railway wagons and planes, during asphalt mixing, during the removal of asbestos waste and materials, in brickworks, in the textile industry and in other industries and businesses [20, 19]. Non-occupational exposure to asbestos can also occur because of the use and inappropriate removal of asbestos-cement roofing materials, asbestos insulation and other products containing asbestos. Environmental exposure to asbestos is most typical with people living near factories where asbestos is processed or used (exposure to polluted air, water and food). Asbestos fibres can also be found in the water running through asbestos-cement pipes, especially if they do not have coverings or are damaged. Family members of workers working with asbestos can also be exposed to asbestos, when it is brought home on clothing, hair or skin [19].

Diseases related to asbestos exposure

Asbestos has been confirmed to be a carcinogenic substance to people [20]. It is causally related to malignant mesothelioma pleura and peritoneum and to lung cancer [16, 15].

Asbestos exposure can also be related to other cancers, such as larynx cancer, ovaries cancer, buccal mucosa cancer, pharynx cancer and kidney cancer. The relation between asbestos exposure and gastrointestinal cancer, especially colon cancer, has also been established recently [13].

Some toxic properties of asbestos fibres, such as the ability to cause infection and scarring, can also be related to the development of various non-cancerous respiratory diseases, such as asbestosis, plural plaque, diffuse pleural thickening and pleural effusion. Asbestosis is one of the most common diseases related to asbestos exposure. Asbestosis is an interstitial lung process which slowly, after a long latent period, progresses to diffuse lung fibrosis and can be related to a higher risk of lung cancer [15].

Diseases related to asbestos exposure still represent an immense problem in Slovenia as well as around the world. The use of asbestos has been legally banned in Slovenia since 1996, however due to the long latent period and environmental pollution with asbestos we expect an increase in asbestos-related diseases, for example malignant mesothelioma, at least until the year 2030. Because of the growing incidence and poor prognosis we need new approaches to earlier detection of asbestos-related diseases, especially for people occupationally and/or environmentally exposed to asbestos.

Molecular mechanisms related to the emergence of asbestos-related diseases

Despite the poor research of the pathogenesis of asbestos-related diseases, the research performed on cell cultures and animal models has implicated that reactive oxygen and nitric species (ROS and RNS) also play an important role in these processes. The most important reactive compounds in the pathogenesis of asbestosis are the superoxide anion ($O_2^{\cdot -}$), hydrogen peroxide (H_2O_2), hydroxyl radical ($OH^{\cdot}$) and nitrogen oxide (NO). Their emergence can be caused by asbestos fibres themselves, and what is more the ROS are also released from the macrophages, activated by phagocytosis of asbestos fibres. Asbestos fibres can also trigger the expression of inducible synthase of nitrogen oxide (iNOS) and therefore increase the formation of NO in alveolar macrophages in the epithelium lung cells. The ROS and RNS can cause damage to all sorts of biomolecules, including the deoxyribonucleic acid (DNA), proteins and lipids, which is why it is assumed that they could perform an important role in the formation and progression of diseases related to asbestos exposure [2].

In the human tissue, complex defence mechanisms are present, including enzymes, protein and antioxidants which remove ROS and/or are involved in preventing cell damage. The first defence line against ROS consists of the antioxidant enzymes superoxide dismutase (SOD), catalase (CAT) and glutathione-peroxidase (GPX). The SOD catalyses the dismutation of $O_2^{\cdot -}$ to H_2O_2 and oxygen (O_2) while CAT and GPX further catalyse the decomposition of H_2O_2 into water (H_2O) in O_2, the first especially in the cytosol, the second in the mitochondria. Three isoenzymes SOD are known in mammals: cytosol copper-zinc SOD (CuZnSOD or SOD1) which is in the cytoplasm and in the catalytic centre which

contains copper (Cu) and zinc (Zn), mitochondria manganese SOD (MnSOD or SOD2) which is in the mitochondria and as a cofactor contains manganese (Mn) and the extracellular SOD (ECSOD or SOD3) which is extracellular and in its catalytic centre also contains Cu an Zn [6, 7].
In the removal process of ROS and their cytotoxic metabolites, which are formed with the oxidation of DNA and its lipids, enzymes from the glutathione S-transferase family also play a role; they catalyse the conjugation with the reduced glutathione. There are seven different GST families described in mammals, among them the most studied are Pi (GSTM1), Mi (GSTM1) and Theta (GSTT1) [10].

The genetic polymorphisms of antioxidant and metabolic genes
The genes carrying the record for antioxidant and metabolic enzymes are polymorphic, which means that at least two different forms are common among the population – the alleles of these genes. These polymorphisms are most often a consequence of an alteration of one single nucleotide – the so-called polymorphisms of single nucleotides (SNP). The SNP in the coding sequence can lead to an alteration of amino acid and a reduced activity of the enzyme. Such polymorphisms are, for example, *GSTP1* Ile105Val and Ala114Val, *MnSOD* Ala–9Val and *EcSOD* Arg213Gly. The alterations of the nucleotide sequence in the promoter region, such as polymorphism *CAT* −262C>T, can affect the level of expression of the gene and the quantity of the cell protein. Genetic polymorphisms can also be a consequence of gene deletion, for example *GSTM1* in *GSTT1*, which leads to a complete absence of enzyme activity.

Genetic factors and asbestos-related diseases
Numerous studies have researched the connections between asbestos-related diseases, especially asbestosis, and malignant mesothelioma and different genetic polymorphisms of candidate genes [4-8, 11-12, 17]. In accordance with the observations that asbestos stimulates the formation of ROS, the expressing of iNOS and activates the infected cascades, our research so far has shown that the polymorphisms of some enzyme genes which remove ROS and their toxic products represent a risk for the emergences of asbestosis in workers, occupationally exposed to asbestos.
An important finding of our previous research is that the deletion of the *GSTT1* gene, but not the *GSTM1* gene, can have a protective effect on the emergence of asbestosis [4]. In the available literature, the connection between asbestosis and the deletion of polymorphism *GSTT1* has not been established until now, however some studies have shown the protective effect of the zero genotype *GSTT1* on the emergence of lung cancer [4, 14]. We have also shown that the *GSTP1* genotype which carries the record for the enzyme with a high enzyme activity and conjugation capacity, to which especially the genotype *GSTP1* Ile105Val contributes, increases the risk of development of asbestosis by 50% [5].
An important finding of our previous research is also the fact that the genotype *MnSOD* –9 Ala/Ala increases the risk for asbestosis [7]. A slightly increased risk for the development of asbestosis has also been found with the *CAT* −262 TT genotype [6]. This result is specifically interesting because the research has shown lower CAT activity in people with this genotype. Due to the CAT having a central role in the primary defence against ROS, a decreased activity of CAT in individuals with the *CAT* −262 TT genotype can explain a somewhat increased risk for asbestosis in people with this genotype [6].

Genetically-environmental interactions and asbestos-related diseases
There is an increasing number of evidence that environmental as well as genetic factors affect the emergence of many diseases. The field of genetically-environmental interactions is new and it includes genetics, toxicology, occupational and environmental hygiene, occupational medicine and epidemiology. The majority of epidemiological environmental studies until now only rarely considered the genetic factors and vice versa. The genetic epidemiological research usually included only little information on environmental exposure and lifestyle [9].
Even though it is true that with diseases related to exposure to dangerous substances and environmental factors one must research the interactions between genetic, epigenetic and environmental factors, such studies are virtually non-existent in asbestos-related diseases. However, such studies are possible in our cohort of people professionally exposed to asbestos, because their exposure to asbestos as well as their smoking habits have been very well established [9].
Since interactions between the genes and the environment are very specific, the purpose of this article is to present the genetically-environmental interactions in the example of asbestosis which is one of the most common asbestos-related diseases and is related to an increased risk in the emergence of lung cancer.

METHODS

Participants

We performed a nested case-control study. The research included 262 participants suffering from asbestosis (cases) and 265 participants who had no confirmed asbestos-related diseases (controls). All the participants were employees at the Salonit Anhovo factory manufacturing cement and asbestos and were occupationally exposed to asbestos. The cases and controls were coordinated according to gender and age.

We gained information about the smoking habits on all the participants and calculated the smoking periods and the number of boxes-years of smoking. We calculated the time of exposure for every worker, which was defined as months of actual exposure to asbestos. The information on the cumulative exposure to asbestos was acquired for every individual separately from a previous research [3].

Asbestosis diagnosis

The diagnosis of asbestosis or "non-asbestos-related disease" was based on the Helsinki criteria [18] and the recommendations by the American Thoracic Society [1]. The diagnosis was confirmed by experts from two Interdisciplinary groups of experts on verification of occupational diseases due to asbestos exposure at the Clinical Institute of Occupational, Traffic and Sports medicine. Each group of experts included a specialist in the field of occupational medicine, a pulmonologist and a radiologist.

Molecular genetic analyses

A sample of the capillary blood from the finger tips from every participant was placed on a mini FTA card (Whatmann Bioscience) from which the genomic DNA was then isolated for the genotyping. The genetic polymorphisms were determined by methods based on multiplying the target parts of the *GSTM1*, *GSTT1*, *GSTP1*, *MnSOD*, *ECSOD*, *CAT* and *iNos* genes with a polymerase chain reaction (PCR).

Statistical analyses

The causal connection between asbestosis and various factors was studied using the method of logistic analysis.

Before determining the interactions between various factors (genetic and environmental) we first analysed the causal connection between the disease (in our case asbestosis) and individual variables, in our case asbestos exposure, smoking and the polymorphisms of individual genes. To do that, we first used the univariate logistic regression and later the multivariate statistic modelling which considered the genotypes, asbestos exposure and possible disruptive variables and modifiers of the effect. To test the latter we first formed simple categorical models based on the stratification and later also introduced the dummy variables into the models of logistic regression. We calculated the ratio of outlooks (RO) and the appropriate 95% intervals of trust (95% IZ).

THE RESULTS

The effect of asbestos exposure and smoking on the risk of asbestosis

Asbestosis was related to the logarithm of cumulative exposure to asbestos (RO= 3.21, 95% IZ = 2.43–4.23) while the relation to smoking was not established (RO = 0.98, 95% IZ = 0.69–1.39).

The effect of individual genetic polymorphisms on the risk of asbestosis

The effect of individual genotypes on the risk of asbestosis was studied in many previous studies and is presented in chart 1. The chart shows that the *GSTP1* genotype carrying the record for the enzyme with high conjugation capacity and the *MnSOD* –9Ala/Ala genotype have an important effect on the increased risk for the development of asbestosis while the zero genotype *GSTT1* has a protective effect on the development of this disease. After the adjustment of gender, age and smoking habits the risk of asbestosis did not change in the studied genotypes (data is not shown). The adjustment to cumulative exposure to asbestos did somewhat increase the risk for asbestosis of genotype *ECSOD* 213Arg/Gly and *CAT* –262 TT (Chart 1).

Chart 1. The effect of individual genetic polymorphisms on the risk of asbestosis

Genotype	**RO (95 % CI)**	**RO (95 % IZ) Adjusted according to smoking habits (whenever / never)**	**RO (95 % IZ) Adjusted according to cumulative exposure to asbestos**
***MnSOD* –9Ala/Ala vs. Ala/Val+Val/Val**	1.50 (1.01–2.24)	1.49 (1.00-2.23)	1.48 (0.96-2.28)
***ECSOD* Arg/Gly vs. Arg/Arg**	1.63 (0.62-4.27)	1.65 (0.63-4.32)	2.07 (0.72-5.94)
***CAT* −262 TT vs. CT+CC**	1.36 (0.70-2.62)	1.37 (0.71-2.66)	1.91 (0.93-3.91)
***GSTM1*- zero vs. present**	1.01 (0.71-1.43)	0.99 (0.70-1.41)	0.97 (0.67-1.42)
***GSTT1*- zero vs. present**	0.61 (0.40-0.94)	0.63 (0.41-0.97)	0.60 (0.38-0.96)
***GSTP1* high vs. medium and low conjugation capacity**	1.49 (1.06-2.10)	1.50 (1.06-2.13)	1.36 (0.94-1.98)
***iNOS* LL vs. SL+SS**	1.20 (0.85-1.69)	1.17 (0.83-1.66)	1.19 (0.82–1.73)

Source: Adapted from [9]

The effect of interactions between genetic polymorphisms on the risk for asbestosis

The analysis of connections between asbestosis and interactions between individual genotypes has shown that the polymorphism *CAT* –262C>T modifies the connection between the polymorphism *MnSOD* Ala–9Val and asbestosis as well as between the polymorphism *iNOS* and asbestosis (p = 0.038; p = 0.031). The interactions between other genetic polymorphisms were not found.

The effect of interactions between genetic polymorphisms and environmental factors on the risk for asbestosis

First we checked whether there exists a connection between genetic factors and smoking habits. In the previous analyses we did not find a connection between asbestosis and smoking, there was also no connection between asbestosis and the zero genotype *GSTM1* (Chart 1). However, the results of the interactions studies have shown that the zero polymorphism *GSTM1* modifies a connection between smoking and asbestosis (p = 0.007; p = 0.054). After smoking habits have been stratified (divided into categories) according to the polymorphism *GSTM1,* we have found an increased risk for asbestosis only with the smokers carrying the zero genotype *GSTM1* (the deletion of the gene), while the genotype "*GSTM1*- present" even performed a protective role.

We have also checked whether there exists a connection between the genotypes and a cumulative exposure to asbestos, for it is well known that the occurrence of asbestosis is connected to asbestos exposure. While calculating the interactions between the genotypes and the cumulative exposure to asbestos we first introduced the cumulative exposure to simple categorical models, and then divided it into two categories: ≤ 11.23 fibres/cm^3-years and > 11.23 fibres/cm^3-years (where 11.23 fibres/cm^3-years is the average cumulative asbestos exposure with the controls). The analysis has shown that the genotypes *MnSOD, CAT* and *iNos* have modified the connection between the cumulative asbestos exposure and asbestosis (p = 0.000, p = 0.015, p = 0.000, p = 0.000) but only in the simple categorical models. In the models of logistic regression the interactions between the genotypes and the cumulative asbestos exposure were not confirmed, except for *iNOS* in the model where logistically transformed asbestos exposure was used as a continuous variable (p = 0.037).

DISCUSSION

Our previous research has contributed importantly to the understanding of genetic factors, especially the interactions between genetic factors and interactions between genetic and environmental factors which can modify an individual's susceptibility to the emergence of asbestos-related diseases.

In the example of asbestosis we have shown that the genetic factors themselves either do not affect the development of the disease or can increase or decrease the risk for the development of the disease. Our key findings were that the genotype *GSTP1*, carrying the record for the enzyme with high conjugation capacity, and the genotype *MnSOD* –9Ala/Ala have an important effect on the increasing risk for the development of asbestosis while the zero genotype *GSTT1* has a protective effect on the development of this disease [5, 7]. Our research was the first to study the connections between asbestosis and the *GSTP1* genotypes. Even though other studies so far have not found a connection between the zero genotype *GSTT1* and asbestosis, there are some studies which identify the protective effect of the zero genotype *GSTT1* on the development of lung cancer [14]. Our findings that the zero genotype GSTT1 with a consequential absence of an active enzyme is connected to a lower risk for asbestosis and that the GSTP1 genotype, carrying the record for an enzyme with high conjugation capacity, presents an increased risk for asbestosis, and that the GSTP1 genotypes, carrying the record for enzymes with low or medium enzyme catalytic activity lower the risk for asbestosis [4, 5] can be explained with previously published observations that in some cases the GST can even catalyse the emergence of a more reactive glutathione conjugate which leads to an increased risk for the development of the disease [10]. Similarly, individuals with the *MnSOD* –9Ala/Ala genotype can have increased values of H_2O_2 and $OH^{\cdot}$ radicals as a consequence of a higher activity of the MnSOD enzyme. These radicals are known to be involved in the pathogenesis of asbestosis.

The most important contribution is our approach to the definition of genetics-genetic and genetics-environmental interactions. We have shown a strong interaction between the polymorphisms *MnSOD* Ala –9Val and *CAT* –262C>T as well as the polymorphisms *iNOS* and *CAT* –262C>T. Considering that the MnSOD and CAT are a part of the primary defence system against the ROS and that they catalyse the sequence of reactions in the process of detoxification of ROS, we can understand that interaction as biologically probable. Similarly, in our research the polymorphism *CAT* –262C>T also modified the connection between the *iNOS* polymorphism and asbestosis. Considering that the ROS and NO participate in the formation of cytotoxic and mutagenic effects of asbestos fibres [2] and the fact that:

- NO, which emerges because of the catalytic activity of iNOS, can work as a protective factor against the toxic effects of H2O2, which is detoxified by CAT and vice versa,
- H2O2 reduces the cytotoxic properties of NO [2],

this interaction is also biologically probable.

This article has also shown the meaning of genetics-environmental interactions in connection with the risk for asbestosis in occupationally exposed people. The important findings of this research show that the zero polymorphism GSTM1 modifies the connection between smoking and asbestosis and that the *iNOS* polymorphism modifies the connection between cumulative asbestos exposure and asbestosis. Extra research is needed to clarify whether the genotypes *MnSOD*, *ECSOD*, *CAT* and *iNOS* work as interruptive variables or as effect modifiers on the connection between cumulative asbestos exposure and asbestosis.
The results of this research show that besides asbestos exposure also genetic factors, which are included in the elimination of ROS and RNS, can have an important effect on the development of asbestosis and need to be considered in further research of occupational/environmental diseases connected to asbestos exposure.

CONCLUSIONS

The understanding of molecular mechanisms leading to the pathogenesis of diseases connected to asbestos exposure is slowly improving. Our studies have shown that besides asbestos exposure genetic factors also play an important role in the emergence of asbestos-related diseases. By analysing the candidate genes we have already identified some genetic risk factors for asbestos-related diseases, especially the polymorphisms of antioxidant genes. A better understanding of molecular mechanisms of the emergence and progression of these diseases enables the detection of new diagnostic and/or prognostic markers.
Our findings until now show that besides environmental and/or occupational exposure to genetic factors as well as the interactions between different genotypes, between the genotypes and lifestyle factors and between the genotypes and environmental/occupational exposure have an important effect on the development of diseases and these interactions and effects should be researched in more detail.
The integration of epidemiological, clinical and molecular-genetic data will enable the development of prognostic models which will be useful in clinical practice. During that research ethical principles should

also be applied, because the knowledge of genetic factors in genetics-environmental interactions can never be used in screening tests in the sense of discrimination.

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Expert's report

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PRIMERI MEZOTELIOMA NA MADŽARSKEM – ZGODBA O DVEH REGISTRIH

Ferenc Kudász, Attila Budavölgyi, Károly Nagy

Izvleček

V letih 1970-80 je bila na Madžarskem dobro razvita industrija za predelavo azbesta. V skladu z odredbo Evropske unije, sta bila prepovedana proizvodnje in trženja izdelkov iz azbesta. Vendar pa traja latentno obdobje med izpostavljenostjo in nastopom bolezni pri mezoteliomu, ki je tesno povezan z izpostavljenostjo azbestu, od dve do štiri desetletja. Torej lahko pričakujemo in spremljamo nove primere mezotelioma. O vsaki bolezni, za katero sumimo, da spada med poklicne bolezni, je treba poročati regionalni inšpekcijski službi za varstvo pri delu. Predvidevamo lahko, da niso prijavljeni vsi primeri mezotelioma, ki spadajo med oklicna obolenja.

V raziskavi smo analizirali podatke Narodnega registra rakastih obolenj. Ta podatkovna zbirka je del sistema zdravstvenega varstva in je povezana z zdravljenjem. Podatkovno zbirko vzdržuje Državni inštitut za onkologijo (OOI).

V obdobju med 2000-2014 je bilo skupaj zabeleženih le 57 primerov mezotelioma, povezanega s poklicnimi boleznimi, Državni register raka pa navaja letno okoli 100 primerov (ICD: C45). V zgoraj navedenem registru je povprečna starost bolnikov 62 let, 60-70 % je moških. Odkrili smo, da so primeri očitno številčnejši v bližini tistih industrijskih centrov, v katerih je potekala predelava azbesta. Podatki o zaposlitvi sicer ne obstajajo, vendar je zelo verjetno, da je bila večina bolnikov izpostavljena na delovnem mestu.

Na Madžarskem je pojavnost mezotelioma blizu vrhunca, pričakujemo pa lahko le počasen upad, ki ga še poslabšuje nizka raven skladnosti s predpisi s področja varstva pri delu in varovanja zdravja na področju azbesta.

Ključne besede: mezoteliom, register, Madžarska, epidemiologija

UVOD

Mezoteliom kot poklicna bolezen

Večino poklicnih bolezni označuje dolga latenca, ki lahko traja tudi desetletja. Takšno časovno obdobje lahko zabriše odnos med boleznijo in poklicem in je pogosto vzrok pomanjkljivega poročanja. Mezoteliom je dober primer dolgega latentnega obdobja. [1] Maligni mezoteliom je tumor, ki se razvije iz sokrvične obloge poprsnice, srca, abdomna in skrotuma. Izid bolezni je negotov, trenutne terapije proti raku v večini primerov niso dovolj učinkovite. [2] Azbest je dokazano rakotvoren in lahko povzroči mezoteliom. [3] Zaradi njegovih odličnih izolacijskih lastnosti, je bila uporaba azbesta zelo razširjena v 20. stoletju. Vendar pa so vedno številčnejši dokazi o boleznih, povezanih z azbestom in njegov rakotvorni potencial, pripeljali do omejitve uporabe in na koncu tudi prepovedi v Evropi. [4] Razvite države se šele soočajo z vrhuncem pojavnosti mezotelioma. [5] Madžarska je proizvajala veliko izdelkov iz azbesta, proizvodnja pa je dosegla vrhunec v sedemdesetih in osemdesetih letih prejšnjega stoletja z 2,87-3,29 kg azbesta/prebivalca/leto [6]. Stanje na področju bolezni, povezanih z azbestom v srednji in vzhodni Evropi, je obravnavala nedavna evropska raziskava. [7]

Glavni vzrok mezotelioma je izpostavljenost azbestu (ali azbestu podobnih vlaken). [8] Katerikoli register mezotelioma je zato zelo zanimiv zaradi možnosti bolj realističnega vpogleda v poklicna rakasta obolenja. Le 10 % primerov mezotelioma v Italiji ni povezanih s poklicno izpostavljenostjo azbestu. [9]

METODE

Register poklicnih bolezni

Na Madžarskem obstaja obveznost poročanja, preiskave in prijave poklicnih bolezni. Trenutna zakonodaja predvideva, da mora prvi zdravnik, ki opazi zadevno bolezen, poročati o svojih sumih regionalni delovni inšpekcijski službi. Le ta preišče potek izpostavljenosti in pošlje dosje v strokovni pregled vrhovnemu organu za varstvo pri delu in varovanje zdravja, ki ima trenutno naziv Oddelek za varovanje zdravja na delovnih mestih pri Uradu vodje zdravstvene službe (OTH-MFF). Regionalni urad

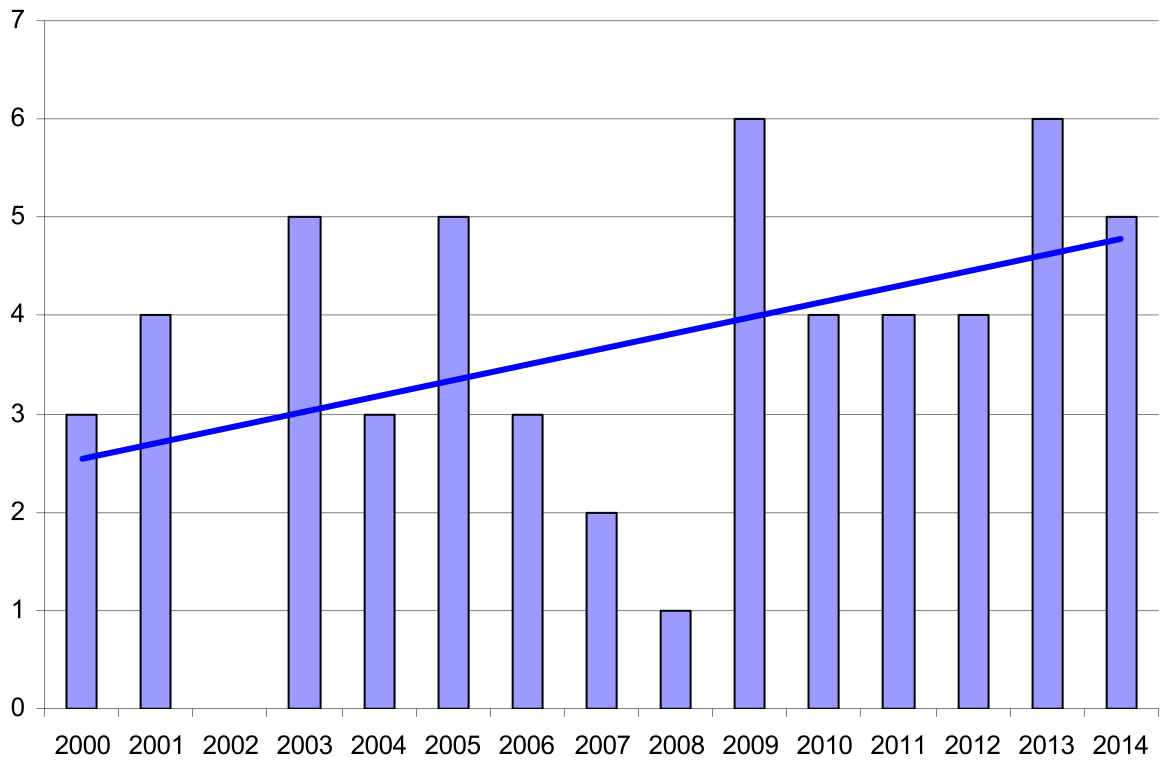
državnega sklada za zdravstveno zavarovanje (OEP) je izdal uradno resolucijo. [10] Potrebno je zaprositi za nadomestilo za poklicne bolezni. Obstaja seznam poklicnih bolezni, ki je v skladu z Evropskim razvidom poklicnih bolezni [11], vendar je odprt, kar pomeni, da se lahko poroča o vseh boleznih, pri katerih je znanstveno dokazano, da izhajajo iz izpostavljenosti na delovnih mestih. Potrjene primere registrira OTH-MFF in tako sestavlja register poklicnih bolezni.
V naši raziskavi smo poiskali primere mezotelioma v letnih poročilih OTH-MFF za obdobje 2000-2014. [12]

Državni register raka
Evropski program za preprečevanje rakastih obolenj je zahteval, da vzpostavijo vse države članice do leta 2000 register raka. Novi madžarski register je bil vzpostavljen leta 1999 v Državnem onkološkem inštitutu (OOI). [13] Je register populacije za epidemiološke namene, v katerem se zbirajo podatki o posameznih primerih rakastih obolenj in podatki o njihovem zdravljenju. [14] Vsak zdravnik, ki zdravi maligno bolezen, mora v elektronski obliki poslati poročilo v osrednjo podatkovno zbirko. [15] Enota zbiranja podatkov je bolnikova maligna bolezen. Podvojitve in napačni vnosi se odstranijo v naslednjem letu in tako ustvarijo podatkovno zbirko za referenčno obdobje. Letna poročila se objavljajo, zbrani podatki so na razpolago na spletu. Anonimizirani podatki o primerih mezotelioma (koda 10 za Mednarodno razvrstitev bolezni: C45) so bili zbrani v obdobju od prvega celotnega leta (2000) do zadnjega leta s prečiščenimi podatki (2014). Pri analizi smo upoštevali letnico rojstva, bivališče (okrožje) in spol. Bolnikov, starih manj kot 26 let, nismo upoštevali, saj njihovi primeri nikakor ne ustrezajo merilom za poklicno izpostavljenost in latentno obdobje glede na trenutna znanstvena spoznanja. Tak pristop ustreza postopku študijske skupine British Occupational Cancer. [16]

REZULTATI

Mezoteliomi kot poklicna bolezen
V zgoraj navedenem obdobju je bilo le 57 primerov zabeleženih v registru varstva pri delu. (slika 1.) Večina bolnikov je delala v dveh tovarnah za proizvodnjo azbestnega cementa na delovnem mestu strojnika, prizadeti pa so bili tudi vzdrževalci in pisarniški delavci, Drugi so bili zaposleni v gradbeništvu, kjer se je uporabljal azbest v obliki pršila. Poleg tega so lahko primeri, povezani z azbestom, razširjeni tudi na druga področja, ne le samo predelavo in gradbeništvo. Elektrikar je bil na primer izpostavljen med rezanjem napršene izolacije vagonov, v katere je nameščal električne žice. Med najnovejšimi primeri je tudi strojnik na plavajočem bagru, ki je bil izpostavljen azbestu, ki se je sproščal iz zavor. Zaradi majhnega števila primerov ima kvantitativna analiza po spolu, regiji, poklicu in starosti le majhno veljavo.

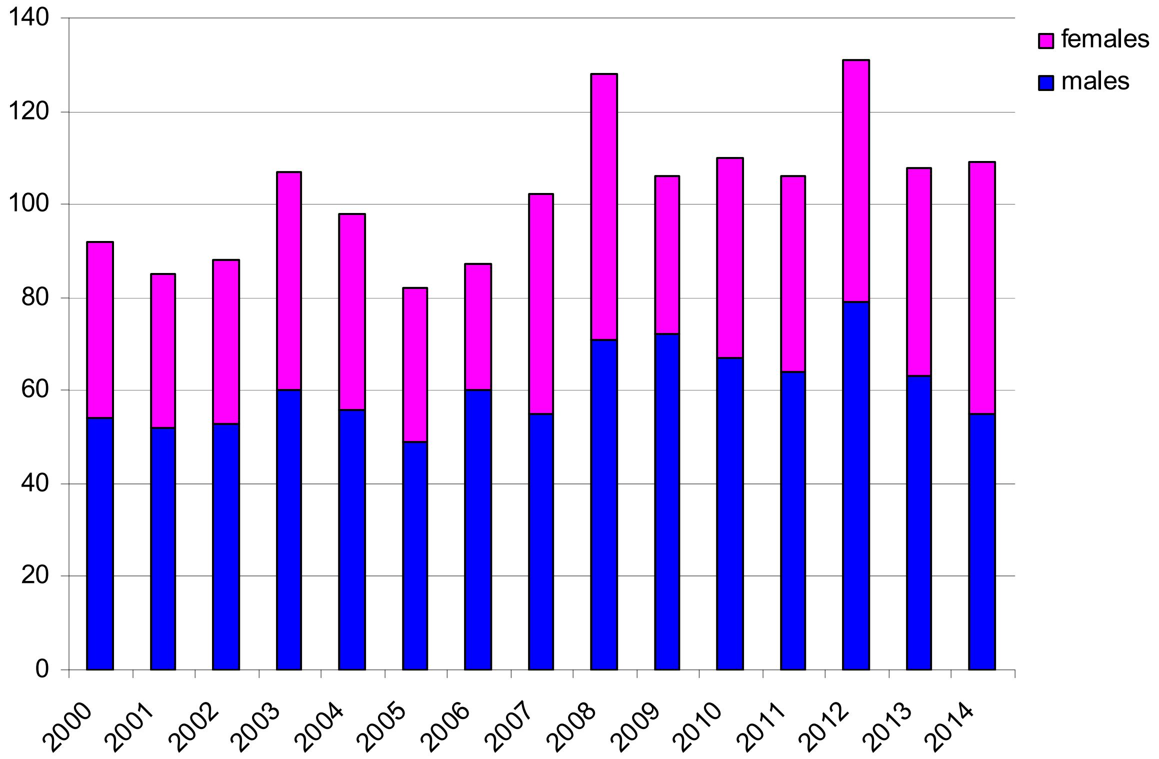
Slika 1. Primeri mezotelioma, ki so na Madžarskem povezani s poklicno izpostavljenostjo azbestu v obdobju 2000 - 2014 in linearna linija trenda.



Vir:podatki iz letnih poročil Državnega urada za varstvo pri delu [12]

Mezoteliom v državnih registrih
Iz neobdelanih podatkov smo izločili 11 primerov (0,7 %), ker so bili bolniki mlajši od 26 let. V registru je tako ostalo 1539 primerov, 629 žensk in 910 moških. (slika 2.) Čeprav kažejo prve številke enakomerno razporejenost, lahko opazimo tudi trende.

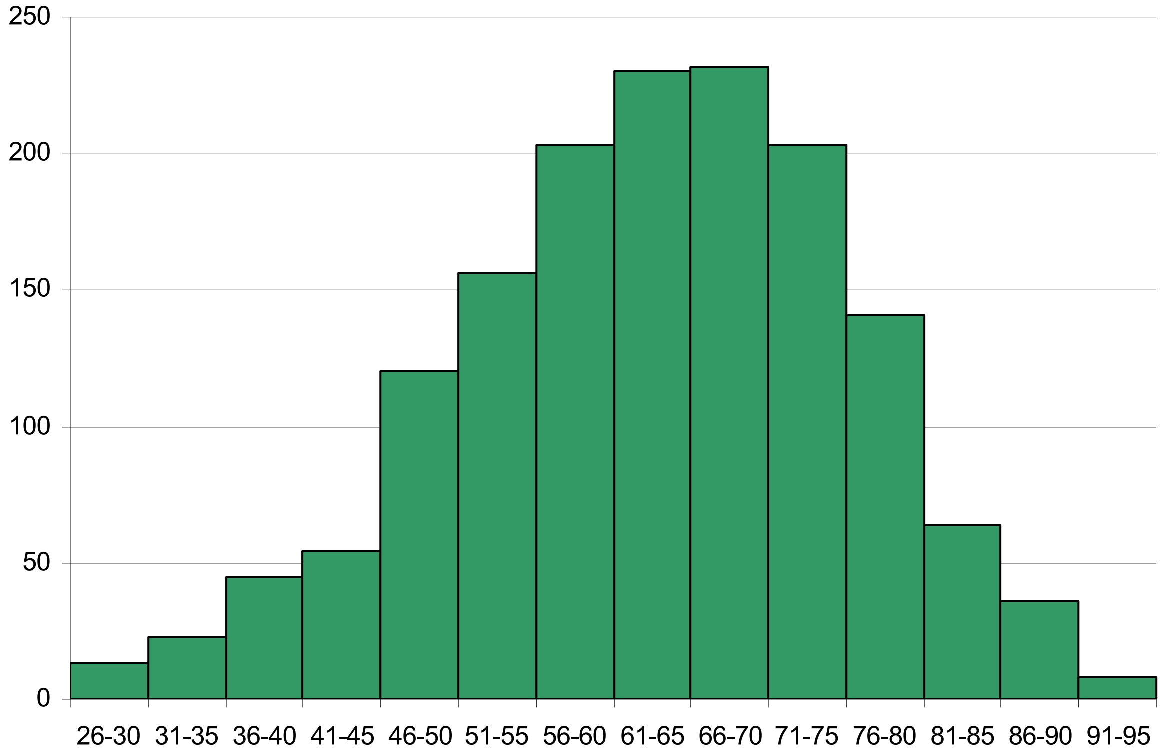
Slika 2. Primeri mezotelioma v madžarskem registru rakavih obolenj v obdobju 2000-2014



Vir: podatki iz Državnega registra rakastih obolenj, Madžarska [13]

Primeri kažejo na znaten porast nad starostjo 45 let in vrhunec pri generaciji od 61 do 70 let. (slika 3.)

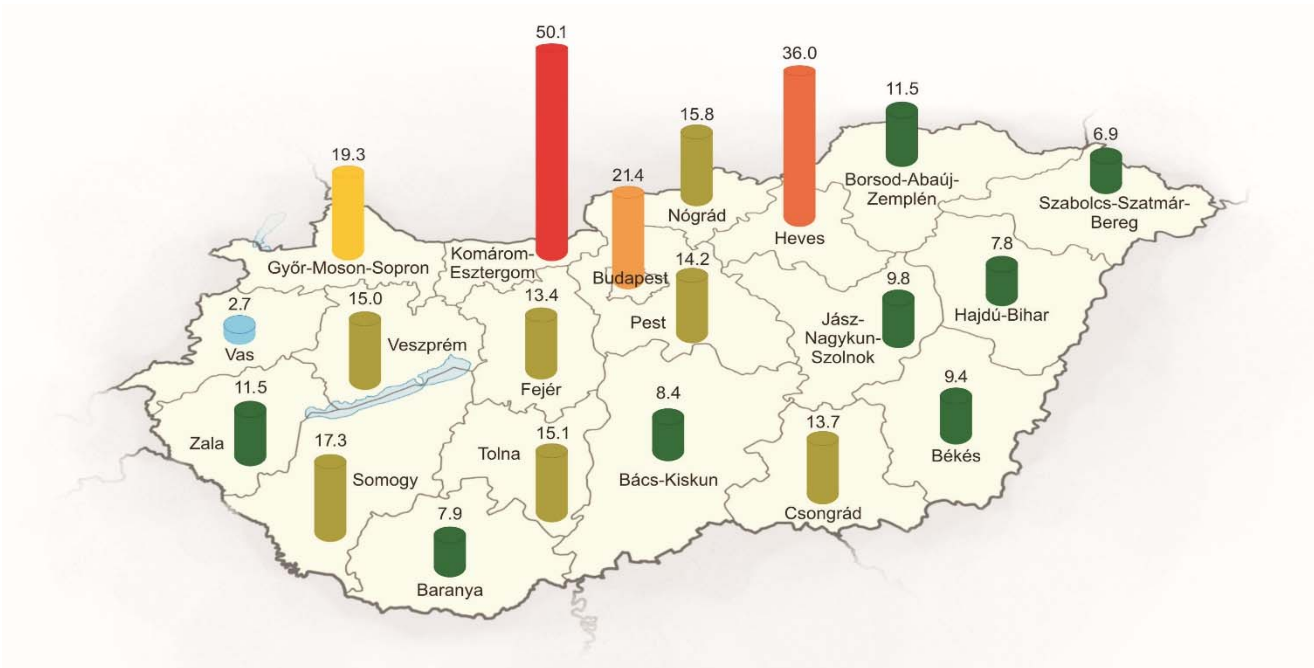
Slika 3. Primeri mezotelioma glede na petletne starostne skupine v madžarskem registru rakavih obolenj v obdobju 2000-2014



Vir: podatki iz Državnega registra rakastih obolenj, Madžarska [13]

Poročila se nanašajo na več kot sto primerov iz prestolnice (Budimpešta: 373), in treh pokrajin (Pest: 176, Komárom-Esztergom: 156, Heves: 111). Ko so bili incidenti preračunani glede na populacijo, se je vrstni red zamenjal, vendar so te štiri regije še naprej ostale pri vrhu. (slika 3.)

Slika 4. Primeri mezotelioma v madžarskih regijah (primerov/100.000 prebivalcev) v obdobju med leti 2000-2014



Vir: podatki iz Državnega registra rakastih obolenj, Madžarska [13]

RAZPRAVA

Opazili smo, da obstaja veliko neskladje med statistiko varstva pri delu in statistiko javnega zdravstva.

Časovne serije

Na osnovi ugotovitev Državnega registra raka je pojavnost mezotelioma v rahlem porastu. To je v skladu z ugotovitvami večine evropskih držav. [17] Poraba azbesta je na Finskem dosegla vrhunec leta 1975, število novih primerov pa je prenehalo naraščati šele pred kratkim. [18] Švedski avtorji ugotavljajo, da je 27-letno obdobje spremljanje prekratko za ugotavljanje učinkov prepovedi, enako pa kažejo tudi ugotovitve na Islandiji. [19] [20] Zaradi dolgega latentnega obdobja ne moremo pričakovati, da bi število primerov na Madžarskem upadlo v naslednjih letih. Na Madžarskem je dosegla poraba azbesta vrhunec v sedemdesetih in osemdesetih letih prejšnjega stoletja, kar pomeni, da lahko pričakujemo v naslednjih desetletjih le enakomerno število primerov.

Starostna porazdelitev

Podatki državnega registra raka kažejo, vrhunec pojavnosti mezotelioma pri mlajši starostni skupini (61-70), kot v mednarodnih podatkih, ki beležijo največje število primerov v starostni skupini 80-84. [21] Verjetna razlaga je, da je dosegla poraba azbesta na Madžarskem vrhunec kasneje in je zato najbolj izpostavljena starostna skupina mlajša. Zgornja analiza WHO kaže, da je v državah s srednjimi prihodki povprečna starost ob smrti nižja kot v državah z visokimi prihodki. [21] V obravnavanem obdobju se je Madžarska uvrščala v kategorijo med zgornjimi srednjimi in visokimi dohodki. [22] Lahko bi sicer razpravljali o tem, ali lahko tesno povežemo zdravstveno stanje ter zdravstveno varstvo in bruto dohodek na prebivalca, ki posredno vpliva na napoved bolezni, Vendar pa neizprosna neodzivnost bolezni na zdravljenje in kratek čas preživetja prej dokazujeta nasprotno.

Geografska porazdelitev

Regionalna porazdelitev primerov je očitno povezana s proizvodnjo azbesta. Izjemno velika pojavnost v okrožjih Komárom-Esztergom in Heves je povezana z dvema tovarnama azbestnega cementa. V prestolnici in okraju Győr-Moson-Sopron je obstajala industrija, ki je uporabljala azbest, kot na primer proizvajalci vagonov ali težke mehanizacije. Poleg tega so velika gradbena podjetja te regije v preteklosti pogosto uporabljala v zgradbah azbest v obliki pršila.

Moteči dejavniki

Viri in tudi tipi azbesta se spreminjajo po posameznih državah. [8] V nekaterih državah je bilo s stališča varstva pri delu problematično pridobivanje, na Madžarskem pa je predstavljala največje tveganje proizvodnja azbestnih izdelkov, še zlasti gradbenih materialov. Azbestu ste lahko izpostavljeni na delovnih mestih in izven njih. Še celo igrače so vsebovale azbest [23], kar sicer ne valja za Madžarsko. Izpostavljenosti izven delovnih mest se lahko pojavi tudi v zaprtih prostorih držav, v katerih se je pogosto uporabljal napršeni azbest. Na Madžarskem morate upoštevati tudi onesnaženost okolja v okolici proizvodnih obratov, pa tudi mesto zaposlitve.

Razlogi za nizko število primerov v poročilih

Na osnovi zgoraj navedenih podatkov verjamemo, da je število mezoteliomov, povezanih s poklicnimi boleznimi, znatno večje od tistega, ki je navedeno v poročilih. Prvi zdravnik, katerega dolžnost in odgovornost je poročati o sumljivem primeru, je lahko splošni zdravnik ali specialist, vendar ima pogosto le malo podatkov o bolnikovi pretekli izpostavljenosti, poleg tega pa ima večinoma premalo časa ter izobrazbo, ki temelji predvsem na kurativi. Ena od posebnih nalog ustanov za medicino dela v podjetjih, je tudi preiskava poklicnih bolezni, ki jo opravljajo zdravniki, specializirani za to področje. [24] Na žalost so te službe pogosto v navzkrižju interesov, ker jih neposredno plačuje delodajalec. Poleg tega dolga latentna doba pomeni, da je bolnik lahko že upokojenec in ne more obiskati specialista za medicino dela. Obstaja splošni trend zmanjševanja poklicnih bolezni, ki ga lahko le delno pripišemo spremembam v industriji in delovnem okolju. Splošno znano je, da so poročila o poklicnih boleznih na Madžarskem močno pomanjkljiva. [25]

Mezoteliom kot kazalnik

Če upoštevamo tesno povezavo med izpostavljenostjo azbestu in mezoteliomu ter hiter in pogosto usoden potek bolezni, je lahko mezoteliom dober kazalnik resnične obremenitve z boleznimi, ki jih povzroča azbest. V povezavi z drugimi boleznimi, povezanimi z azbestom, je pljučni rak zalo pomemben. Izračuni kažejo, da sta na vsak primer mezotelioma 1 - 2 pljučna raka, ki ju je povzročil azbest. [16] [26]

Posledice v prihodnosti

Izpostavljenost azbestu se nadaljuje in sicer tako na prostem, kot v zaprtih prostorih, zanjo so odgovorni tudi manj očitni viri, kot na primer neregistrirano odstranjevanje azbesta, ki ga opravi hitro sestavljena skupina delavcev. Taki primeri izpostavljenosti so danes na Madžarskem najbolj skrb vzbujajoči.

Spremljanje primerov iz državnega registra raka omogoča odkrivanje poklicnega ozadja in pomaga določiti pomanjkljivosti v poročanju. Poleg tega bo slednje pomagalo določiti ogrožene poklice. [19]

Izboljšanje ozaveščenosti med zdravniki, ki se lahko začne že v prvih letih univerzitetnega izobraževanja in traja do njegovega zaključka, bi lahko zagotovilo boljšo skladnost pri poročanju. Vendar pa zgolj ta ukrep ne bo bistveno izboljšal natančnosti poročanja. [27] Predlagamo avtomatizirani sistem za poročanje, ki bi postal obvezni modul programske opreme v zdravstvenem varstvu. Če so izpolnjena predhodno določena merila (npr. koda ICD in še neka vrsta kode, povezana z varstvom pri delu), bi sistem samodejno odprl okno z vprašanjem, ali želi zdravnik prijaviti kot bolezen, za katero sumi, da je poklicnega izvora. Kjer je izpostavljenost tako tesno povezana z boleznijo kot v tem primeru, je že sama diagnoza mezotelioma dovolj, da zdravnik vpraša bolnika oz. bolnico glede izpostavljenosti azbestu. Poleg tega lahko vsak vpis v državni register raka samodejno sproži spletno povpraševanje v podatkovni zbirki „Register dejavnosti, povezanih z rakotvornimi snovmi". Če je potrjena izpostavljenost rakotvornim snovem, prejme zdravnik ustrezno povratno sporočilo. Zavedamo se, da bodo pri vzpostavitvi takega sistema pojavili izzivi, povezani z varovanjem osebnih podatkov.

S tem, ko se bomo izognili obremenitvi, povezani z izpolnjevanjem obrazcev, bodo morda izvajalci zdravstvenega varstva bolj pripravljeni poročati. Poleg tega se lahko možnost pregleda poklicne zgodovine v okviru bolezni pretvori v vsakodnevno prakso.

ZAKLJUČEK

Zdi se, da lečeči zdravniki v sistemu zdravstvenega varstva le malo upoštevajo možnost, da je lahko vzrok bolezni izpostavljenost na delovnem mestu. To ne velja le za bolezni z dolgo latentno dobo (rak), temveč tudi za akutne motnje, kot je na primer astma. Slednje se odraža v majhnem številu prijav pri večini poklicnih bolezni.

Registri javnega zdravstvenega varstva lahko posredujejo dragocene podatke za oceno pojavnosti poklicnih bolezni, tudi rakastih.

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Dela kot strokovnjak za medicino dela pri Državnem inštitutu za varstvo pri delu, ki je trenutno organiziran kot oddelek.
Raziskovalno področje: izvedljivost, ergonomičnost, poklicne bolezni. Sodeloval je pri številnih projektih EU-OSHA

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MESOTHELIOMA CASES IN HUNGARY – A TALE OF TWO REGISTERS

Ferenc Kudász, Attila Budavölgyi, Károly Nagy

Abstract

In the 1970-80-ies there used to be a substantial asbestos processing industry in Hungary. In compliance with the European Union regulations manufacturing and placing on the market of asbestos products was banned. However, concerning mesothelioma, which is very closely linked to asbestos exposure, the latency period between exposure and disease manifestation is about two-four decades. Thus, new mesothelioma cases are expected and can be observed. Any disease that is suspected to be of occupational origin must be reported to the regional labour inspection body. However, occupational mesothelioma cases are underreported.

In our study we analysed the dataset of the National Cancer Register. This data collection is within the health care system and is linked to treatment. The database is maintained by the National Institute of Oncology (OOI).

While in the period of 2000-2014 altogether only *57* occupational mesotheliomas were registered, the National Cancer Register contains around 100 cases (ICD: C45) annually. In the later register the mean age of the patients was 62 years, 60-70% were males. We have found that cases are clearly centred around those industrial hotspots where asbestos processing used to take place. There is no data on occupational history but it is likely that most patients were exposed at work.

Hungary is around the peak of mesothelioma morbidity and only slow decline is expected, which is aggravated by the low adherence to occupational safety and health requirements concerning asbestos.

Key words: mesothelioma, register, Hungary, epidemiology

INTRODUCTION

Mesothelioma as occupational disease

Most occupational diseases are characterised by long latency, which may mean even decades. Such a time-span may blur the relation of the disease to the occupation, and can be a source of underreporting. Mesothelioma is a good example of that long latency period. [1] Malignant mesothelioma is a tumour developing from the serous linings of the pleura, heart, abdomen and the testicular sac. The prognosis of the disease is very poor, current anticancer therapies are still not satisfactorily effective in most cases. [2] Asbestos is a proven human carcinogen and can induce mesothelioma. [3] Because of its admirable insulating properties asbestos was used extensively in the 20th century. However, the growing evidence on severe asbestos-related diseases and its carcinogen potential led to restrictions of use and finally to a ban in the European Union. [4] The developed world is just facing the peak of mesothelioma cases. [5] Hungary manufactured high amount of asbestos products, peaking in the 70-80-ies with 2.87-3.29 kg asbestos/capita/year [6]. The situation of asbestos-related diseases in Central and Eastern Europe was investigated in a recent European study. [7]

Mesothelioma is predominantly due to asbestos (or asbestos like fibre) exposure. [8] It makes any mesothelioma register very attractive to get insight into more valid occupational cancer figures. Only 10% of mesothelioma cases were reported to be due to non-occupational asbestos exposure in Italy. [9]

METHODS

Register of occupational diseases

In Hungary occupational diseases are subjects to reporting, investigation and registering. The current legislation states that it is the duty of the first physician who observes the disease in question to report the suspicion to the regional labour inspection body. The latter shall investigate the exposure background and the dossier shall be sent for expert revision to the top level occupational health body, which is currently called the Occupational Health Department in the Office of the Chief Medical Officer (OTH-MFF). Until now the official resolution was issued by the regional body of the National Health

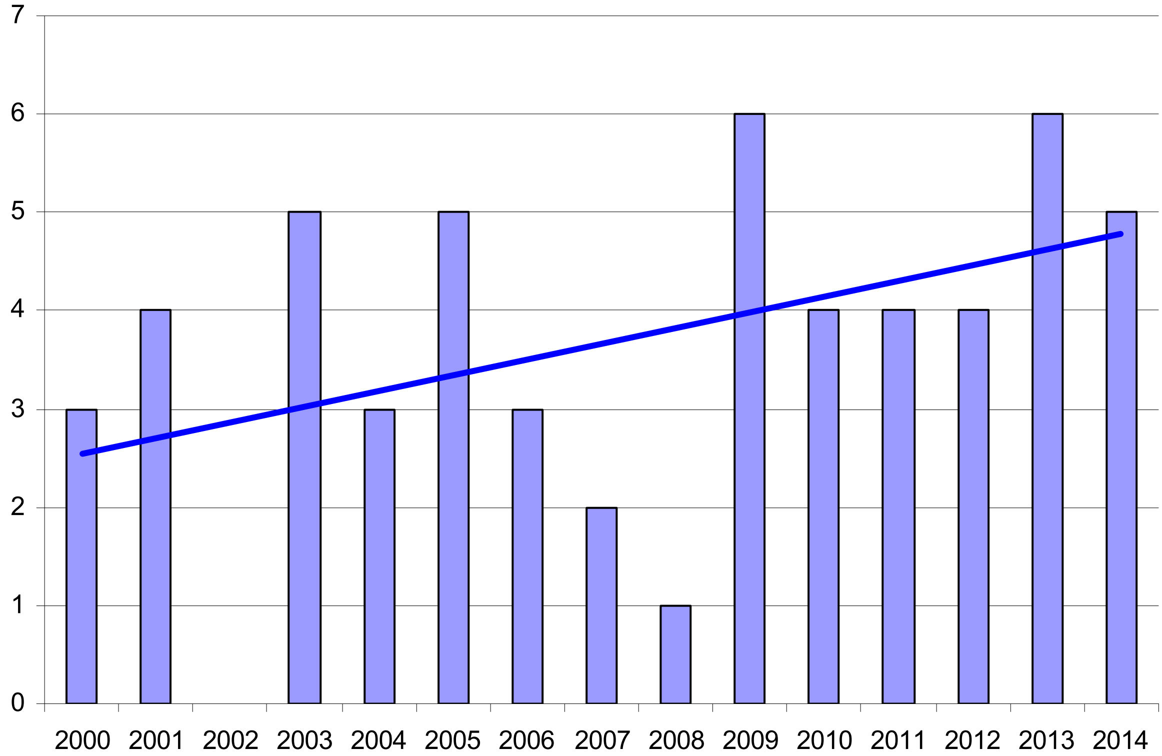
Insurance Fund (OEP). [10] Compensation of occupational diseases has to be applied for. There is a list of occupational diseases, which is conform to the European schedule of occupational diseases [11], but it is open, so any disease scientifically proven to be due to occupational exposure can be reported. Confirmed cases are registered at OTH-MFF and establish the register of occupational diseases.
In our analysis mesothelioma cases were extracted from the yearly reports of OTH-MFF for the period 2000-2014. [12]

National Cancer Register
The Europe Against Cancer programme requested that Member States establish their cancer registers by the end of 2000. The new Hungarian register was set up in 1999 in the National Institute of Oncology (OOI). [13] It is a population register for epidemiologic purposes, collecting individual cancer cases and treatment data thereof. [14] Every physician treating a malignant disease has to report the data, electronically, to this central database. [15] The unit of the data collection is the patient's malignant disease. Duplicates, erroneous entries are purged the following year to create the valid dataset for the reference period. Yearly reports are published and aggregate data are available on-line. Anonymised data of mesothelioma cases (International Classification of Diseases 10 code: C45) were retrieved starting with the first complete year (2000) until the last year with purged data (2014). We used years of birth and report, place of residence (county), and gender in the analysis. Patients below the age of 26 were omitted as their cases are absolutely not compliant with the requirements concerning occupational exposure and latency period based on current knowledge. This approach conforms to the procedure of the British Occupational Cancer Burden Study Group. [16]

RESULTS

Occupational mesotheliomas
In the time period written above there were only *57* cases registered in the occupational register. (Figure 1.) Most of the patients worked in two asbestos cement product manufacturing plants as machine operators, but maintenance and office workers were victims too. Others were employed in the construction sector, where sprayed asbestos was used. Moreover, asbestos cases stretch well beyond asbestos processing and construction. For example, an electrician was exposed during the carving of sprayed insulation of carriages while installing electrical wires. Furthermore, among recent cases a machine operator on a dredger was exposed to the asbestos released from the breaks. The low number of cases makes any quantitative analysis by gender, region, occupation or age of little value.

Figure 1. Occupational asbestos-related mesothelioma cases in Hungary recognised in years 2000-2014 and linear trend line

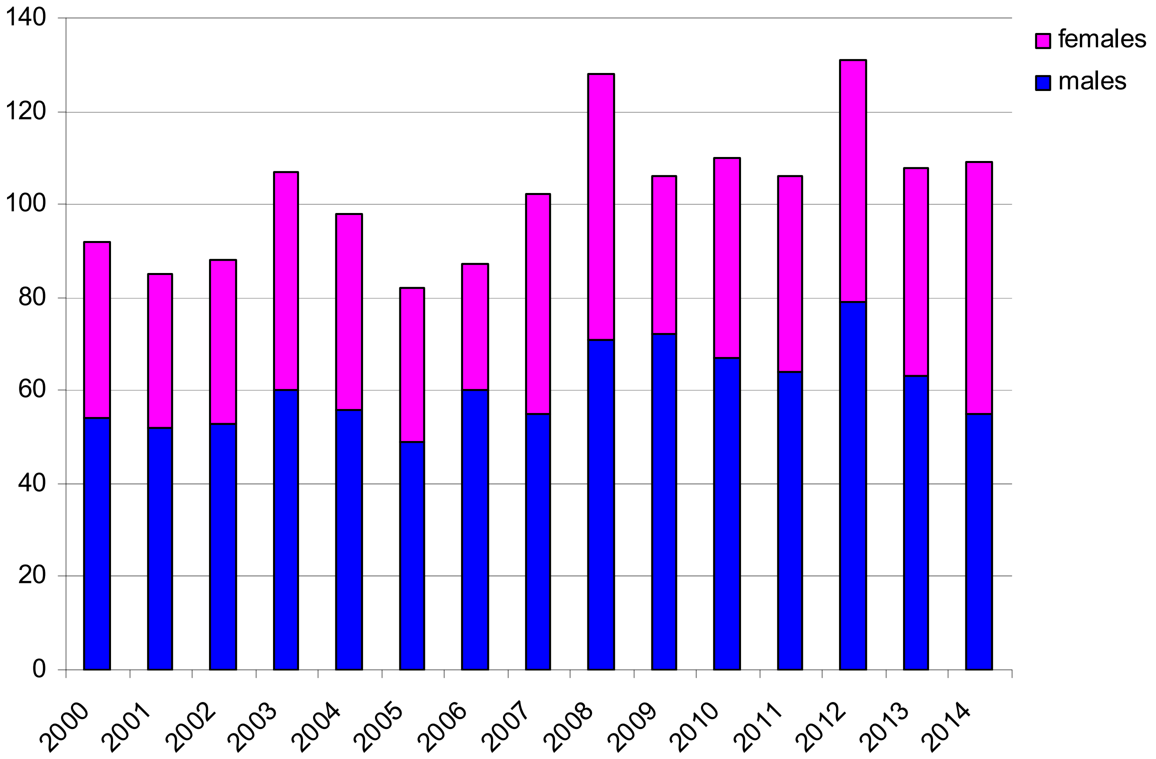


Source: data from yearly reports of the national occupational health body [12]

Mesotheliomas in the National Register

We omitted 11 cases (0.7%) from the raw data because they were younger than 26 years. There were 1539 cases left from the register, 629 females and 910 males. (Figure 2.) Although yearly figures scatter, an increasing tendency can be observed.

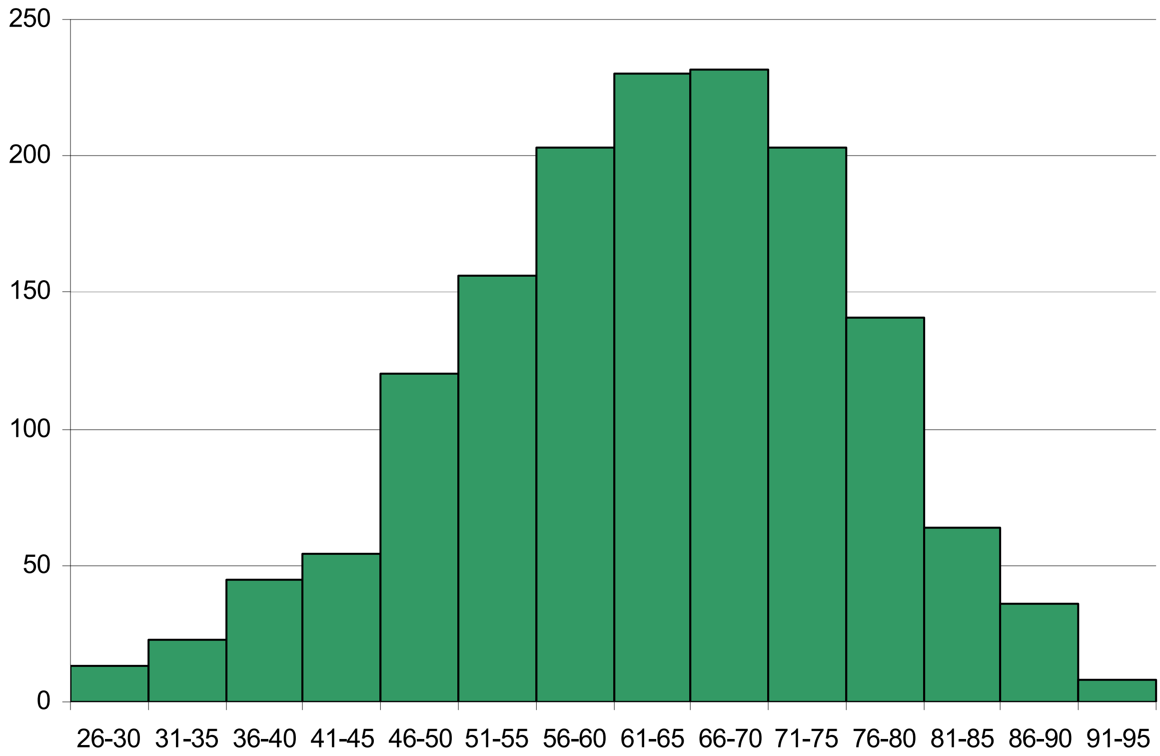
Figure 2. Mesothelioma cases in the Hungarian Cancer Register 2000-2014



Source: data of the National Cancer Register, Hungary [13]

Cases showed a marked surge above the age of 45 and peaked in the 61-70 years old generations. (Figure 3.)

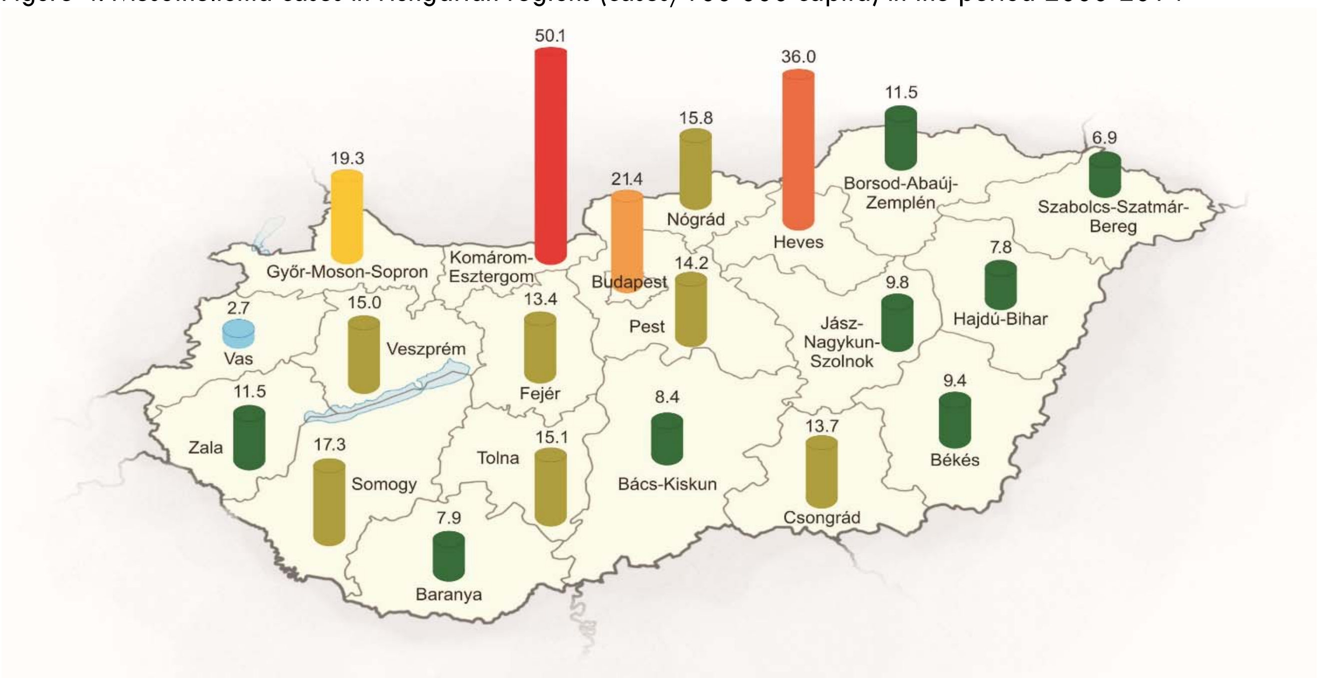
Figure 3. Mesothelioma cases in five year age groups in the Hungarian Cancer Register 2000-2014



Source: data of the National Cancer Register, Hungary [13]

Over hundred cases were reported from the capital of Hungary (Budapest: 373), and three counties (Pest: 176, Komárom-Esztergom: 156, Heves: 111). When incidences were corrected to population, the order switched but these four regions kept their top rank. (Figure 3.)

Figure 4. Mesothelioma cases in Hungarian regions (cases/100 000 capita) in the period 2000-2014



Source: data of the National Cancer Register, Hungary [13]

DISCUSSION

We found that there was a huge mismatch between the occupational statistics and the public health care statistics.

Time series

Based on the findings from the National Cancer Register, the incidence of mesothelioma was slightly rising. This is in line with the findings for most European countries. [17] Asbestos consumption peaked in Finland in 1975 and the number of new cases flattened out only recently. [18] Swedish authors found a follow-up time up to 27 years too short to illustrate the effect of ban, similarly to the findings in Iceland. [19] [20] Due to the long latency period, it is not expected that the number of Hungarian cases will fall in the upcoming years. In Hungary the consumption of asbestos peaked in the (70)-80-ies, which can promise only a flattening of cases in the next decades.

Age distribution

Data from the National Cancer Register show that the peak of mesothelioma cases is in a younger age group (61-70) than published international data, which peaks at the age of 80-84. [21] A plausible explanation may be that in Hungary asbestos consumption peaked later and thus the exposed age cohort is younger. The above WHO analysis showed that in middle income countries the mean age at death is lower than in high income countries. [21] Hungary balanced between the upper-middle and the high-income categories in the time period observed. [22] One might argue that the population's health status and health care can be closely linked to gross national income per capita, which indirectly influences the prognosis of the disease. However, the merciless unresponsiveness of the disease to medical treatments and low survival time makes this explanation less likely.

Geographical distribution

The regional distribution of cases are clearly related to asbestos manufacturing. The outstanding incidence ratio of Komárom-Esztergom and Heves counties are due to two asbestos cement factories. In the Capital and Győr-Moson-Sopron county asbestos consumption industries were present, like manufacturing of carriages or heavy machinery. Furthermore, a big construction company from this region is known to have typically used sprayed asbestos in their buildings in the past.

Confounders

Asbestos sources and also types may vary among countries. [8] While in some countries mining was a significant occupational source, in Hungary it was the manufacturing of asbestos products, especially building materials. However, asbestos exposure could occur at and outside of the workplace. Even toys are known to have contained asbestos. [23], although this is not known for Hungary. Non-occupational exposure may be indoor environmental in countries where sprayed asbestos were commonly used. In Hungary the outdoor environmental pollution near the manufacturing sites must be taken into account as well when considering occupational origin.

Reasons for low reporting

Based on the above figures, we believe that the number of occupational mesotheliomas is significantly higher than those reported. That first physician, whose duty and responsibility would be to report the suspected case, can be the general practitioner or the specialist, but they may have little information on the patient's past exposures, have little time and their education is mainly focused on curative measures. One of the specified roles of occupational health services at the enterprises, where physicians work with an occupational focus in mind, is the investigation of occupational diseases.. [24] Unfortunately, the services are in conflict of interest because they are directly paid by the employer. Furthermore, the long latency may result that the patient is a pensioner and they cannot meet an occupational health specialist. There is an overall decreasing tendency of occupational diseases, which can only partially be due to change of industry and working environment. There is a common understanding that occupational diseases are hugely underreported in Hungary. [25]

Mesothelioma as an indicator

Concerning the close relations between asbestos exposure and mesothelioma, the usually fast and lethal outcome of the disease, mesothelioma can be a good indicator of true asbestos-related disease burden. Among the other asbestos-related diseases, lung cancer could be of high importance. Calculations suggest that for every mesothelioma case there are 1-2 lung cancers due to asbestos. [16] [26]

Future implications

Asbestos exposure is continuing from indoor and outdoor environmental sources, besides less obvious occupational sources like unregistered asbestos removal carried out by ad-hoc group of workers. The issue is one of the highest concerns in relation with asbestos exposure in today's Hungary.

Follow-up of cases from the National Cancer Register to discover occupational background would help to justify underreporting. Furthermore, it could help to identify occupations at risk. [19]

Awareness-raising among physicians, which can start even at the gradual university years and persist in their continuous medical education, may provide better reporting compliance. However, this alone promises little rise in reporting figures. [27] We propose automated reporting systems that would be compulsory modules of health care softwares. If predefined criteria are met (e.g. ICD code plus some kind of occupational code), the system would pop-up a question whether the physician considers reporting it as a disease that is suspected to be of occupational origin. Where exposure is so closely linked to a disease, like here, the sole diagnosis of mesothelioma could be enough to prompt the physician to ask the patient whether he/she was ever exposed to asbestos. Furthermore, any input to the National Cancer Register could automatically trigger an on-line query towards the "Register of activities with carcinogen substances" database [28]. If carcinogen exposure history is confirmed, a case suspicion may be proposed to the doctor in return. We understand that data privacy issues can be challenging in the establishment of such systems.

By overcoming the administrative burden of filling out forms, health care providers may be more willing to report. In addition, the possibility of occupational history behind the disease would be mainstreamed into their everyday practice.

CONCLUSION

Treating physicians in the health care system seems to consider little the possibility of occupational origins for diseases. This applies not only to diseases with long latency period, like cancers but even to acute disorders like asthma. This is reflected by the low reporting incidence of most occupational diseases.

Public health registries may provide valuable data for the estimation of occupational disease prevalence, including cancers.

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BREZ AZBESTA VARNA (DELOVNA) MESTA; OZAVEŠČANJE KROVCEV O DELU Z AZBESTOM

Damjana Miklič Milek, Metoda Dodič Fikfak

Povzetek

Delavci, ki se na svojih delovnih mestih ukvarjajo z obnovitvenimi deli, zlasti krovci in drugi gradbeni delavci, se pogosto srečujejo z azbestom, azbestcementnimi izdelki in/ali odpadki, vendar se slabo zavedajo nevarnosti azbesta. S promocijo zdravja pri delu smo poskušali izboljšati znanje, odnos in zavest zaposlenih v smislu večje varnosti za zdravje ter zmanjševati tvegano vedenje pri ravnanju z azbestcementnimi izdelki in/ali odpadki. Kampanja ozaveščanja je bila zasnovana kot informativni in izobraževalni program in je bila posebej osredotočena na dejavnosti za ohranjanje in izboljšanje zdravja na delovnem mestu. Izvajali smo dve vrsti dejavnosti: oblikovali smo izobraževalna in informativna gradiva (izobraževalni film, priročnik…) za podporo širše kampanje ozaveščanja o nevarnosti izpostavljenosti azbestu ter izvedli izobraževalne delavnice za delavce in delodajalce, ki opravljajo krovsko dejavnost ali katero drugo gradbeno dejavnost. Izobraževalnih delavnic, ki so se v treh terminih odvijale na treh lokacijah, se je udeležilo 51 krovcev. Celotna vsebina usposabljanja je bila zasnovana tako, da so delavci pridobili veščine in znanja o varovanju delavcev pred tveganji zaradi izpostavljenosti azbestu pri delu.

Ključne besede: azbest, krovci in drugi gradbeni delavci, promocija zdravja pri delu

AZBEST IN (NE)VARNA DELOVNA MESTA

Grška beseda azbest (asbestos – neuničljiv, večen) označuje najpomembnejše lastnosti tega v naravi prisotnega minerala, kar je tudi glavni razlog za njegovo razširjenost v industriji in gradbeništvu. Edinstvene tehnične lastnosti so privedle do povečane uporabe zlasti med močno gospodarsko rastjo po letu 1945. Azbest najdemo v več kot 3000 izdelkih, od velikih količin pri stavbah ali ladjah pa tudi do manjših, npr. v cigaretnih filtrih [1].

Zavedati se moramo, da se letna proizvodnja azbesta na svetu ni zmanjšala, čeprav so številne države prepovedale njegovo uporabo [2]. Letna proizvodnja azbesta v svetu je še vedno okoli 4 milijone ton ali 0,7 kg na človeka [3]. Vseevropska prepoved azbesta in sedanji nadzor trga ne moreta preprečiti, da se proizvodi iz azbesta ne bi uvažali na evropski trg.

V Slovenijo je bilo od leta 1946 uvoženega približno 670.000 ton azbesta. Večinoma je bil to beli azbest. Večino tega, tj. približno 614.000 ton (89 %), je uvozil Salonit iz Anhovega. Največja poraba azbesta je bila sredi 70. in 80. let [3]. V Sloveniji smo do leta 1996 proizvajali salonitne plošče, plošče za tesnila, azbestno lepenko, elastometal, azbestcementne cevi, kite, paste, azbestne mase, lepila, azbestno tkanino, azbotekst, kombi-S-plošče, kaširne in kombi plošče, motorna tesnila, industrijska tesnila in filtre, izolirne trakove, uporabljali smo čisti brizgani azbest, azbest smo odstranjevali in vgrajevali v tirna vozila, vgrajevali smo ga tudi v kotle in iz njega izdelovali zavorne obloge [3].

Azbestni izdelki, ki smo jih proizvajali v Sloveniji, so uporabni od enega leta do več kot 45 let, ponekod pa je azbest trajno vgrajen v objekte. Za izdelke, ki jih je bilo v Sloveniji največ proizvedenih, je življenjska doba od 35 do 45 let, kar pomeni, da je večina izdelkov še v uporabi, da pa se čas uporabe polagoma že izteka. Sčasoma bodo ti izdelki v približno enakih količinah pristali na odlagališčih [3].

V tovarnah, kjer so delali z azbestom, in v njihovi okolici je bilo temu nevarnemu mineralu izpostavljenih več milijonov ljudi po vsem svetu. Čeprav se je število izpostavljenih v delovnem okolju po prepovedi uporabe azbesta v industriji (proizvodnji azbestnih izdelkov) občutno znižalo, pa še vedno prihaja do izpostavljenosti azbestu predvsem med delavci, ki gradbene objekte iz preteklosti obnavljajo. Med njimi so najbolj ranljivi krovci in ostali gradbeni delavci, ki sodelujejo pri prenovah starejših gradbenih objektov.

Kljub temu, da so vse oblike azbesta nevarne in so bile njegove nevarne posledice popisane, da v zvezi s tem obstaja vrsta pravnih aktov in da je uporaba azbesta v Sloveniji od leta 1996 prepovedana, je veliko azbestnih izdelkov še vgrajenih v strehe, vodovodno napeljavo, izolacijo, talne obloge (plošče »vinaz«) in podobno.

V Sloveniji so trenutne razmere na področju nepremičnin neugodne za gradnjo novih objektov, zato je zaznati naraščajoč trend obnove starejših stavb. Večinoma gre za zasebne vlagatelje – fizične osebe, ki prenavljajo starejše nepremičnine za lastno rabo in ki večinoma najemajo manjše, cenejše izvajalce za izvedbo sanacijskih del.

Menjava azbestcementne kritine, ki je po desetletjih uporabe dotrajana in »cveti« (slika 1), pri tem pa se v okolje sprošča ogromno azbestnih vlaken, izjemno nevarnih za zdravje, je po letu 2009 postala pogosto opravilo malih in srednje velikih podjetij in/ali samostojnih podjetnikov, ki se ukvarjajo z gradbenimi in krovskimi deli.

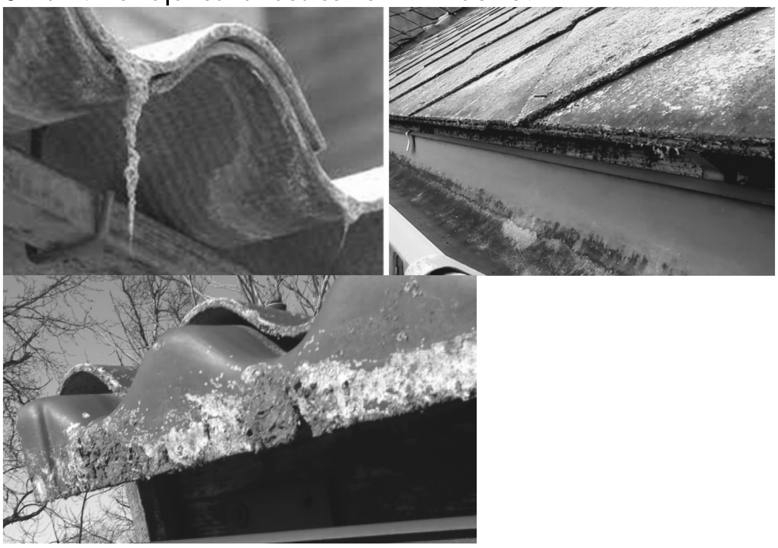
Neprofesionalno odstranjevanje dotrajane kritine tako ne ogroža le delavcev, ki s tem materialom delajo, ampak tudi okoliške prebivalce, saj se nevarna azbestna vlakna širijo po zraku in lahko onesnažijo veliko območje [4]. Varno odlaganje azbestcementnih izdelkov je pomemben del vsakega načrta za odstranjevanje nevarne kritine [5].

Velik problem je neznanje oziroma pomanjkljivo poznavanje azbesta. Številni delavci so pri svojem delu izpostavljeni azbestu, pa tega bodisi ne vedo, bodisi izpostavljenosti pripisujejo manjše tveganje [3].

Veliko tveganje za izpostavljenost azbestu na delovnem mestu obstaja pri poklicih, kot so: krovci, vodovodni inštalaterji, strojniki, ki se ukvarjajo s toplotnimi sistemi, električarji, stavbni mizarji, polagalci talnih oblog, monterji opreme za trgovine, vzdrževalci, vključno s pogodbenimi delavci in hišniki, čistilci, koordinatorji za varnost in zdravje pri delu, inšpektorji za delo in drugi poklici, pri katerih delavci potrebujejo dostop do nadstreškov, prostorov pod opaži in drugih »skritih« mest [2].

Ocenjujemo, da v Sloveniji okoli 30 odstotkov vseh kritin vsebuje azbest, ki ga je treba varno odstraniti, da je tveganje pri takih delih za zdravje ljudi zelo visoko in da so stroški zdravljenja bolezni, ki jih povzroča izpostavljenost azbestu, še vedno zelo visoki.

Slika 1: Dotrajanost azbestcementnih izdelkov



V Sloveniji opažamo tudi ponovno uporabo rabljenih azbestcementnih izdelkov, ko se pri obnovi streh zasebnih hiš in odstranitvi dotrajanih azbestcementnih izdelkov iz bivalnih prostorov te azbestcementne odpadke shrani in naknadno ponovno uporabi za strehe drvarnic, vrtnih lop, pasjih ut in drugih pomožnih objektov. Na spletnih portalih malih oglasov se (še vedno) pojavljajo oglasi tipa »prodam« ali »podarim« azbestcementne plošče [6].

Zato se je na področju izobraževanja in osveščanja za varno delo z azbestom pokazala velika potreba po dodatnem organiziranem, ciljno usmerjenem delu na področju promocije zdravja za varno delo z azbestom. Tudi Evropski ekonomsko-socialni odbor (EESO) v svojem zadnjem mnenju [2] poziva Evropsko komisijo, naj v sodelovanju z nacionalnimi organi zagotovi potrebno podporo za ukrepe in pobude za zagotovitev zaščite vseh delavcev v EU.

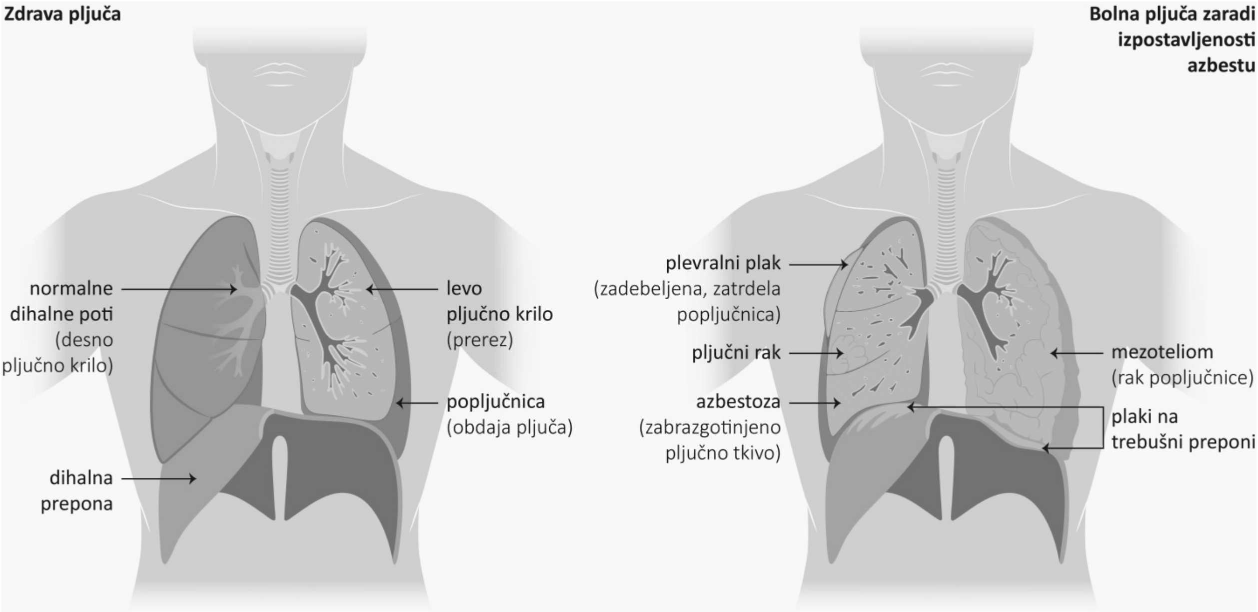
Kljub temu, da se je v preteklosti že izvajalo nekaj izobraževalnih programov in vsebin, prilagojenih delavcem (predvsem delavcem v industriji azbestnih izdelkov), ki so prihajali v stik z azbestom na delovnem mestu, pa na KIMDPŠ ocenjujemo, da zavedanje o tveganjih za zdravje še zdaleč ni na zadovoljivi ravni.

BOLEZNI, POVEZANE Z IZPOSTAVLJENOSTJO AZBESTU

Tveganje za zdravje zaradi izpostavljenosti azbestu je bilo znano že v poznem 19. stoletju. Nevarnost za zdravje pomeni predvsem njegova struktura in velikost delcev, ki jih lahko človek vdihne [7]. Vse oblike azbesta (beli, modri in rjavi) so rakotvorne [8]. Tudi nizke koncentracije azbestnega prahu v zraku lahko povzročijo zelo resne različne bolezni pljuč npr. azbestozo, bolezni plevre, mezoteliom, pljučni rak in druge (slika 2). Najnevarnejši je rak pljučne in trebušne mrene, mezoteliom. Azbest zelo verjetno povzroča tudi raka na grlu, prebavilih in ledvicah. Pravimo, da je azbest splošen karcinogen [9].

Čeprav je uporaba azbesta v več državah prepovedana, je ocenjeno, da vsako leto v svetu umre več kot 100.000 ljudi zaradi posledic izpostavljenosti azbestu [2]. Gre za katastrofo razsežnosti Hirošime, počasna, neusmiljena in tiha Hirošima [10]. Tako rekoč vsakih pet minut v svetu nekdo umre zaradi bolezni, povezane z azbestom.

Slika 2: Bolezni, povezane z izpostavljenostjo azbestu: azbestoza, plevralni plaki, mezoteliom in pljučni rak [6]

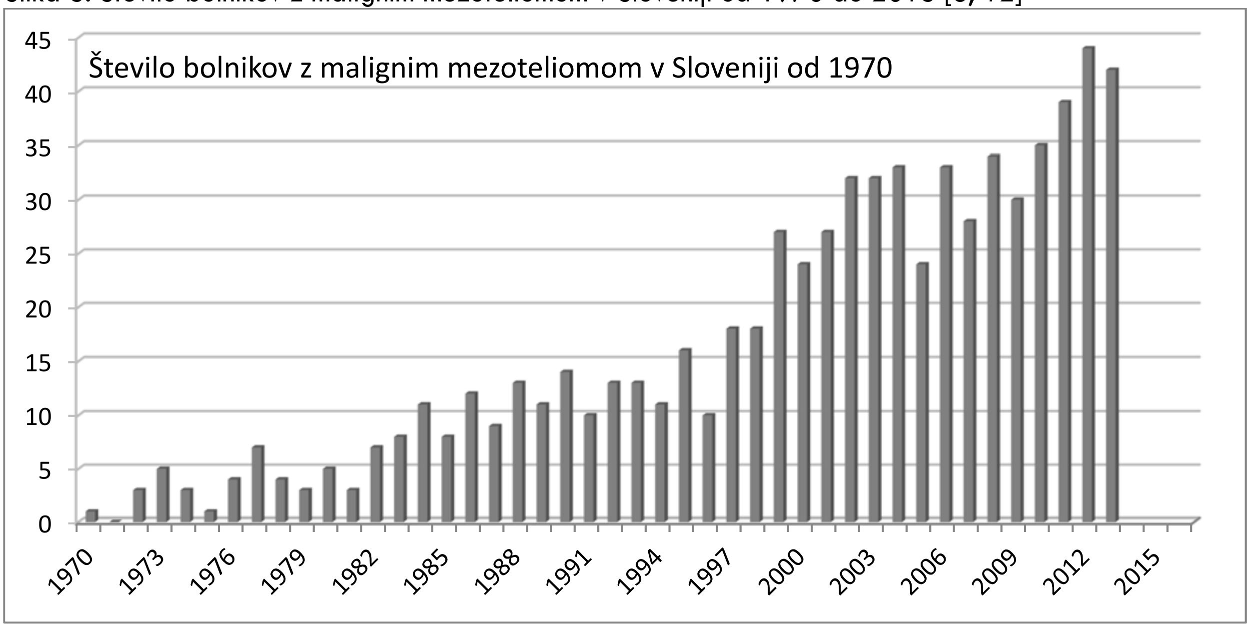


Slika 2a prikazuje zdrava pljuča: lokacijo pljuč, dihalnih poti, poprsnice in trebušne prepone v telesu. Slika 2b prikazuje bolna pljuča zaradi izpostavljenosti azbestu [6].

V Sloveniji je bilo azbestu neposredno izpostavljenih približno 3000 delavcev, posredno pa 23.000 delavcev [11]. Če k temu prištejemo še družine teh delavcev, ki so bile azbestu izpostavljene zaradi prenosa azbestnih vlaken v družinsko okolje prek obleke in las zaposlenega, potem je ta številka še veliko višja.

Podatki o pojavljanju mezotelioma v Sloveniji kažejo, da se je kljub prepovedi uporabe azbesta v letu 1996 incidenca mezotelioma v prejšnjih letih na videz sicer umirila, vendar pa je v naslednjih letih spet porasla (slika 3), med zbolelimi pa je tretjina takih, ki so bili azbestu minimalno izpostavljeni [6, 12].

Slika 3: Število bolnikov z malignim mezoteliomom v Sloveniji od 1970 do 2013 [6, 12]



Pričakujemo, da bo število teh bolezni vsaj tako visoko še najmanj dve desetletji; kako dolgo bo to obdobje, pa je odvisno od tega, kako bomo naše bivalno in naravno okolje očistili azbesta. Doslej smo se s tem problemom srečevali le pri delavcih, ki so bili poklicno izpostavljeni azbestu, prebivalstvo pa je bilo skoraj povsem zanemarjeno.

Interdisciplinarna skupina strokovnjakov za verifikacijo poklicnih bolezni zaradi izpostavljenosti azbestu, ki deluje v skladu z zakonodajo s tega področja in ima sedež na Kliničnem inštitutu za medicino dela, prometa in športa v Ljubljani, je v obdobju 1998-2011 obravnavala 2.533 oseb s sumom na poklicno bolezen, povezano z izpostavljenostjo azbestu, od tega je pri 1.833 osebah potrdila poklicno bolezen za vsaj eno od diagnoz, povezanih z izpostavljenostjo azbestu [13].

Večina teh oseb je bila nekdaj zaposlenih v tovarnah, kjer so izdelovali azbestcementne izdelke, precej pa je bilo tudi delavcev vzdrževalcev opreme in vozil, v katerih se (je) nahaja(l) azbest, ali delavcev izolaterjev. V več kot 170 primerih potrjenih poklicnih bolezni je šlo za maligne bolezni pljuč in drugih organov, kjer so obeti za preživetje zelo slabi. Čeprav smo glede na za te bolezni značilno dolgo latentno dobo upali, da smo vrh obolevnosti z mezoteliomom že dosegli, pa temu ni tako. Najverjetnejši vzrok za to pa je še vedno onesnaženo življenjsko in delovno okolje v Sloveniji.

OZAVEŠČANJE KROVCEV O DELU Z AZBESTOM - NAČRTOVANJE IN IZVAJANJE PROJEKTA "PROMOCIJA ZDRAVJA ZA VARNO DELO Z AZBESTOM"

Na Kliničnem inštitutu za medicino dela prometa in športa se že več let aktivno ukvarjamo s problematiko poklicnih bolezni zaradi izpostavljenosti azbestu in smo v preteklosti že izvedli in izvajali več aktivnosti osveščanja prebivalstva Slovenije o nevarnosti azbesta.

Ker menimo, da je bilo v Sloveniji doslej preveč nepotrebnih smrti zaradi izpostavljenosti azbestu (ocenjujemo, da jih je bilo od leta 1960 do danes približno 2000) in premalo učinkovitih ukrepov, hkrati pa smo prepričani, da lahko ta položaj bistveno izboljšamo z aktivnostmi promocije zdravja pri delu, smo pristopili k oblikovanju in načrtovanju projekta z naslovom »Promocija zdravja za varno delo z azbestom«.

Snovalci projekta, Klinični inštitut za medicino dela, prometa in športa (KIMDPŠ) ter Obrtno-podjetniška zbornica Slovenije (OZS) – Sekcija krovcev in kleparjev, smo projekt z naslovom »Promocija zdravja za varno delo z azbestom« prijavili na Javni razpis za sofinanciranje projektov za promocijo zdravja na delovnem mestu v letu 2015 in 2016 in zanj pridobili finančno podporo Zavoda za zdravstveno zavarovanje Slovenije.

Projekt popolnoma sledi tudi Mnenju EESO o odpravi azbesta v EU (z dne 18. 2. 2015), kjer je v točki 1.8 jasno navedeno, da je »za varno odstranjevanje nujno ustrezno usposobiti delavce, in sicer tako tiste, ki delajo v specializiranih podjetjih, kot tiste, ki pridejo v stik z azbestom po naključju«.

V okviru projekta na KIMDPŠ nadaljujemo in poglabljamo dosedanje sistematično delo na področju informiranja in izobraževanja glede zdravstvene in varnostne ozaveščenosti zaposlenih, ki na delovnih mestih prihajajo v stik z azbestcementnimi izdelki in/ali odpadki.

Namen projekta je bil delavce, ki se na delovnem mestu srečujejo z velikim tveganjem za izpostavljenost azbestu, ozavestiti o nevarnosti azbesta in jih s pomočjo orodij promocije zdravja na delovnem mestu usposobiti za varno delo.

Projektne aktivnosti so bile usmerjene v izboljšanje znanja, vedenja in ozaveščenosti delavcev v smislu večje varnosti za zdravje ter zmanjševanje tveganih ravnanj oziroma vedenj zaposlenih pri ravnanju oziroma delu z azbestcementnimi izdelki in/ali azbestcementnimi odpadki.

V projektu smo se osredotočili predvsem na mikro, mala in srednje velika podjetja ter samostojne podjetnike in obrtnike, ki se na svojem delovnem mestu srečujejo z velikim tveganjem za izpostavljenost azbestu. Sem sodijo različni poklici, ki se ukvarjajo z obnovitvenimi deli. Izmed vseh članov OZS se z gradbeništvom ukvarja približno 9.000 poslovnih subjektov, ki zaposlujejo še približno 20 tisoč delavcev. Gradbeno področje pokriva več sorodnih sekcij. V Sekciji gradbincev je združenih približno 5.000 izvajalcev gradbenih del in zaključnih del v gradbeništvu. Po podatkih iz obrtnega registra se v Sloveniji okoli 300 samostojnih podjetnikov in gospodarskih družb ukvarja s kleparskimi in krovskimi deli. Sekcija instalaterjev-energetikov združuje več kot 960 izvajalcev strojno-instalacijskih del.

Neposredna ciljna javnost so bili: a) krovci; b) mali delodajalci in samozaposleni na območju Slovenije, ki pretežno opravljajo krovska dela in so člani Sekcije kleparjev in krovcev OZS, ki vključuje okoli 800 poslovnih subjektov, med katerimi prevladujejo samostojni podjetniki; c) ostali gradbeni delavci, pri katerih obstaja veliko tveganje za izpostavljenost azbestu na delovnem mestu. Posredna ciljna javnost so bili tudi vsi člani OZS, saj lahko pri opravljanju svoje dejavnosti ali v domačem okolju prihajajo v stik z azbestom.

Ker gre za delovna mesta pretežno v gradbenem sektorju, kjer so v veliki meri zaposleni predvsem delavci z nižjimi stopnjami izobrazbe, so tovrstni programi promocije zdravja pri delu izjemnega vzgojno-izobraževalnega pomena pri uveljavljanju zdravja na delovnem mestu ter s tem posledično boljšega zdravja celotne populacije.

V okviru projekta smo postavili nekatere splošne cilje, predvsem:
- ohranjanje zdravja in delazmožnosti delavcev,
- dvig varnostne kulture na delovnem mestu,
- večja ozaveščenost delodajalcev (predvsem manjših obrtnikov in podjetij) in delavcev o pomembnosti in smotrnosti promocije zdravja pri delu,
- s pomočjo osveščanja in informiranja o dejavnostih in aktivnostih v okviru projekta povečati zavedanje o pomenu preprečevanja izpostavljenosti azbestu med ciljnimi skupinami ter njihovimi svojci in prijatelji.

Operativni cilji so bili:
- usposobiti vsaj 30 krovskih mojstrov za sodelovanje pri izvajanju praktičnih delavnic prikaza varnega dela z azbestom z namenom prenosa znanja in skrbi za zdravje na svoje (so)delavce;
- izvesti enodnevne izobraževalne delavnice z demonstracijo pravilnega odstranjevanja azbestcementnih odpadkov ne glede na velikost pokrite površine;
- oblikovati prilagojena izobraževalna gradiva za podporo izobraževalnim aktivnostim ter oblikovati informativna in druga gradiva za podporo širši kampanji osveščanja ciljnih javnosti.

Za doseganje navedenih ciljev smo projekt zasnovali kot informativen in vzgojno-izobraževalni program in se konkretno usmerili v aktivnosti za ohranjanje in izboljševanje zdravja na delovnem mestu. Načrtovali in izvajali smo dva tipa aktivnosti: pripravili smo izobraževalna gradiva in izvedli izobraževalne delavnice z demonstracijo.

Izobraževalna gradiva

Prilagojena izobraževalna, informativna in druga gradiva smo želeli oblikovati na eni strani za podporo izobraževalnim aktivnostim, na drugi strani pa za podporo širši kampanji osveščanja ciljnih javnosti.

Delovna skupina, v kateri so sodelovali različni strokovnjaki z bogatim znanjem in izkušnjami, je pripravila izhodišča za vsebino izobraževalnih, informativnih in drugih gradiv. Pripravljena besedila so bila strokovno in jezikoslovno pregledana. Tako smo v okviru projekta:
- posneli in distribuirali izobraževalni film [14], ki je za ogled prosto dostopen tudi na spletni strani: http://www.kimdps.si/novice/projekt-promocija-zdravja-za-varno-delo-z-azbestom,
- oblikovali in izdali priročnik Varno odstranjevanje azbestcementne kritine [6] ter
- pripravili delovno gradivo za izvedbo izobraževalnih delavnic.

Za podporo izobraževalnim aktivnostim smo izbrali in oblikovali tudi promocijsko gradivo za dodatno utrjevanje izobraževalnih vsebin s področja promocije zdravja za varno delo z azbestom in prenos glavnih sporočil do vsakega delavca, ki je potencialno lahko izpostavljen azbestu. Vsak od udeležencev izobraževalne delavnice je prejel (slika 3):

- cerado za označevanje gradbišča;
- čelado za varno delo na višini z napisom »Brez azbesta – varna delovna mesta« ter znakom »Promocija zdravja za varno delo z azbestom«;
- ključek USB z izobraževalnim filmom;
- »olfa« nož z napisom »Azbestne odpadke zavij v folijo!«;
- blokec s samolepilnimi listki v obliki hiške z napisom »Brez azbesta – varna delovna mesta«.

Slika 3: Promocijsko gradivo

Izobraževalne delavnice

Celotna vsebina usposabljanja je bila zasnovana tako, da so delavci pridobili veščine in znanja, kot jih določa 15. člen Pravilnika o varovanju delavcev pred tveganji zaradi izpostavljenosti azbestu pri delu, in je vključevala naslednje teme:

- lastnosti azbesta in njegovi učinki na zdravje ter sinergični učinek azbesta in kajenja na zdravje;
- vrste proizvodov ali materialov, ki lahko vsebujejo azbest;
- postopki, pri katerih lahko pride do izpostavljenosti azbestnemu prahu ali prahu materialov, ki vsebujejo azbest;
- pomen preventivnih ukrepov za zmanjšanje izpostavljenosti na najmanjšo možno raven;
- načini varnega dela, varnostni ukrepi in varovalna oprema za zagotavljanje varnosti in zdravja pri delu;
- namen, možen izbor in izbira, omejitve in pravilna uporaba osebne varovalne opreme za varovanje dihal;
- postopki za ravnanje v nujnih primerih;
- postopki dekontaminacije;
- postopek varnega ravnanja z odpadki, ki vsebujejo azbest;
- pomen zdravstvenih pregledov.

Seminarje in delavnice so izvajali različni strokovnjaki z bogatim znanjem, izkušnjami in strokovnimi referencami pri proučevanju azbesta, posledic azbesta za zdravje in varnem delu z azbestcementnimi izdelki in odpadki.

Izvedene so bile tri brezplačne enodnevne izobraževalne delavnice, ki so se v treh terminih odvijale na treh lokacijah, in sicer v Mariboru (1. 3. 2016), Ljubljani (10. 3. 2016) in Novem mestu (24. 3. 2016). Delavnic se je udeležilo skupaj 51 krovcev oz. malih delodajalcev in samozaposlenih, ki pretežno opravljajo krovska dela.

Na koncu delavnice so udeleženci izpolnili test iz varnosti in zdravja pri delu za delavce, ki odstranjujejo azbestcementno kritino, s katerim smo preverili, ali smo informacije, znanja in veščine posredovali udeležencem tako, da so si jih tudi dejansko zapomnili. Vsi udeleženci so test uspešno opravili in prejeli potrdila o opravljenem strokovnem usposabljanju. Evalvacija izvedenih izobraževalnih delavnic je pokazala, da so udeleženci tovrstne koristne (dodatne) informacije potrebovali, ter potrdila potrebnost tovrstnih izobraževanj.

BREZ AZBESTA VARNA (DELOVNA) MESTA

Koncept, ki ga KIMDPŠ že več let širi v slovenskem prostoru z izvajanjem izobraževanj za svetovalce za promocijo zdravja na delovnem mestu ter podpornim delovanjem Slovenske mreže za promocijo zdravja pri delu, je že v osnovi zastavljen tako, da ga je možno trajno in konsistentno nadgrajevati tako na nacionalni ravni (v smislu novih inovativnih ukrepov za izboljšanje zdravja delavcev in njihovih ožjih družinskih članov) kot na uporabniški ravni, saj se znanja, pridobljena med sodelavci (naj)bolje in (naj)učinkoviteje »primejo« posameznikov. Zavedamo se in to tudi nenehno poudarjamo, da so učinki programov promocije zdravja dolgoročni, zato se jih je treba za zagotovitev uspeha lotiti preudarno in domišljeno.

Trajna dostopnost programa uvajanja promocije zdravja, s katerim ustvarjamo takšno delovno okolje, ki blagodejno vpliva na zdravstveno stanje delavcev, je zato izjemno pomembna, še toliko bolj, kadar gre za delovna okolja, za katere vemo, da so zdravju škodljiva.

Na naši spletni strani www.cilizadelo.si tako kljub zaključku projekta še vedno ponujamo izobraževanja za krovce in ter ostale gradbene delavce [15]. Po naši oceni in glede na odzive s terena so krovci in ostali gradbeni delavci v skrbi za svoje zdravje in zdravje svojih sodelavcev še vedno bolj ali manj prepuščeni sami sebi.

Zato bomo na KIMDPŠ še naprej aktivno načrtovali aktivnosti in izvajali ukrepe za promocijo zdravja pri delu in si dolgoročno prizadevali za:

- zmanjšanje tveganja za nastanek malignega mezotelioma, azbestoze in pljučnega raka med gradbenimi delavci, posebej krovci;
- ohranjanje zdravja in delazmožnosti delavcev;
- dvig varnostne kulture med gradbenimi delavci;
- boljšo informiranost in osveščenost gradbenih delavcev o škodljivih učinkih azbestcementnih izdelkov;
- zdravju prijazno, strokovno ustreznejše in varnejše delo z azbestcementno kritino med krovci;
- krepitev zavedanja o pomenu preprečevanja izpostavljenosti azbestu med posrednimi in neposrednimi ciljnimi skupinami ter njihovimi svojci in prijatelji;
- manjšo bolniško odsotnost, upokojevanje in stroške, povezane z boleznimi zaradi izpostavljenosti azbestu.

Rezultate projekta, predvsem gradiva za osveščanje različnih javnosti in izobraževalne programe tudi po zaključku projekta dopolnjujemo v skladu s potrebami in izkušnje prenašamo na nekatere ciljne skupine, ki jih v projektu nismo zajeli.

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ZAHVALA

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Diplomo s področja živilstva in doktorsko disertacijo s področja biotehnologije je zagovarjala na Biotehniški fakulteti v Ljubljani. Zaposlena je na Kliničnem inštitutu za medicino dela, prometa in športa kot promotorka zdravja. Področje delovanja so predvsem načrtovanje programov in projektov ter ukrepov promocije zdravja pri delu na področju prehrane in gibanja v delovnih organizacijah. Sodeluje tudi v mednarodnih projektih in pri prenosu programov promocije zdravja pri delu v slovenski prostor. V zadnjem času aktivno deluje in izvaja projekte na področju osveščanja posebnih ciljnih skupin delavcev, ki so (bile) pri svojem delu izpostavljene azbestu. Pomemben segment dela je dolgoročno načrtovanje kampanj in programov promocije zdravja.

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ASBESTOS-SAFE (WORK) PLACES; RAISING AWARENESS OF ROOFERS WORKING WITH ASBESTOS

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Abstract
Workers in their jobs, especially roofers and other construction workers who are engaged in renovation works, are often faced with asbestos, asbestos-cement products and/or waste, but are poorly aware of the dangers of asbestos. By workplace health promotion, we tried to improve the knowledge, attitude and awareness of employees in terms of enhanced safety for health and reducing risky behaviour when dealing with asbestos-cement products and/or waste. The awareness campaign was designed as an informative and educational programme, and was specifically focused on activities to maintain and improve health in the workplace. We carried out two types of activities: We created educational and informational materials (educational video, user manual, etc.) to support broader awareness campaigns about the dangers of asbestos exposure and conducted training workshops for workers and employers engaged in roofing or any other construction activity. Educational workshops, which were held three times at three locations, were attended by 51 roofers. The entire content of the training has been designed so that workers gain skills and knowledge about the protection of workers from risks related to exposure to asbestos at work.

Keywords: asbestos, roofers and other construction workers, workplace health promotion

ASBESTOS AND (UN)SAFE WORK PLACES

The Greek word asbestos (meaning indestructible, everlasting) marks the most important characteristics of this mineral, present in nature, which is the main reason for its prevalence in industry and construction. Its unique technical characteristics have led to an increased use especially during the fast economic growth after 1945. Asbestos can be found in over 3000 products, in high quantities in buildings and ships, and in lower quantities, for example in cigarette filters [1].

We have to be aware of the fact that the annual production of asbestos in the world has not been reduced even though many countries have banned its use [2]. The annual production of asbestos worldwide is still approximately 4 million tonnes or 0.7 kg per person [3]. The all-European ban of asbestos and the current market control cannot prevent asbestos products from being imported to the European market.

Approximately 670,000 tonnes of asbestos have been imported to Slovenia since 1946. It was mostly white asbestos. The majority of that, approximately 614,000 (89%), was imported by Salonit Anhovo. The largest use of asbestos was during the 1970s and the 1980s [3]. Up to 1996, Slovenia produced Salonite panels, washer panels, asbestos cardboard, elastometal, asbestos-cement pipes, putty, pastes, asbestos masses, glue, asbestos fabric, azbotekst, van-S-panels, coating and van panels, motor washers, industrial washers and filters, and insulation tapes. We used pure sprayed asbestos, we removed and installed asbestos into railway vehicles, we installed it into kettles and produced braking pads from it [3].

The asbestos products made in Slovenia have an expiration date up to one year or more than 45 years and in some products, asbestos is permanently built into the products. The majority of products made in Slovenia have an expiration date from 35 to 45 years, meaning that most of these products are still in use but their lifespan is slowly coming to an end. Eventually, the same amount of these products will end up in landfills [3].

In factories working with asbestos and their surroundings, several million people have been exposed to this dangerous mineral. Even though the number of people exposed to asbestos in the workplace has decreased since the ban of asbestos use in industry (the production of asbestos products), there is still a lot of exposure to asbestos especially among workers renovating older construction works. The most vulnerable group are roofers and other construction workers, who take part in the renovation of older construction works.

Despite all forms of asbestos being dangerous and its dangerous consequences being catalogued, the fact that there are plenty of legal acts concerning asbestos use and that asbestos use has been banned in Slovenia since 1996, a lot of asbestos products are still installed in roofs, plumbing, insulation, flooring ("vinaz" panels) and the like.

The situation in the real-estate industry in Slovenia is currently unfavourable to the building of new buildings, which is why there is a growing trend of renovating older buildings. These are often private investors - people renovating older properties for their own use and who mostly hire smaller, cheaper contractors to perform the renovation works.

During the replacement of asbestos-cement roofing, which is worn out after decades of use (Picture 1), a lot of asbestos fibres are released into the environment, which are extremely dangerous to health. However, since 2009 these replacements have often been done by small or medium sized companies and/or sole proprietors specializing in construction and roofing.

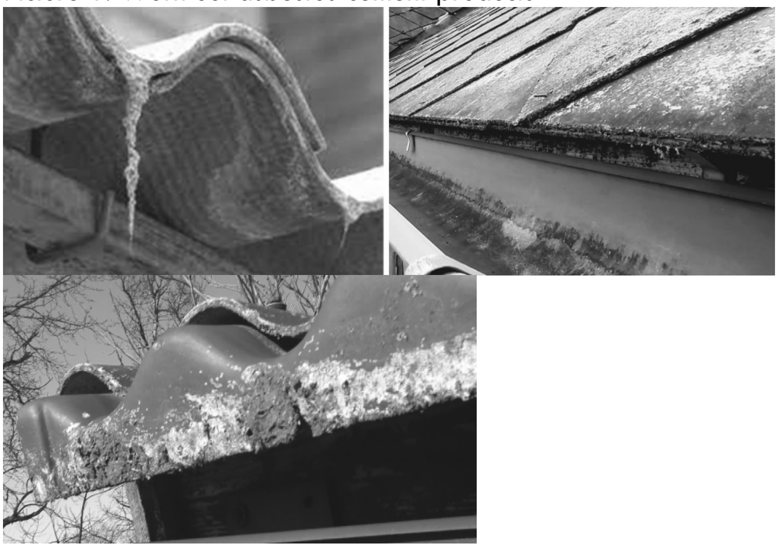
Unprofessional removal of worn out roofing therefore endangers the workers working with this material as well as the nearby residents, because asbestos fibres are spread through the air and can pollute a large area [4]. Safe disposal of asbestos-cement products is an important part of the every plan for the removal of dangerous roofing [5].

A common problem is ignorance or inadequate knowledge of asbestos. Many workers are exposed to asbestos in their line of work but they might not know that or they believe that the exposure is a minor risk [3].

A major risk for asbestos exposure in the workplace exists with professions such as: roofers, plumbers, engineers working with heating systems, electricians, construction carpenters, flooring contractors, shop fitters, maintenance personnel, including contract workers and janitors, cleaners, occupational safety and health workers, occupational inspectors and other professions where workers need access to roofs, spaces under sheathings and other "hidden" places [2].

Our assessment is that approximately 30 percent of all roofings in Slovenia contain asbestos, which needs to be safely removed. The health risks for people working in such professions are very high and the costs of treating asbestos-related diseases are still very high.

Picture 1: Worn out asbestos-cement products



In Slovenia we can also see used asbestos-cement products being re-used; after the renovation of old private houses and the removal of worn out asbestos-cement products from the living areas, these asbestos-cement products are saved and re-used as roofing in woodsheds, garden sheds, dog sheds and other utilities. One can (still) find Internet ads selling or giving away asbestos-cement panels [6].

This is why a great need for extra organized and target-focused work in the field of health promotion has arisen regarding education and awareness of safe work with asbestos. The European Economic and Social Committee (EESC) in their last opinion [2] also urges the European Committee to ensure the necessary support, in cooperation with the national authorities, for measures and initiatives to provide protection of all workers in the EU.

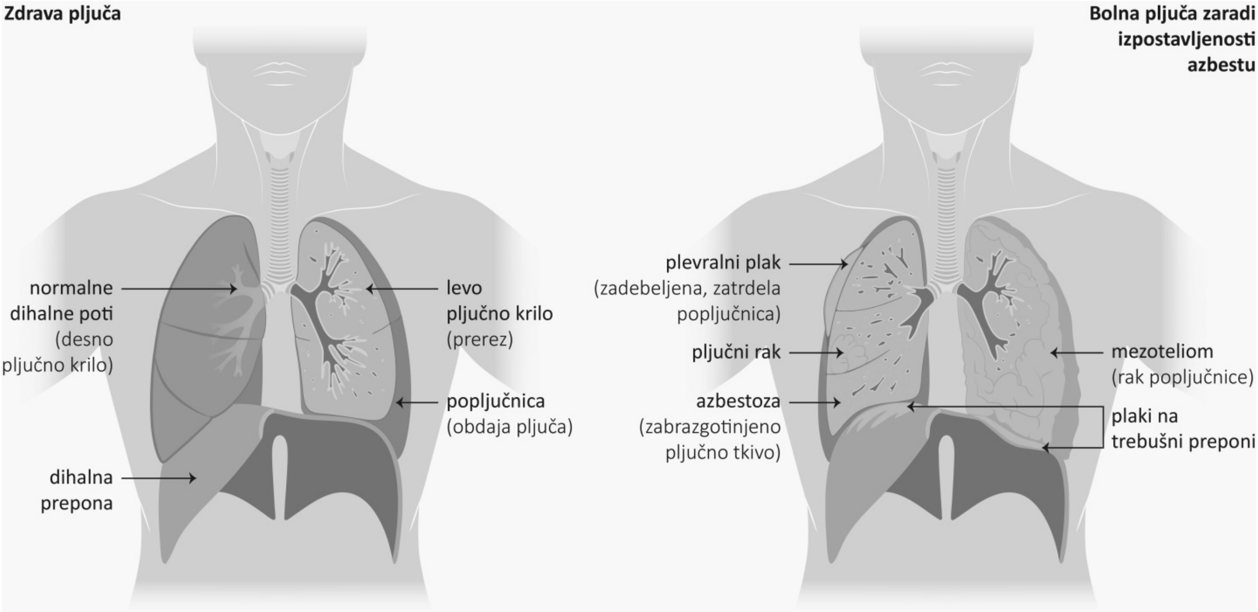
Despite the fact that some educational programmes and contents have been carried out in the past and are adapted to workers (especially workers in the asbestos production industry) who are in contact with asbestos in the workplace, the Clinical Institute of Occupational, Traffic and Sports Medicine believes that the awareness on health risk factors is far from a satisfactory level.

DISEASES RELATED TO ASBESTOS EXPOSURE

The health risk of asbestos exposure was known already in the late 19th century. Its structure and the size of the particles that can be inhaled are the most dangerous to health [7]. All forms of asbestos (white, blue and brown) are carcinogen [8]. Even small concentrations of asbestos dust in the air can cause various serious diseases, for example asbestosis, pleural diseases, mesothelioma, lung cancer and others (Picture 2). The most dangerous is pulmonary and peritoneum cancer mesothelioma. Asbestos most probably also causes larynx cancer, gastrointestinal cancer and kidney cancer. We say that asbestos is a general carcinogen [9].

Even though asbestos use is banned in many countries it is estimated that every year more than 100,000 people in the world die of consequences of asbestos exposure [2]. It is a catastrophe of Hiroshima dimensions; a slow, ruthless and quiet Hiroshima [10]. Almost every 5 minutes one person in the world dies of an asbestos-related disease.

Picture 2: Asbestos exposure related diseases are: asbestosis, pleural plaque, mesothelioma and lung cancer [6].

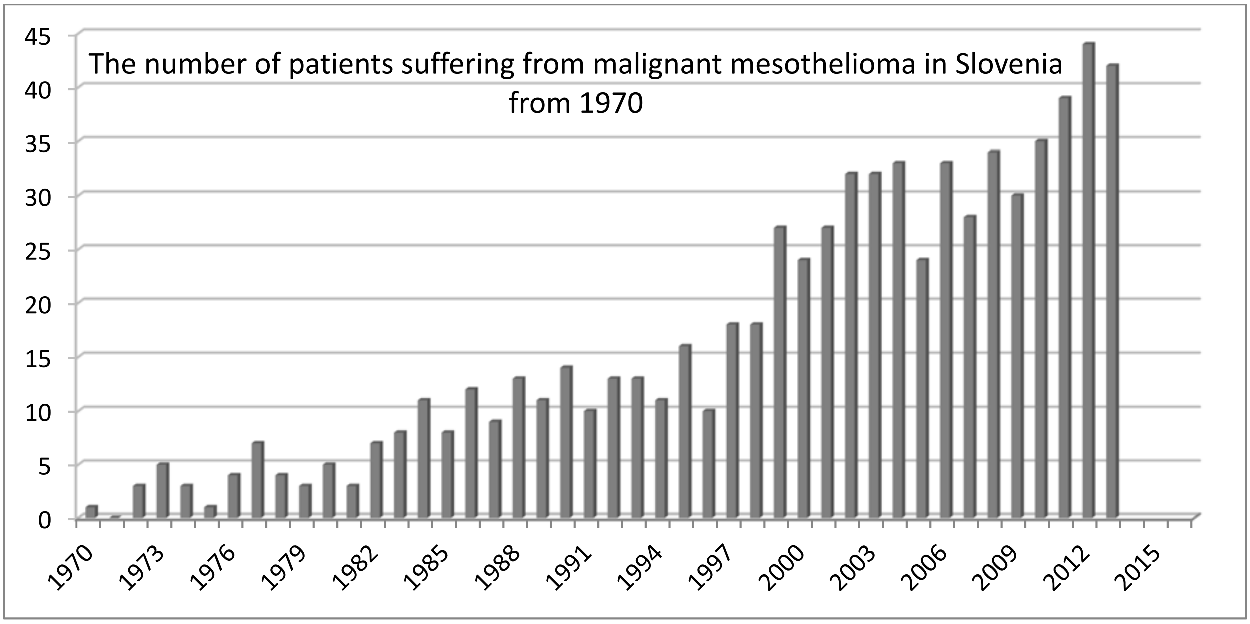


Picture 2a shows healthy lungs: the location of lungs, the respiratory tract, pleura and the diaphragm in the body. Picture 2b shows the diseased lungs due to asbestos exposure [6].

In Slovenia, approximately 3000 workers have been directly exposed to asbestos and 23,000 workers indirectly [11]. If we also count the families of these workers, who were exposed to asbestos due to the transfer of asbestos fibres into the family environment through clothing and hair of the workers, the numbers increase dramatically.

The data on mesothelioma occurrence in Slovenia shows that despite the ban on asbestos use in 1996, the incidence of mesothelioma seemingly decreased in the previous years, however in the following years it increased again (Picture 3). Among the affected people there is one third of those minimally exposed to asbestos [6, 12].

Picture 3: The number of people suffering from malignant mesothelioma in Slovenia between 1970 and 2013 [6, 12].



It is expected that the number of these diseases will stay this high for at least two more decades; the length of this period however depends on how we cleanse our living and natural environment of asbestos. Until now this problem was only seen in workers occupationally exposed to asbestos, while the common population was almost completely overlooked.

An interdisciplinary group of experts on verification of occupational diseases due to asbestos exposure, working in accordance with the legislation in this field and established at the Clinical Institute for Occupational, Traffic and Sports Medicine in Ljubljana has treated 2,533 people with suspected asbestos-related diseases in the period between 1998 and 2011. Among those, 1,833 had confirmed diagnoses of occupational diseases related to asbestos exposure [13].

The majority of these people used to work in factories producing asbestos-cement products, many of them were maintenance workers for equipment and vehicles containing asbestos or insulation workers. In more than 170 cases of confirmed occupational diseases there were malignant diseases of lungs or other organs, where the chances of survival are very poor. We had hoped that the peak of mesothelioma incidence had already reached because of its long latent period; however, this is not the case. The most probable cause of this is the still polluted living and working environment in Slovenia.

RAISING ROOFERS' AWARENESS ON WORKING WITH ASBESTOS - THE PLANNING AND IMPLEMENTATION OF THE PROJECT "PROMOTION OF HEALTH FOR SAFE WORK WITH ASBESTOS"

At the Clinical Institute of Occupational, Traffic and Sports Medicine we have been actively working on the problem of occupational diseases caused by asbestos exposure for many years. In the past, we already carried out many activities for raising awareness of Slovenia's population on the dangers of asbestos.

We believe that there have been too many unnecessary deaths caused by asbestos exposure in Slovenia up to now (we estimate approximately 2000 deaths from 1960 until today) and not enough effective measures being taken, and at the same time we are certain that this situation can be improved by promoting health in the workplace, which is why we have approached the planning and implementation of the project "Promotion of Health for Safe Work with Asbestos".

The founders of the project, the Clinical Institute for Occupational, Traffic and Sports Medicine (KIMDPŠ) and The Chamber of Craft and Small Business of Slovenia (OZS) - the Tinsmiths and Roofers Section, have put forth the project "Promotion of Health for Safe Work with Asbestos" to a public call for tender for funding projects on health promotion in the workplace in 2015 and 2016 and gained the financial support from the Health Insurance Institute of Slovenia.

The project also completely follows the Opinion of the EESC on freeing the EU from asbestos (from the 18th of February 2015), where point 1.8 clearly states that "safe removal is highly dependent on trained workers of two categories: those working in specialised companies and those in professions and occupations who come into contact with asbestos accidentally".

As part of the project at KIMDPŠ we continue and expand our previous systematic work in the field of informing and educating about health and safety awareness of employees who come into contact with asbestos-cement products and/or waste in the workplace.

The purpose of the project is to raise awareness among workers, who are faced with a high risk of asbestos exposure in the workplace, about the dangers of asbestos and train them how to work safely using tools which promote occupational safety.

The project activities were aimed at improving the knowledge, behaviour and awareness of the workers in terms of greater health safety, the decrease in hazardous actions and behaviours of the employees when handling and working with asbestos-cement products and/or asbestos-cement waste.

The project focused especially on micro, small and medium size businesses, sole proprietors and craftsmen dealing with high risk of asbestos exposure in the workplace. These involve various professions dealing with renovation works. Of all the members of The Chamber of Craft and Small Business of Slovenia there are approximately 9,000 business subjects working in construction, employing approximately 20,000 workers. The field of construction covers many related sections. The Construction Section unites approximately 5,000 construction contractors. According to the Chamber's data, there are approximately 300 sole proprietors and companies in Slovenia working in roofing and tinsmith. The Energy Installations Section comprises more than 960 contractors of machine-installation works.

The direct target audience were: a) roofers; b) small business owners and sole proprietors in Slovenia, who mainly work in roofing and are members of the Roofers and Tinsmiths Section of The Chamber of Craft and Small Business in Slovenia, which includes approximately 800 business subjects, among which sole proprietors prevail; c) other construction workers with a high risk of asbestos exposure in the workplace. The indirect target audience were all members of the Chamber of Craft and Small business of Slovenia, because they can come into contact with asbestos during their work or in their home environment.

Due to the fact that these workplaces are prevalent in the construction sector, where the employees are mostly workers with lower levels of education, these programmes of occupational health promotion are of vital educational importance in enforcing health in the workplace and consequently better health of the entire population.

As part of this programme we set some general goals, especially:

- maintaining health and the worker's ability to work,
- raising the safety culture in the workplace,
- a higher awareness of employers (especially small business owners and sole proprietors) and workers on the importance and functionality of occupational health promotion,
- increasing the awareness on the meaning of preventing asbestos exposure among target groups as well as their friends and family by raising awareness and informing about the activities, which are part of this project.

The operational objectives were:

- training at least 30 roofing masters to cooperate in the execution of practical workshops showing safe work with asbestos and the intention to transfer knowledge about health care to their (co)workers;
- performing one-day educational workshops demonstrating the correct removal of asbestos-cement waste regardless of the size of the roofing surface;
- designing customized educational materials to support educational activities and designing informative and other materials to support a broader campaign of raising awareness among the target audience.

To reach the above-mentioned objectives we have designed the project as an informative and educational programme focused specifically on activities to preserve and improve health in the workplace. We planned and executed two types of activities: we prepared educational materials and performed educational workshops with demonstrations.

Educational materials

We wanted to design the adapted educational, informative and other materials in a way that supports the educational activities as well as supporting the broader campaign of raising awareness of the target audience.

The work group which comprised various experts with extensive knowledge and experience prepared the starting points of the contents of the educational, informative and other materials. The prepared materials were reviewed and edited by experts. As part of the project the following activities took place:

- the filming and distribution of an educational film [14], available at the following website: http://www.kimdps.si/novice/projekt-promocija-zdravja-za-varno-delo-z-azbestom,
- designing and publishing the manual Safe Removal of Asbestos-cement Roofing (Varno odstranjevanje azbestcementne kritine) [6] and
- preparation of materials for the conduction of educational workshops.

In order to support the educational activities, we also collected and designed promotional materials for further consolidation of educational content on health promotion for safe work with asbestos and the inform every worker potentially exposed to asbestos about the most important topics. Each participant was given (Picture 3):

- a construction site sign;
- a helmet for safe work at height with the inscription “Asbestos-safe workplaces (Brez azbesta - varna delovna mesta)” and the sign “The promotion of health for safe work with asbestos (Promocija zdravja za varno delo z azbestom)”;
- a USB stick with the educational film;
- a Stanley knife with the inscription “Wrap asbestos waste in foil! (Azbestne odpadke zavij v folijo!)”
- a post-it pad in the shape of a house with the inscription “Asbestos-safe workplaces (Brez azbesta - varna delovna mesta)”.

Picture 3: Promotional materials

Educational workshops

The complete training content was designed in a way for the workers to gain skills and knowledge specified by article 15 of the Rules on the protection of workers from the risks related to exposure to asbestos at work and included the following topics:

- the characteristics of asbestos and its effects on health and the synergetic effect of asbestos and smoking on health;
- the types of products or materials which can contain asbestos;

- the procedures during which exposure to asbestos dust or the dust of materials containing asbestos can occur;
- the meaning of preventive measures to reduce the exposure to a minimum level;
- the manners of safe work, safety measures and protective equipment for providing occupational safety and health;
- the purpose, possible selection and choice, the restrictions and correct use of personal protective equipment for the protection of the respiratory system;
- treatment procedures in emergencies;
- decontamination procedures;
- the procedure of safely handling waste which contains asbestos;
- the meaning of health checks.

The seminars and workshops were carried out by various experts with extensive knowledge, experience and professional references in studying asbestos, the consequences of asbestos on health and safe work with asbestos-cement products and waste.

Three one-day educational workshops were carried out, which took place on three dates in three locations: Maribor (1st of March 2016), Ljubljana (10th of March 2016) and Novo Mesto (24th of March 2016). In total, 51 roofers or small business owners and sole proprietors working in roofing attended the workshops.

At the end of the workshop the participants completed a test in occupational safety and health for workers removing asbestos-cement roofing, which checked whether the participants actually remembered the information, knowledge and skills given to them. All the participants completed the test successfully and received a certificate on a completed professional training. The evaluation of the executed educational workshops has shown that the participants needed these types of useful (extra) information and has confirmed the necessity of such trainings.

ASBESTOS-SAFE (WORK) PLACES

The concept that has been spread around Slovenia for many years by the Clinical Institute for Occupational, Traffic and Sports Medicine (KIMDPŠ) by carrying out educational workshops for counsellors of promotion of occupational health, with the support of the Slovene Network of Occupational Health Promotion, was in its basis established so it could be permanently and consistently upgraded on the national level (new innovative measures to improve health of workers and their family members) as well as on the user level, because knowledge acquired among co-workers best and most efficiently "sticks" to individuals. We are aware of, and constantly emphasize the fact that the effects of the programmes of health promotion are long-term, which is why they need to be tackled prudently and imaginatively.

The long-lasting accessibility of the introduction of health promotion programme, which creates a working environment that has a soothing effect on the workers' health, is therefore extremely important, even more so when those are the working environments we know are hazardous to health.

That is why we still offer education for roofers and other construction workers on our website www.cilizadelo.si despite that the project has already ended [15]. We assess, according to the responses from the field, that roofers and other construction workers are still more or less dependent on themselves in the care for their health and the health of their co-workers.

That is why the Clinical Institute for Occupational, Traffic and Sports Medicine will keep on planning activities and performing measures for the promotion of occupational health and working on long-term efforts to:

- reduce the risk of the emergence of malignant mesothelioma, asbestosis and lung cancer among construction workers, especially roofers;
- maintain health and working abilities of the workers;
- raise the safety culture among construction workers;

- provide better information to construction workers about harmful effects of asbestos-cement products;
- promote health-friendly, professionally more appropriate and safer work with asbestos-cement roofing among roofers;
- strengthen awareness about the meaning of preventing asbestos exposure among indirect and direct target groups, their family and friends;
- promote fewer sick leaves, less retirements and smaller costs related to diseases caused by asbestos exposure.

The results of the project, especially the materials created to raise awareness among various audiences as well as the educational programmes that are being complemented in accordance with demands and know how are passed to the target groups not included in the project, even after the programme has concluded.

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She defended the B.Sc. degree in the field of food science and technology and a Ph.D. in the field of biotechnology at the Biotechnical Faculty in Ljubljana. She is employed at the Clinical Institute of Occupational, Traffic and Sports Medicine as a workplace health promoter. She is mainly involved in planning and management of specific workplace health promotion, nutrition and exercise programme and/or projects. She also participates in international projects and transferring the programmes of promotion to Slovenia. Recently, she is actively involved in the project where the key point is raising awareness of specific target groups of workers who are (or were) in their work exposed to asbestos. An important segment of her work is long-term planning campaigns and health promotion programmes.

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VLOGA VARNOSTNEGA INŽENIRJA PRI VERIFIKACIJI POKLICNIH BOLEZNI POVEZANIH Z IZPOSTAVLJENOSTJO AZBESTU

Milko Rutar, varn. ing.

Povzetek

V prispevku je predstavljena vloga varnostnega inženirja v postopku verifikacije poklicnih bolezni povezanih z izpostavljenostjo verifikacije poklicnih bolezni povezanih z izpostavljenostjo azbestu .Zaradi različnih metod izvajanja meritev kontaminiranosti delovnega okolja ,je potrebno vse rezultate preračunati v vl/cm^3,ter jih primerjati z danes veljavnimi mejnimi vrednostmi(MV).Vloga varnostnega inženirja je vodenje celotnega postopka,ki poteka v podjetju, vse do oddaje potrebnih zapisov zdravniku, ki vodi zbiranje potrebne dokumentacije.

Ključne besede

azbest, konverzijski faktorji, izpostavljenost, tipične koncentracije

UVOD

Rojstni dan tovarne "Cementi Isonzo S.A." je bil 2. maj 1921, ko je prvič zagorelo v peči za proizvodnjo cementa. Do jeseni istega leta so se dogradili še objekti za proizvodnjo "salonita", ki je pričela obratovati 1922. leta, najprej kot proizvodnja plošč, kasneje pa še cevi. Tovarna je večkrat menjala lastnike. Italijanska firma "Eterna" jo je tudi modernizirala. Med 2. sv. vojno je tovarna z manjšimi prekinitvami redno obratovala, saj so bili njeni proizvodi strateškega pomena za vojaške potrebe. Do razpada Italije je bila ta v njihovem upravljanju, po razpadu pa jo je prevzela nemška vojaška uprava. Dokončno je podjetje prišlo pod domačo upravo leta 1946. Za obdobje 1922-1946 ne obstaja dokumentacija o količinah proizvedenih azbestcementnih (a/c) izdelkov, niti o porabi azbesta. Lastniki so vse dokumente, kot tudi načrte proizvodnih linij, odpeljali v Italijo. Prvi znani zapis o azbestu sega v 1946. leto, iz katerega je razvidno, da italijanski lastniki niso uspeli odpeljati 7 ton azbesta. Ta količina je navedena kot prva količina, s katero se je poskusilo obuditi a/c proizvodnjo. Zaradi pomanjkanja kvalitetnih surovin in splošne krize, so si v podjetju v začetku pomagali celo z dodajanjem različnih tekstilnih ostankov, papirja, slame. To so bili prvi zametki vlaknocementne proizvodnje. V azbestcementni (a/c) industriji se je uporabljalo okoli 15 % azbestnih vlaken, ostalo pa je bil cement in kremenčev pesek. Azbest je imel pri tem funkcijo armature v cementnem matriksu. Salonit Anhovo je v svoji proizvodnji uporabljal krizotilna vlakna (~90 % vseh vlaken) – beli azbest, le manjši del pa je bil t. i. modri (plavi azbest) – krokidolit. Tega se je uporabljalo za proizvodnjo a/c tlačnih cevi. Nizkotlačne oz. kanalizacijske cevi niso vsebovale plavega azbesta predvsem zaradi bistveno višje cene, ki je bila takrat na svetovnem tržišču. Od 1946. leta pa do zaustavitve proizvodnje leta 1996 je bilo uporabljeno 615 tisoč ton azbesta. Podjetje je bilo tudi uvoznik azbesta za večino slovenskih podjetij, ki so v svojih izdelkih uporabljala azbest. A/c proizvodnja je dosegla višek sredi 80. let, ko se je letno proizvedlo okoli 224 tisoč ton a/c izdelkov, za kar se je porabilo približno 25 tisoč ton azbesta. Tovarna je zaposlovala med 1600 in 2500 delavcev. Zaradi gospodarske in politične krize, izgube jugoslovanskega tržišča ter zavedanja o škodljivosti azbesta, istočasno pa tudi zapiranja trgov v EU, je bilo podjetje prisiljeno zmanjševati proizvodnjo. Dokončna agonija in zaprtje – zaustavitev a/c proizvodnje je bila 20. decembra 1996. Sledilo je še zadnje dejanje, tj. izvedba sanacije vseh objektov in proizvodnih linij. Ta je trajala približno 2 leti, ko so bile proizvodne zmogljivosti pripravljene na brezazbestno - vlaknocementno (v/c) proizvodnjo. Kasneje se je izvedla še sanacija brežine reke Soče, kamor se je dolga desetletja odlagalo odpadke iz a/c proizvodnje. Azbest je posebno nevarna snov, ki lahko povzroča hude bolezni. Današnja znanost še vedno ni na takšni ravni, da bi bilo mogoče določiti stopnjo "varne" koncentracije. Vsekakor pa velja načelo, da manjša kot je izpostavljenost azbestu (čas in inteziteta), manjše je tveganje za razvoj bolezni. Azbest nedvomno povzroča raka, še posebej v kombinaciji s kajenjem.

Vloga varnostnega inženirja pri verifikaciji poklicnih bolezni, povezanih z izpostavljenostjo azbestu

Pravo vlogo varnostnega inženirja pri verifikaciji poklicnih bolezni, povzročenih z izpostavljenostjo azbestu, je dal Pravilnik o določitvi poklicnih bolezni zaradi izpostavljenosti azbestu (Ur.l. RS, št. 26/1997).

Ta je določil bolezni, ki se štejejo za poklicne:

1. Azbestoza
2. Bolezni plevre:
   - plaki parietalne plevre
   - difuzne zadebelitve plevre
   - benigni plevralni izliv
3. Pljučni rak
4. Maligni mezoteliom plevre ali peritoneja.

Pravilnik je določal pogoje za priznavanje poklicnih bolezni, pri čemer je zahteval:

Azbestoza:

- Pozitivna delovna anamneza, dokaz izpostavljenosti prahu azbesta ali prahu materialov, ki vsebujejo azbest v delovnem procesu ali kakršnikoli aktivnosti pri delu, pri kateri lahko pride do tveganja zaradi izpostavljenosti azbestu;
- Kumulativna izpostavljenost 25 vlaken/cm^3 let ali pa tudi kratkotrajnejša izpostavljenost (rušilna dela, razpraševanje, sanacijska dela …);
- Čas od začetka izpostavljenosti (latentna doba) najmanj 15 let.

Bolezni plevre:

- Pozitivna delovna anamneza, dokaz izpostavljenosti prahu azbesta ali prahu materialov, ki vsebujejo azbest v delovnem procesu ali kakršnikoli aktivnosti pri delu, pri kateri lahko pride do tveganja zaradi izpostavljenosti azbestu;
- Kumulativna izpostavljenost 25 vlaken/cm^3 let ali pa tudi kratkotrajnejša izpostavljenost (rušilna dela, razpraševanje, sanacijska dela …);
- Latentna doba najmanj 15 let za plake in najmanj 20 let za kalcinirane plake.

Pljučni rak:

- Pozitivna delovna anamneza, dokaz izpostavljenosti prahu azbesta ali prahu materialov, ki vsebujejo azbest v delovnem procesu ali kakršnikoli aktivnosti pri delu, pri kateri lahko pride do tveganja zaradi izpostavljenosti azbestu;
- Kumulativna izpostavljenost 25 vlaken/cm^3 let ali pa tudi kratkotrajnejša izpostavljenost (rušilna dela, razpraševanje, sanacijska dela …);
- Latentna doba praviloma najmanj 10 let;
- Drugi pogoji v povezavi s poklicno azbestozo ali boleznijo pleure.

Maligni mezoteliom plevre in peritoneja:

- Pozitivna delovna anamneza – dokaz izpostavljenosti azbestu;
- Latentna doba praviloma najmanj 10 let.

Diagnostični postopek pri postavitvi suma na poklicno bolezen vodi zdravnik, specialist medicine dela ali zdravnik, specialist medicine dela, prometa in športa, ki zbere vso potrebno dokumentacijo za verifikacijo poklicne bolezni.

Verifikacijo poklicne bolezni in oceno zmanjšanja življenjskih funkcij izvaja interdisciplinarna skupina strokovnjakov.

Pravilnik je uvedel novosti, kot so novi pojmi, npr.:

- kumulativna izpostavljenost 25 vlaken/cm^3 let,
- čas izpostavljenosti (latentno dobo),
- kratkotrajno izpostavljenost visokim koncentracijam,
- delovno anamnezo o izpostavljenosti …

Zaradi zahtev Pravilnika in zahtev zdravnikov medicine dela, ki so vodili postopke zbiranja zdravstvene dokumentacije in verifikacije poklicne bolezni, je bilo potrebno v čim krajšem času izdelati metodo izračunavanja kumulativne ekspozicije azbestnemu prahu.

Pri tem se je pojavilo ogromno težav. Te so bile npr. kako vrednotiti rezultate različnih metod merjenja intenzitete onesnaženja zraka (vl/cm3) z azbestom, kako spremljati izpostavljenost zaradi stalnega spreminjanja delovnih mest delavcev, pogostem menjavanju del (tudi brez odločb o premestitvah), dela na akord, počitniškega dela, dela v času obvezne šolske prakse, kako izpolnjevati pomanjkljive evidence, kako določati izpostavljenost pri delih kot so vzdrževalci, delavci v režiji… Ne nazadnje so se pojavljali celo zahtevki za izračun kumulativne ekspozicije delavcem, ki so se izpostavljali azbestu v obdobju, ko so bili lastniki tuja podjetja. Salonit Anhovo ni bil pravni naslednik tujih lastnikov, zato tem delavcem nismo mogli računati kumulativnih ekspozicij. Po drugi strani smi v naših arhivih imeli ogromno podatkov, ki pa jih je bilo potrebno ustrezno zbrati, da se jih je lahko uporabilo za celotno obdobje od leta 1946 do 1996.

Razvoj konverzijskih faktorjev za preračunavanje delcev/cm^3 v vlakna/cm^3 in iz mg/cm^3 v vlakna/cm^3

V Salonitu Anhovo se je v obdobju od leta 1961 do zaključka proizvodnje izvedlo vsaj tisoč meritev azbestnega prahu.

Tabela 1.

Obdobje	Metoda/naprava	Enota	Število meritev
1961 – 1970	konimeter	delci/cm^3	293
1974 – 1975	membranski filter	vlakna/cm^3	16
1976 – 1985	gravimetrična metoda	mg/cm^3	169
1986 – danes	membranski filter	vlakna/cm^3	561

Vir: [1] in lasten vir

V strokovni javnosti je bilo narejenih več poskusov razvoja konverzijskih faktorjev. Za Salonitove meritve je to poizkusil že dr. Primož Gspan, ki je na skupini vzorcev uporabil dve vzporedni metodi, to je gravimetrijsko in membransko filtrsko. Konverzijski faktorji so bili objavljeni v BK report-u iz leta 1997, podobne vrednosti je objavil tudi IVD Maribor, EU direktiva iz leta 1987 pa je navajala nekoliko drugačne vrednosti (tabela 2) .

Tabela 2.

BK – Report 1/97	5vl/ml = 0,1 mg/m^3
IVD Maribor 1986	5 vl/ml = 0,1 mg/m^3 (za azbestni prah) 1 vl/ml = 0,1 mg/m^3 (za mešanico cement-azbestnega prahu)
EU direktiva 87/217/EEC	2 vl/ml = 0,1 mg/m^3

Vir: [4]

Razvoj konverzijskih faktorjev za preračunavanje delcev/cm^3 v vlakna/cm^3 in iz mg/cm^3 v vlakna/cm^3

V Salonitu Anhovo smo se odločili, da se za konverzijske faktorje upoštevajo izračuni, ki so bili določeni za konkretne izmerjene vrednosti v Salonitu Anhovo in jih je v svoji študiji izračunala in uporabila M. Dodič Fikfak. [1]

Konverzijske faktorje je izračunala s pomočjo 78 vzorcev (60 vzorcev pri ceveh in 18 pri ploščah), ki so bili istočasno analizirani z membransko-filtrsko in gravimetrijsko metodo. Manjši del vzorcev je bil analiziran s konimetrom in membransko-filtrsko metodo. Dobljeni faktorji so služili za proučevanje kohorte cca. 7000 delavcev, katerim so bile izračunane kumulativne ekspozicije. Pri tem se je bil izračunandobil konverzijski faktor (4,7) za suha delovna mesta v proizvodnji cevi in konverzijski faktor za suha delovna mesta v proizvodnji plošč (1,6).
Mokra a/c delovna mesta v proizvodnji so bila pod velikim vplivom suhih emisij, zato smo se odločili za uporabo samo enega konverzijskega faktorja (0,8) tako za suho kot tudi za mokro proizvodnjo a/c cevi.

Za proizvodnjo a/c plošč sta se izračunala dva konverzijska faktorja (0,3 in 1,2). Z določitvijo petih različnih faktorjev konverzije, ki veljajo najtočneje za Salonit Anhovo, smo lahko izračunali kumulativne ekspozicije azbestnemu prahu. [1]

Poenostavljeno povedano, se je za pretvorbo koncentracij upoštevalo:

- vplive mokrega ali suhega delovnega procesa,
- ali se je ta odvijal pri proizvodnji cevi ali proizvodnji plošč,
- kakšne vrste prah se je pri delu sproščal (čisti azbest ali pa mešanica a/c).

Glede na priporočila EU direktive 87/217/EEC smo vse meritve preračunali tudi na njihov priporočeni faktor. Tako razpolagamo v z dvema podatkoma o količinah azbesta na posameznem delovnem mestu oz. merilnem mestu.

MDK (MV) in kumulativno delovanje

Pri boleznih, pri katerih je za njihov nastanek in razvoj pomembna določena doza, je ključno izračunati kumulativno dozo , to je dozo snovi, ki jo je delavec dobil v določenem času.

Količina snovi, ki jo delavec prejme, je odvisna od teže dela (število vdihov/minuto …), gibanja po prostoru (različne koncentracije), časa zadrževanja v posameznem območju - koncentraciji. Omenjena tematika je multidisciplinarna, zato smo za konkretne izračune individualne kumulativne doze azbesta, upoštevajoč vse konverzijske faktorje, uporabili računalniški program, ki ga je je skupaj s strokovnjaki Univerze v Massachusettsu razvila M.Dodič Fikfak. Program upošteva vsako delovno mesto delavca, čas izpostavljenosti na vsakem delovnem mestu, intenzitete izpostavljenosti na posameznem delovnem mestu in konverzijske faktorje tako, da na podlagi formule: $D= \sum_i c_i t_i$, kjer je c specifična koncentracija snovi za določen delovni proces ali operacijo oz. intenziteta take izpostavljenosti, t pa pomeni trajanje take koncentracije ali drugače čas preživet na takem delovnem procesu ali operaciji, izračunamo celokupno prejeto dozo.
Na podlagi tega programa smo v podjetju naredili program, ki izračuna celotno kumulativno ekspozicijo azbestnemu prahu, ki mu je bil zaposleni izpostavljen v obdobju zaposlitve v podjetju. Program izdela tudi ustrezni zapis, kjer so vneseni podatki o delovnih mestih zaposlenega, spremembah po datumih, izračunana je kumulativna ekspozicija na vseh delovnih mestih in v vseh časovnih obdobjih. Na koncu se prikaže še seštevek celotne kumulativne ekspozicije upoštevajoč specifične konverzijske faktorje in poseben izračun, ki ga upošteva evropski priporočeni konverzijski faktor.

Vloga varnostnega inženirja je pri tem odločujoča. Brez dobrega poznavanja celotne zgodovine organizacije dela v podjetju, poznavanja tehnoloških postopkov vključno s časovnim vrednotenjem pogojev dela, ne gre. Poznati mora celotno zgodovino izvajanja meritev, ki lahko segajo tudi 50 let nazaj. V pomoč so mu lahko študije, raziskave, interdisciplinarne naloge. V primeru nejasnosti se lahko posluži tudi osebnega razgovora s posameznimi delavci. To možnost se je prakticiralo na začetku, vendar se je zaradi množice zahtevkov to kasneje opustilo. Nemalokrat je potrebno iskati tudi pomoč drugih strokovnjakov – zdravnikov specialistov medicine dela, pulmologov, rentgenologov …
Postopek vedno sproži dopis/zahtevek zdravnika, ki vodi in zbira potrebno dokumentacijo. Najprej se je v arhivu podjetja poiskalo "personalno" mapo delavca , iz katere naj bi bili razvidni podatki o delih in koliko časa jih je delavec opravljal. V kolikor je bila evidenca pomanjkljiva (prvi razvidi del in nalog so se naredili šele 1961 leta), ,je bilo potrebno podatke dobiti iz delavske knjižice zaposlenega, pogosto pa je bilo potrebno opraviti osebni razgovor z delavcem. Na podlagi pridobljenih podatkov o vrsti del in času opravljanja teh del, se je določilo šifro delovnega mesta, za katero smo imeli izračunane kumulativne ekspozicije azbestnemu prahu. Program je nato izračunal skupno kumulativno ekspozicijo in naredil dokončni izpis.

Pravilnik o pogojih za določitev bolezni zaradi izpostavljenosti azbestu in merilih za določitev višine odškodnine (Ur. l. RS, št. 61/2007)

Tudi ta pravilnik, ki je še v veljavi, določa posamezne bolezni zaradi izpostavljenosti azbestu. Te v bistvu ostajajo iste, so pa spremenjeni pogoji za priznanje le-teh. Pravilnik je uvedel nov pojem in sicer mejno vrednost (MV), ki pri delu ne sme biti prekoračena. Ta znaša 0,1 vl/cm^3. Določene so tudi časovne ekspozicije, ki morajo znašati več mesecev do več let. Lahko pa so tudi kratkotrajne ekspozicije izpostavljenosti visokim intenzitetam azbestnih vlakna..

Vloga varnostnega inženirja se je v bistvu malo spremenila, saj mora določiti, ali se je zaposleni izpostavljal MV, ki je presegala 0,1 vl/cm^3. Pri tem mu ni "prihranjeno" preračunavanje starih meritev, ki so bile izvedene še po metodah, ki niso merile vlaken.

Za ilustracijo prikazujem nekaj tipičnih koncentracij, ki se sproščajo pri izvajanju posameznih opravil.

Tipične koncentracije izpostavljenosti azbestu pri delu s cement-azbestnimi materiali

Tabela 3.

Tehnika	Opombe	Tipična izpostavljenost vl./ml
Strojno vrtanje a/c materiala	z lokalnim izpušnim prezračevanjem ali odsesavanjem	do 1
Strojno rezanje brez izpušnega prezračevanja: - Brusilno rezanje - Krožna žaga - Rezbarska žaga	slaba praksa	15 – 25 10 – 20 2 - 10
Ročno žaganje		do 1
Odstranjevanje listov* a/c	*verjetno a/c plošč	do 0,5
Zlaganje listov* a/c	*verjetno a/c plošč	do 0,5
Suho rušenje konstrukcij iz a/c na daljavo		do 0,1
Pometanje po rušenju konstrukcij	slaba praksa	več kot 1
Mokro rušenje konstrukcij iz a/c na daljavo		do 0,01
Čiščenje navpičnih oblog iz a/c z mokrim krtačenjem		1 – 2
Čiščenje navpičnih oblog iz a/c s suhim krtačenjem		5 - 8

Vir: [5 in 6]

Spisek je daljši in zajema tudi dela odstranjevanja razpršenega azbesta, kjer se lahko ob nepravilnem postopku odstranjevanja sprošča celo do 1000 vl./ml. Navedene koncentracije izpostavljenosti so povezane z delovnim časom in niso izračunane kot s časovno obremenitvijo izravnano povprečje. Vendar pa je jasno, da lahko daljše opravljanje del pomeni s časovno obremenitvijo povprečne koncentracije, večje od 0,1 vl. /ml. Izpostavljenosti so tipične vrednosti. Enak postopek na različnih mestih lahko povzroči višje ali nižje koncentracije.

Nekateri rezultati kažejo posledice nesprejemljivo slabe prakse. Če se uporabljajo nadzorovane tehnike podiranja, ki se ne izvajajo pravilno, lahko tak način dela povzroči visoke koncentracije vlaken v zraku. [5 in 6].

Tipične koncentracije so le opora pri odločanju strokovnjakov iz varnosti in zdravja pri delu, da se ustrezno pripravijo ob morebitnem srečanju s podobnimi opravili. Predvideti morajo programe ustreznih ukrepov, ki se morajo pri delu obvezno izvajati. Vse se mora dokumentirati in ustrezno arhivirati.

Izvajanje meritev je lahko odločujočega pomena. Problemi današnje izpostavljenosti bodo lahko aktualni čez 20 ali pa še več let. Seveda to ne velja le za azbestna opravila, ampak tudi pri uporabi rakotvornih snovi, izpostavljenosti hrupu …

ZAKLJUČEK

V prispevku sem poskušal prikazati obdobje 20 let od sprejetja Zakona o odpravljanju posledic dela z azbestom, ter pravilnikov, ki so določali postopke za verifikacijo poklicne izpostavljenosti azbestu. V sodelovanju s strokovnjaki so bile zbrane vse meritve, v ustrezno enoto so bile preračunane vrednosti (vl/cm^3 oz. vl/ml). Za celotno obdobje so se analizirala delovna mesta, izračunala se je kumulativna ekspozicija ter z ustreznim programom pospešilo računanje le-teh. V prvih 10 letih, ko je veljal še Pravilnik o določitvi poklicnih bolezni zaradi izpostavljenosti azbestu (Ur. l. RS, št. 26/1997), smo v Salonitu Anhovo izračunali kumulativne izpostavljenosti za 2091 delavcem. Po letu 2007 se je ne glede na nov pravilnik, ki ne zahteva kumulativnih izračunov, opravilo še 271 kumulativnih izračunov ekspozicij azbestnemu prahu. Skupna številka tako znaša 2362 izračunov.

Varnostni inženir mora predstavljati moralno in strokovno integriteto, biti mora neodvisen, suveren v znanju in presojanju ter sprejemljiv do sugestij.

Čeprav v prispevku prikazujemo številke, ker nam kažejo količino narejenega dela, pa se moramo zavedati, da se za njimi skrivajo tragične zgodbe zaposlenih v cement azbestni industriji, ki jim je 74 let dajala "kruh" , blagostanje in hkrati težka obolenja in smrt mnogim delavcem. Žal "zgodba" še zdaleč ni končana.

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THE ROLE OF A SAFETY MANAGER IN THE VERIFICATION OF OCCUPATIONAL DISEASES RELATED TO ASBESTOS EXPOSURE

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Abstract

In the contribution, the role of a safety manager in the verification procedure of occupational disease related to asbestos exposure is presented. Due to different methods for measurements of asbestos contamination in working environments there is a need to recalculate the measured values to a unique unit (f/cm^3) and compare these results with the limit value (MV) valid today. The safety manager coordinates and manages the whole procedure in the company until the prepared records are forwarded to the medical expert who organizes the collection of all necessary documentation.

Keywords:

asbestos, conversion factors, exposition, typical concentrations

INTRODUCTION

The establishment of the "Cementi Isonzo S.A." factory was 2nd May 1921 when the furnace for cement production first started to burn. By autumn that same year the facilities for "salonit" production were built, and started their operation in 1922; first as the production of panels and later pipes. The factory's owner changed many times. It was modernized by the Italian company "Eterna". During the 2nd World War the factory continued operating with short interruptions, because its products were of strategic importance to the military needs. Until the downfall of Italy, the factory was under their management, after that it was taken over by the German administration. The company finally came under Slovenian management in 1946. There is no documentation on the quantity of produced asbestos-cement (a/c) products or used asbestos during 1922-1946. The owners took all the documents as well as the production lines plans to Italy. The first known record of asbestos is from 1946 and it shows that the Italian owners did not manage to take 7 tonnes of asbestos. This quantity is listed as the first amount used to try to revive the a/c production. Due to shortages of quality raw material and the general crisis the company even added various textile residues, paper and straw to their products in the beginning. These were the beginnings of fibre-cement production. In the asbestos-cement (a/c) industry approximately 15% of asbestos fibres were used, the rest was cement and silicic sand. Asbestos performed the function of reinforcement in the cement matrix.

Salonit Anhovo used chrysotile fibres (~90 % of all fibres) in their production of white asbestos, only a small part was the so-called blue asbestos - crocidolite. It was used for the production of a/c pressure hoses. The low pressure or sewer pipes did not contain blue asbestos especially due to its higher price in the world market at that time. From 1946 to the shutdown of the production in 1996, 615 thousand tonnes of asbestos were used. The company was also the importer of asbestos for the majority of Slovene companies which used asbestos in their products. The a/c production reached its peak in the middle of the 1980s when approximately 224 thousand tonness of a/c products were produced per year, for which approximately 25 thousand tonnes of asbestos were used. The factory employed between 1600 and 2500 workers. Due to the economic and political crisis, the loss of the Yugoslavian market and the awareness on the harmful effects of asbestos, and at the same time the closing of EU markets, the company was forced to reduce their production. The final agony and closure - the shutdown of the a/c production occurred on 20 December 1996. The final act followed - the sanitation of all facilities and production lines. This took approximately 2 years, when the production capabilities were prepared for asbestos-free fibre-cement (f/c) production. Later, also the sanitation of the Soča river bank was carried out, because the a/c production waste was disposed there for decades. Asbestos is extremely dangerous and can cause severe diseases. Science today still hasn't been able to determine the level of "safe" concentration. However, the main principle is that the lesser the asbestos exposure (time and intensity), the lower is the risk of diseases. Asbestos definitely causes cancer, especially in combination with smoking.

The role of a safety manager in the verification of occupational diseases related to asbestos exposure

The real role of safety managers in the verification of occupational diseases caused by asbestos exposure was established by the Rules on the determination of occupational diseases resulting from exposure to asbestos (Official Gazette of RS 26/1997).

It determined the diseases considered occupational:

5. **Asbestosis**
6. **Pleural diseases:**
    - **Parietal pleural plaques**
    - **Diffuse thickening of the pleura**
    - **Benign pleural effusion**
7. **Lung cancer**
8. **Malignant plural mesothelioma or peritoneum**

The Rule determined the conditions for recognition of occupational diseases, where it demanded:

Asbestosis:

- **Confirmed occupational anamnesis, the evidence of exposure to asbestos dust or dust of the materials containing asbestos during the work process or other working activities where the risk of asbestos exposure can occur;**
- **Cumulative exposure of 25 fibres/cm^3/year or a shorter exposure (demolition works, dedusting, sanitation works ...);**
- **Time from the beginning of exposure /(latent period) at least 15 years.**

Pleural diseases:

- **Confirmed occupational anamnesis, the evidence of exposure to asbestos dust or dust of the materials containing asbestos during the work process or other working activities where the risk of asbestos exposure can occur;**
- **Cumulative exposure of 25 fibres/cm^3/year or a shorter exposure (demolition works, dedusting, sanitation works ...);**
- **The latent period of at least 15 years for plaques and at least 20 years for calcified plaques.**

Lung cancer:

- **Confirmed occupational anamnesis, the evidence of exposure to asbestos dust or dust of the materials containing asbestos during the work process or other working activities where the risk of asbestos exposure can occur;**
- **Cumulative exposure of 25 fibres/cm^3/year or a shorter exposure (demolition works, dedusting, sanitation works ...);**
- **Latent period of at least 10 years;**
- **Other conditions related to occupational asbestosis or pleural disease.**

Malignant mesothelioma and peritoneum

- **Confirmed occupational anamnesis - evidence of asbestos exposure;**
- **Latent period of at least 10 years.**

The diagnostic procedure in establishing a suspicion of occupational disease is conducted by a doctor, specialist in occupational medicine, or a doctor, specialist in occupational, traffic and sports medicine, gathering all the documentation necessary to verify an occupational disease.

The verification of occupational disease and the assessment of lesser life functions is performed by an interdisciplinary group of experts.

The Rule introduced novelties, for example new concepts, such as:

- **Cumulative exposure of 25 fibres/cm³/years,**
- **Time of exposure (latent period),**
- **Short-term exposure to high concentrations,**
- **Work anamnesis on exposure ...**

Because of the demands of the Rule and the specialists on occupational medicine managing the process of collecting health documentation and verifying occupational diseases, a method of calculating the cumulative exposition to asbestos dust had to be created in a very short time.

Many difficulties occurred. These were, for example, how to evaluate the results of different methods of measuring the intensity of air pollution (fib/cm3) with asbestos, how to monitor the exposure while the workers constantly switch workplaces, frequently changed workplaces (even without a written order to transfer), piecework, summer jobs, practical work in school, how to fill deficient records, how to determine the exposure in maintenance works, administration works ... There were also claims to calculate the cumulative exposition of workers exposed to asbestos during the period when the companies were managed by foreigners. Salonit Anhovo was not the legal successor of the foreign owners, which is why we could not calculate the cumulative expositions of those workers. On the other hand, our archives held plenty of data which needed to be properly collected and used for the complete period between 1946 and 1996.

The development of conversion factors to convert parts/cm³ into fibres/cm³ and mg/cm³ to fibres/cm³

In Salonit Anhovo at least one thousand measurements of asbestos dust were carried out in the period from 1961 to the shutdown of production.

Chart 1.

Period	Method/machine	Unit	Number of measurements
1961 - 1970	Conimeter	parts/cm³	293
1974 - 1975	Membrane filter	fibres/cm³	16
1976 - 1985	Gravimetric method	mg/cm³	169
1986 - today	Membrane filter	fibres/cm³	561

Source: [1] and own source

In the professional public, many experiments regarding the development of conversion factors were made. For the measurements of Salonit this was already tried by Dr. Primož Gspan, who used two parallel methods on a group of samples - the gravimetric method and the membrane-filter method. The conversion factors were published in the BK report in 1997. Similar values were also published by IVD Maribor, however, the EU directive from 1987 mentions somewhat different values (chart 2).

Chart 2.

BK- Report 1/97	5 fib/ml = 0.1 mg/m³
IVD Maribor 1986	5 fib/ml = 0.1 mg/m³ (for asbestos dust) 1 fib/ml = 0.1 mg/m³ (for a mix of cement-asbestos dust)
EU directive 87/217/EEC	2 fib/ml = 0.1 mg/m³

Source: [4]

The development of conversion factors to convert parts/cm³ to fibres/cm³ and from mg/cm³ to fibres/cm³

In Salonit Anhovo we decided to use as conversion factors the calculations established for concrete measurements in Salonit Anhovo that were calculated and used by M. Dodič Fikfak in her study. [1]

The conversion factors were calculated with the help of 78 samples (60 samples in pipes and 18 samples in panels) which were analysed at the same time with the membrane-filter method and the gravimetric method. A smaller part of samples was analysed using the conimeter and the membrane-filter method. The acquired factors served for the research of a cohort of approximately 7,000 workers, whose cumulative expositions were calculated. The conversion factor for dry workplaces in pipe production (4.7) was calculated as well as the conversion factor for dry workplaces in panel production (1.6).
The wet a/c workplaces in the production were under great effect of dry emissions, which is why we only decided on the use of one conversion factor (0.8) for the dry as well as wet production of a/c pipes.

For the production of a/c panels two conversion factors were calculated (0.3 and 1.2). By establishing five different factors of conversion, which are specific for Salonit Anhovo, we were able to calculate the cumulative expositions to asbestos dust. [1]

To simplify, in the conversion of concentration we considered:

- **the effects of wet or dry working process,**
- **whether the process took place in pipe or panel production,**
- **which sort of dust was released during work (pure asbestos or an a/c mix)**

According to the recommendations of EU Directive 87/217/EEC, we also calculated all the measurements to their recommended factor. Therefore, we possess two different sets of information on the quantity of asbestos in individual workplaces or places of measurement.

MAC (LV) and the cumulative working

A certain dosage of exposure is needed for the occurrence of diseases. The key is to calculate their cumulative dosage, i.e., the dosage of the substance that the worker received in a certain period of time.

The quantity of the substance that the worker receives depends on how hard the work is (number of breaths/minute), movement around the area (different concentrations), how much time a worker spent in a certain area - concentration. The mentioned theme is multidisciplinary, which is why we used a software to do the specific calculations of individual cumulative dosage of asbestos, considering all the conversion factors. The software was developed by M. Dodič Fikfak with the help of experts from the University in Massachusetts. The software considers all the worker's workplaces, the time of exposure in every workplace, the intensity of exposure in every workplace and the conversion factors, so as to calculate the overall dosage received on the basis of the formula: $D = \sum_i c_i t_i$, where c is the specific concentration of the substance for a certain work process or operation or the intensity of such exposure, and t is the time of such concentration or the time spent on such working process or operation.
On the basis of this software our company designed a programme which calculates the entire cumulative exposition to asbestos dust to which the employee was exposed in the period of their employment at the company.
The programme also creates a proper record where the data is entered about the employee's workplaces, changes according to dates, and the cumulative exposition in all workplaces in every time period is calculated. In the end the sum of the complete cumulative exposition is displayed, considering the specific conversion factors and a special calculation, which is used by the European recommended conversion factor.

The safety manager plays a decisive role during this process. One cannot work without a good knowledge about the complete history of work organization in the company and knowledge of technological procedures including the temporal evaluation of work conditions. The safety manager needs to know the complete history of performing measurements, which can go as far as 50 years into

the past. He can help himself with the studies, research, interdisciplinary assignments. In case of uncertainty he can also talk personally with individual workers. This possibility was used at the beginning, but because of the great amount of applications it was abandoned. Very often one must seek the help of other experts - doctors, specialists of occupational medicine, pulmonologists, radiologists...
The procedure is always started by a memo/order from the doctor who is in charge and collects the necessary documentation. First the worker's "personal" file was found in the archive, where information on the types of work the worker performed and how long they did it should be found. If the record was insufficient (the first work and assignment reports were made only in 1961), the required information from the employee's records and often a personal interview with the worker was needed. On the basis of the acquired information on the type of works and the duration of these works the code of the workplace was established, for which the cumulative expositions to asbestos dust were calculated. The programme then calculated the collective cumulative exposition and made the final display.

Rules on the determination of occupational diseases resulting from exposure to asbestos and the criteria for determining the compensation (Ur. l. RS, št. 61/2007)

This rule, which is still valid, also determines individual diseases caused by asbestos exposure. They basically stay the same, but the conditions for their recognition have changed. The Rule introduced a new concept of a limit value (LV), which cannot be exceeded at work. The value is 0.1 fib/cm^3. The temporal expositions are also determined, which need to be several months up to several years. There can also be short-term episodes of exposure to high intensities of asbestos fibres.

The role of a safety manager has changed a bit, because he must decide, whether the workers were exposed to LV exceeding 0.1 fib/cm^3. In doing so, he must re-calculate the old measurements performed by the methods not measuring fibres.

To illustrate, I am adding some typical concentrations released during the performance of individual works.

The typical concentrations of asbestos exposure in work with cement-asbestos materials

Chart 3.

Technique	Notes	Typical exposure fib./ml
Machine drilling of a/c material	With local exhaust ventilation or suction	Up to 1
Machine drilling without exhaust ventilation - **Grinding cutting** - **Circular saw** - **Jig saw**	Bad practice	 15 - 25 10 - 20 2 - 10
Hand sawing		Up to 1
Removal of sheets* a/c	*Probably of a/c panels	Up to 0.5
Piling of sheets* a/c	*Probably of a/c panels	Up to 0.5
Dry demolition of a/c construction from distance		Up to 0.1
Sweeping after construction demolition	Bad practice	More than 1
Wet demolition of a/c construction from distance		Up to 0.01
Cleaning of vertical a/c linings with wet brushing		1 - 2
Cleaning of vertical a/c linings with dry brushing		5 - 8

Source: [5 and 6]

The list is longer and also includes the works of disperse asbestos removal, where in case of incorrect removal up to 1000 fib./ml can be released. The stated concentrations of exposure are related to working hours and are not calculated as the average balanced with a temporal load. However, it is clear that long-term work can assume average concentrations higher than 0.1 fib. /ml. The exposures are of typical values. The same process in different places can cause higher or lower concentrations. Some results show the consequences of unacceptably bad practice. If the controlled techniques of demolition are used, but performed incorrectly, the work methods can cause high concentrations of fibres in the air. [5 and 6].

The typical concentrations are only guidelines in the decision-making process of occupational safety and health experts. The concentrations shall be adequately prepared before possibly encountering such works and must foresee the programmes of appropriate measures, which need to be performed during work. Everything must be documented and appropriately archived.

The performance of measurements can be of vital importance. The problems of today's exposure can become topical in 20 or more years. This does not stand only for asbestos exposure, but also exposure to other carcinogen substances, exposure to noise...

CONCLUSION

In the article, I tried to represent the period of 20 years from the adoption of the Act Concerning Remedying the Consequences of Work with Asbestos and the regulations determining the procedure for the verification of occupational asbestos exposure. In cooperation with experts, all the measurements were collected and the values were converted into proper units ((fib/cm^3 oz. fib/ml). The workplaces were analysed for the complete period, the cumulative exposition was calculated and the calculation was performed faster by the use of software. In the first 10 years, when the Rules on the determination of occupational diseases resulting from exposure to asbestos Ur. l. RS, št. 26/1997) were still valid, in Salonit Anhovo we calculated the cumulative exposures for 2091 workers. After 2007, regardless of the new regulations, which do not require cumulative calculations, 271 more cumulative calculations of asbestos dust expositions were made. The collective number therefore is 2362 calculations.

The safety manager must represent moral and professional integrity; he must be independent, sovereign in his knowledge and judgement and open to suggestions.

Even though the article represents numbers, because they show us the quantity of the work performed, we must be aware of the fact that behind these numbers, the tragic stories of the employees in the asbestos-cement industry are hidden, employees who had been given "bread", well-being and at the same time severe diseases and death by this industry for 74 years. Sadly, the "story" is far from over.

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VERIFIKCIJA POKLICNIH BOLEZNI V SLOVENIJI

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Povzetek

Pravih razsežnosti poklicnih bolezni v Republiki Sloveniji ne poznamo, ker nimamo nacionalnega registra poklicnih bolezni. Za nobeno poklicno bolezen, razen pri sumu na poklicno ali okoljsko bolezen zaradi izpostavljenosti azbestu, ni določen postopek priznavanja.
Zavod za pokojninsko in invalidsko zavarovanje v postopkih ugotavljanja delovne invalidnosti letno prizna od 25 do 50 poklicnih bolezni, pričakovali bi jih okrog 800 do 1000.
Predlog je, da bi lahko sprožili proces priznavanja poklicne bolezni delavec, njegov osebni zdravnik, delodajalec ali specialist, vsi preko osebnega zdravnika. Ta bi delavca s sumom na poklicno bolezen napotil k specialistu medicine dela, imenovanega s strani Ministrstva za zdravje. Ko bi pridobil podatke o izpostavljenosti, o predhodnem in obdobnih zdravstvenih pregledih, bi v primeru utemeljenega suma poslal dokumentacijo na interdisciplinarno skupino strokovnjakov na Klinični inštitut za medicino dela, prometa in športa, ki bi bolezen kot poklicno dokončno potrdila ali jo zavrnila.
Žal pa ni rešeno ključno vprašanje plačnika celega procesa.

Ključne besede: poklicne bolezni, Slovenija, verifikacija

UVOD - INTRODUCTION

Razsežnost, register, seznam poklicnih bolezni

Pravih razsežnosti poklicnih bolezni v Republiki Sloveniji ne poznamo, ker kljub zakonski obvezi nimamo nacionalnega registra poklicnih bolezni. Odkrivanje poklicnih bolezni je po letu 1990 zastalo. Od leta 1998 dalje se odkriva in priznava le poklicne bolezni, povzročene z azbestom. Tudi epidemiološkega spremljanja incidence in prevalence poklicnih bolezni ni, pogostnost ni primerljiva z Evropsko unijo. Prav tako ni ustreznih ukrepov preprečevanja poklicne patologije [1]. Ocenjujemo, da je glavni razlog ne-odkrivanja poklicnih bolezni v Sloveniji dejstvo, da zdravje in varnost pri delu v celoti financira delodajalec. Seveda pa nikjer na svetu nobenemu delodajalcu odkritje poklicne bolezni ni v interesu. V primeru suma na delavčevo poklicno bolezen bi namreč moral delavca napotiti na pregled k pooblaščenemu izvajalcu medicine dela, ki ga v Republiki Sloveniji sam plačuje neposredno. Posledično bolnega delavca, ki mu je bolezen povzročilo delo, ne pošlje na pregled, zdravnik pa, ker je od delodajalca finančno odvisen, poklicne bolezni ne odkrije. Tudi invalidske komisije Zavoda za pokojninsko in invalidsko zavarovanje (ZPIZ), ki bi po veljavni zakonodaji poklicne bolezni morale priznavati, tega ne izvajajo.

Zadnji veljavni seznam poklicnih bolezni je leta 2003 predpisalo Ministrstvo za delo, družino, socialne zadeve in enake možnosti [2]. Spisek skupin oz. povzročiteljev poklicnih bolezni sledi priporočilom Evropske komisije iz leta 1990 [3]. Njena zadnja priporočila so sicer iz leta 2003, vendar jih Slovenija v svojih predpisih ni upoštevala [4]. V času pisanja te publikacije konec leta 2016 v Republiki Sloveniji še ni bilo predpisa, ki bi določal poklicne bolezni in dela, na katerih se pojavljajo te bolezni, pogoje, ob katerih se štejejo za poklicne bolezni, in postopek ugotavljanja, potrjevanja in prijavljanja poklicnih bolezni. V skladu Zakonom o pokojninskem in invalidskem zavarovanju bi ga do 01.01.2014 moral določiti minister, pristojen za zdravje [5,6].
·Za dober in funkcionalen Pravilnik o poklicnih boleznih bi bilo potrebno, da strokovne podlage zanj pripravijo strokovnjaki z znanjem in izkušnjami ter dobrim poznavanjem sistemov verifikacije in registracije poklicnih bolezni v Evropski uniji in svetu.

Problematika poklicnih bolezni v Evropski uniji in Republiki Sloveniji

Postopki verifikacije in sistemi socialne varnosti se na področju poklicnih bolezni med državami članicami močno razlikujejo, zato tudi številke med seboj niso primerljive. Tri najpogostejše poklicne bolezni so po podatkih Eurostata bolezni kostno mišičnega sistema (35 %), kožne bolezni (14 %) in bolezni dihal (14 %). Sledijo bolezni čutil, kjer izstopa poklicna naglušnost (13 %), nevrološke bolezni (8 %) in rakave bolezni (5 %) [7]. Okrog 30 % poklicnih bolezni je povezano z izpostavljenostjo kemičnim snovem. Tako so do 90 % poklicnih rakov povzročile kemikalije (v 86 % je to azbest, v 4 % pa ostale kemikalije kot npr. aromatski amini, krom, ogljikovodiki).

Po nepopolnih podatkih Inšpektorata Republike Slovenije za delo je bilo v obdobju od 1985 do 1987 v Sloveniji povprečno po 350 nedokazanih primerov poklicnih bolezni (incidenca 42 primerov na 100.0000 delavcev), v slabih dveh tretjinah je šlo za poklicno naglušnost in v dobri tretjini za poklicne okvare zaradi stika z nevarnimi snovmi [8].

Prave razsežnosti problematike poklicnih bolezni v Republiki Sloveniji torej ne poznamo. Obstajajo le zelo pomanjkljivi podatki o incidenci poklicnih bolezni. ZPIZ v postopkih ugotavljanja delovne invalidnosti letno prizna od 25 do 50 poklicnih bolezni, pričakovali pa bi jih okrog 800 do 1000.

Tabela 1: *Število poklicnih bolezni na 100.000 delavcev, ki jih je priznal ZPIZ, 2010-2015.*

Leto	2010	2011	2012	2013	2014	2015
Število poklicnih bolezni	**45**	**50**	**32**	**25**	**38**	**27**
Število poklicnih bolezni na 100.000 delavcev	**5.3**	**6.1**	**3.9**	**3.2**	**4.8**	**3.4**

Najpogostejše so poklicne bolezni kože, ki jih priznamo le 10 do 29 letno oz. približno 2 na 100.000 delavcev. V Angliji, Nemčiji ali skandinavskih deželah jih priznajo od 70 do 80. Še resnejše je stanje pri poklicni astmi. ZPIZ je v obdobju od leta 2011 do 2015 priznal le dve poklicni astmi in nobene v ostalih letih. V primerjavi z drugimi državami Evropske unije bi v Sloveniji pričakovali okrog 300 primerov poklicne astme letno.

Ministrstvo za zdravje je sicer leta 2003 naročilo Univerzitetnemu kliničnemu centru Ljubljana, Kliničnemu inštitutu za medicino dela, prometa in športa (UKCL KIMDPŠ), da pripravi smernice, to je splošne in specifične kriterije verifikacije poklicnih bolezni, ki jih opredeljuje nacionalna veljavna zakonodaja. Smernice naj bi postale strokovna podlaga za vzpostavitev enotnega nacionalnega registra poklicnih bolezni in sumov na poklicno bolezen, ki bi omogočil spremljanje in ukrepanje za varovanje zdravja delavcev pri delu [1]. Ta cilj je deloma že uresničen, saj je UKCL KIMDPŠ že pripravil smernice za 16 poklicnih bolezni, v izdelavi je naslednja skupina smernic (kostno mišične bolezni). Žal pa pripravljene smernice niso prispevale k večjemu odkrivanju poklicnih bolezni, kar jasno kaže na pomanjkljivost predpisov in ne strokovnih usmeritev.

METODE - METHODS

Opredelitev pojmov in definicij

Poklicna bolezen: je bolezen, povzročena z daljšim neposrednim vplivom delovnega procesa in delovnih pogojev na določenem delovnem mestu ali pri delu, ki sodi v neposreden okvir dejavnosti, na podlagi katere je oboleli zavarovan in je navedena v seznamu poklicnih bolezni [2].
Sum na poklicno bolezen: je bolezen, povzročena z daljšim neposrednim vplivom delovnega procesa in delovnih pogojev na določenem delovnem mestu ali pri delu, ki sodi v neposreden okvir dejavnosti, na podlagi katere je oboleli zavarovan in je navedena v seznamu poklicnih bolezni, vendar trenutno niso izpolnjeni vsi kriteriji za verifikacijo (sum na poklicno bolezen ni zakonsko opredeljen).
Z delom povezana bolezen: je mnogovzročno pogojena zdravstvena okvara, na nastanek katere so vplivali fizikalni, psihosocialni, individualni, sociokulturni dejavniki in dejavniki delovnega okolja (ni posebej zakonsko opredeljena, definicija povzeta po WHO, 1985).

Incidenca poklicnih bolezni (pogostnost): je število novoodkritih dokazanih primerov poklicnih bolezni na 100.000 zaposlenih v opazovanem obdobju (običajno od 1.1. do 31.12. v letu).
Prevalenca poklicnih bolezni (razširjenost): je število vseh odkritih dokazanih primerov poklicnih bolezni na 100.000 zaposlenih v opazovanem obdobju.
Specifična umrljivost: je število umrlih zaradi poklicnih bolezni na 1000 zaposlenih v opazovanem obdobju (običajno od 1.1. do 31.12. v letu).

Splošni kriteriji verifikacije poklicnih bolezni

V smernicah je UKCL KIMDPŠ oblikoval sledečo shemo splošni kriterijev verifikacije poklicnih bolezni [1]:

A. Objektivizirana vzročna zveza med izpostavljenostjo poklicnemu dejavniku tveganja na določenem delovnem mestu (v določenem delovnem okolju), ugotovljena z delovno anamnezo in oceno tveganja obremenitev in škodljivosti, ki naj bi bolezen povzročila, in odzivnostjo delavca na poklicno izpostavljenost. To se ugotavlja z osebno anamnezo, klinično sliko, laboratorijskimi in funkcijskimi testi ter ostalimi ustreznimi diagnostičnimi postopki in preiskavami.

B. Najnižja intenziteta izpostavljenosti, ki po merilih stroke že lahko povzroči poklicno bolezen.

C. Najkrajši čas izpostavljenosti, ki po merilih stroke že lahko povzroči poklicno bolezen.

D. Latentna doba za nastanek poklicne bolezni: od trenutka zadnje izpostavljenosti vzročnemu dejavniku do trenutka prvih znakov poklicne bolezni.

E. Indukcijska doba: najkrajši čas od začetka izpostavljenosti vzročnemu dejavniku do začetka poklicne bolezni.

Za dokazovanje poklicne bolezni morajo biti praviloma izpolnjeni kriteriji A, B, C in D [2].
Specifični kriteriji verifikacije poklicnih bolezni so navedeni v specifičnem delu smernic pri posamezni poklicni bolezni.
V kolikor niso izpolnjeni vsi kriteriji od A do D, se lahko postavi le sum na poklicno bolezen.

REZULTATI - RESULTS

Priporočen sistem in potek odkrivanja, verifikacije in registracije poklicnih bolezni v Republiki Sloveniji

Temeljno vprašanje je postopek verifikacije poklicne bolezni na podlagi danes veljavne zakonodaje.
Natančno je postopek verifikacije določen le pri sumu na poklicno ali okoljsko bolezen zaradi izpostavljenosti azbestu: delavca ali upokojenega delavca oziroma prebivalca, ki je živel v bližini vira azbesta pregleda specialist medicine dela in tudi razišče, kje, koliko in kdaj je bil delavec/prebivalec izpostavljen in katero bolezen ima. Na osnovi izpostavljenosti in bolezni sklepa, ali je med njima povezanost. Če v ekspertizi utemeljeno posumi na poklicno bolezen zaradi izpostavljenosti azbestu (azbestoza, bolezni plevre, pljučni rak ali mezoteliom), ekspertizo pošlje Interdisciplinarni skupini strokovnjakov za verifikacijo poklicne bolezni zaradi izpostavljenosti azbestu na KIMDPŠ, ki jo je imenoval minister za zdravje. Skupina strokovnjakov pregleda izvide in na podlagi dokazov poklicno bolezen potrdi ali zavrne. Če je poklicna bolezen potrjena, lahko delavec potrdilo o poklicni oz. okoljski bolezni pošlje Komisiji za odpravljanje posledic dela z azbestom na Ministrstvu za delo, družino, socialne zadeve in enake možnosti. Komisija določi delavcu odškodnino, katere višina je odvisna od delavčeve diagnoze, starosti in delovne dobe.

Za nobeno drugo poklicno bolezen pa ni določen postopek priznavanja. Praviloma bi poklicno bolezen sicer v sodelovanju s specialistom medicine dela morala priznati Invalidska komisija ZPIZa, a je to bolj izjema kot pravilo. Tudi če se delavec odloči za sodno pot priznavanja poklicne bolezni tako, da bo verifikacijo poklicne bolezni plačal sam ali da mu jo plača njegov sindikat in bolezen verificirajo strokovnjaki KIMDPŠ, tega mnenja sodišče lahko tudi ne prizna, če sledi mnenju sodnega izvedenca, ki praviloma poklicno bolezen slabše pozna.

Trenutno je Ministrstvo za zdravje oblikovalo delovno skupino, ki naj bi oblikovala listo poklicnih bolezni in določila pot priznavanja teh. Predlog je, naj bi delavec sam, osebni zdravnik, delodajalec ali specialist, vsi preko osebnega zdravnika, sprožili proces priznavanja poklicne bolezni. Osebni zdravnik bi z napotnico poslal delavca s sumom na poklicno bolezen k specialistu medicine dela, ki bi bil imenovan s strani Ministrstva za zdravje. Ta bi pridobil podatke o izpostavljenosti od delodajalca in pooblaščenega izvajalca medicine dela, prometa in športa, od slednjega bi pridobil tudi podatke o predhodnem in obdobnih zdravstvenih pregledih. Na osnovi vseh pridobljenih podatkov bi postavil utemeljen sum na poklicno bolezen ali bi pa sum ovrgel. V primeru utemeljenega suma bi poslal dokumentacijo na interdisciplinarno skupino strokovnjakov, ki naj bi bila sestavljena iz dveh specialistov medicine dela in specialista klinične medicine iz področja delavčeve bolezni, ta bi bolezen kot poklicno dokončno potrdila ali pa jo zavrnila. Komisija bi imela sedež na KIMDPŠ. Vprašanje plačnika celega procesa še ni rešeno.

Upoštevajoč podatke evropske statistike o pogostosti poklicnih bolezni iz leta 2001 [7], novejših podatkov tudi v Evropi ni, bi v Sloveniji pričakovali letno okrog 1150 primerov sumov poklicnih bolezni, od tega okrog 290 priznanih poklicnih bolezni in sicer 210 pri moških in 80 pri ženskah.
Po nepopolnih podatkih pa je v Sloveniji letno priznanih manj kot tretjino vseh pričakovanih poklicnih bolezni, pa še te so pretežno poklicne azbestne bolezni, katerih dokazovanje je posebej zakonsko opredeljeno.

RAZPRAVA - DISCUSSION

Poklicne bolezni so pomemben kazalec negativnega zdravja delavcev in odražajo zdravstveno ogroženost delavca na delovnem mestu. Prave razsežnosti problematike poklicnih bolezni v Republiki Sloveniji ne poznamo, ker nimamo republiškega registra. Obstajajo le izjemno pomanjkljivi posamezni podatki o incidenci poklicnih bolezni, sumov na poklicne bolezni in z delom povezanih bolezni. V skladu z veljavno zakonodajo [2,9] se poklicna bolezen ugotavlja in dokazuje z zdravstvenim nadzorom delavcev na preventivnih zdravstvenih pregledih, ki jih izvaja pooblaščeni izvajalec medicine dela, prometa in športa. Poklicne bolezni pa priznavajo izvedenski organi Zavoda za pokojninski in invalidsko zavarovanje Slovenije, pri čemer sodelujejo z delavčevim osebnim zdravnikom, pooblaščenim izvajalcem medicine dela in delodajalcem oziroma zavodi za usposabljanje invalidnih oseb [5,6]. Poklicno bolezen prijavlja inšpekciji dela delodajalec [10].
Upravljalec Zbirke podatkov o poklicnih boleznih, sumih na poklicno bolezen in z delom povezanih bolezni pa naj bi bil po veljavni zakonodaji pristojnem Nacionalni inštitut za javno zdravje [11].

Ugotavljamo, da je največja pomanjkljivost sedanjih zakonskih določb odsotnost skupnega imenovalca, ki bi smiselno in hierarhično povezal vse vpletene inštitucije, ki sodelujejo v procesih verifikacije poklicnih bolezni.
Menimo, da bi bilo za zagon tega sistema v praksi najbolj primerno vzpostaviti delavsko zavarovalnico, financirano s strani delodajalcev, ki bi ločeno od sistema splošnega zdravstvenega zavarovanja zavarovala delavce za primer poškodb pri delu in poklicnih bolezni. Na ta način bi bila zagotovljena tudi strokovna in finančna neodvisnost specialistov medicine dela, prometa in športa od delodajalcev, ki financirajo preventivne zdravstvene aktivnosti, povezane z dejavniki tveganja na delovnem mestu, in tudi odkrivanje poklicnih bolezni, ki so s temi tveganji povezane [1]. Vendar tako ureditev deloma onemogoča evropska zakonodaja s področja zavarovalništva.

Smernice, ki jih je kot shemo splošnih kriterijev verifikacije poklicnih bolezni oblikoval in jih še oblikuje je UKCL KIMDPŠ, predstavljajo odlično doktrinarno izhodišče za vse pooblaščene izvajalce medicine dela, prometa in športa. Dokler ni smernic za vse poklicne bolezni, ki jih vsebuje naš Pravilnik o seznamu poklicnih bolezni [2], predlagamo, da se smiselno uporabljajo Evropski priporočeni kriteriji verifikacije poklicnih bolezni, ki jih je pripravila Enota za medicino dela in higieno Evropske unije [12]. Članicam je tudi priporočila, da čimprej osvojijo in poenotijo svoje evidence pri statističnem in epidemiološkem spremljanju incidence poklicnih bolezni, kar pomeni, da naj se vzpostavi enoten evropski register sumov poklicnih bolezni in poklicnih bolezni. Tak register je nujen za spremljanje in primerjavo incidence ter za ustrezno ukrepanje v članicah skupnosti za večjo varnost in zdravje pri delu [12,13,14].

ZAKLJUČEK - CONCLUSSION

Ker v Sloveniji doslej razen za azbestne bolezni še ni sprejet sistem verifikacije poklicnih bolezni, smo predlagali, da bi na podlagi veljavne zakonodaje verifikacija poklicnih bolezni potekala na tak način, da bil lahko sprožili proces priznavanja poklicne bolezni delavec sam, njegov osebni zdravnik, delodajalec ali specialist, vsi preko osebnega zdravnika. Ta bi z napotnico poslal delavca s sumom na poklicno bolezen k specialistu medicine dela, imenovanega s strani Ministrstva za zdravje. Ko bi pridobil podatke o izpostavljenosti, o predhodnem in obdobnih zdravstvenih pregledih, bi lahko postavil utemeljen sum na poklicno bolezen ali bi pa sum ovrgel. V primeru utemeljenega suma bi poslal ekspertno dokumentacijo na interdisciplinarno skupino strokovnjakov na KIMDPŠ, ki bi bolezen kot poklicno dokončno potrdila ali pa jo zavrnila.
Ključno vprašanje plačnika celega procesa še ni rešeno. Zato pot do cilja pa vodi le preko soglasja vseh deležnikov in predvsem političnih strank.

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VERIFICATION OF OCCUPATIONAL DISEASES IN SLOVENIA

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Abstract

The enormity of problems regarding occupational diseases in the Republic of Slovenia is not known because we do not have a national register of occupational diseases. Except for occupational or environmental asbestos diseases, there is no other occupational disease with a determined process of verification.
The Pension Insurance recognizes 25 to 50 occupational diseases per year, there are 800 to 1000 occupational diseases expected.
There is a proposal that the verification process of occupational diseases should be started by the worker, his general practitioner, the employer or any other medical specialist – by a referral of the worker´s GP to a specialist in occupational medicine authorized by the Ministry of Health. When he receives the data on occupational exposure, pre-employment and regular medical check-ups, he prepares the expertise and sends it to the interdisciplinary commission at the Clinical Institute of Occupational, Traffic and Sports Medicine.
Unfortunately, the payer of the process has not been established yet.

Keywords: Occupational diseases, Slovenia, verification

INTRODUCTION

Extensiveness, register, list of occupational diseases

The exact dimensions of occupational diseases in Slovenia are not known because despite the legal obligation we do not have a national register of occupational diseases. Discovering occupational diseases ceased after 1990. Since 1998 only asbestos-related diseases have been discovered and recognized. There is also no epidemiological monitoring of the incidence and prevalence of occupational diseases, the frequency cannot be compared to the European Union. There are also no suitable measures for preventing occupational pathology [1]. We estimate that the main cause of non-discovery of occupational diseases in Slovenia is the fact that health and safety at work are financed completely by the employer. Of course, it is not in the employer's interest to discover occupational diseases anywhere in the world. In case of suspicion of an occupational disease the employer should refer the worker to a specialist in occupational medicine, who is paid directly by the employer. Consequently, the worker suffering from an occupational disease is not referred to a specialist and the doctor does not diagnose an occupational disease because he is financially dependent on the employer. The disability commission boards at the Pension and Disability Insurance Institute of Slovenia (ZPIZ), who are legally obliged to verify occupational diseases, do not perform them.

The last valid list of occupational diseases was written by the Ministry of Work, Family, Social Affairs and Equal Opportunities in 2003 [2]. The list of groups or causes of occupational diseases follows the recommendations of the European Commission from 1990 [3]. Its last recommendations were written in 2003; however, Slovenia did not consider them in the regulations [4]. At the time this publication was written, at the end of 2016, there was no regulation in Slovenia determining occupational diseases and the lines of work in which these diseases occur, the conditions under which they are considered occupational diseases and the process of establishing, verifying and reporting occupational diseases. In accordance with the Pension and Disability Act, it should have been determined by the Minister of Health by the 1st of January 2014 [5,6].
·For good and functional Regulations of Occupational Diseases it is necessary to have the expert bases for it prepared by experts with knowledge and experience as well as a good knowledge of the systems of verification and registration of occupational diseases in the European Union and in the world.

The problems of occupational diseases in the European Union and in Slovenia

The procedures of verification and social security systems differ in the field of occupational diseases among the members of the EU, which is why the numbers cannot be compared. The three most common occupational diseases according to the information on Eurostat are diseases of the musculoskeletal system (35%), skin diseases (14%) and respiratory diseases (14%). They are followed by sense organ diseases, where occupational hearing impairment is most common (13%), neurological diseases (8%) and cancer diseases (5%) [7]. Approximately 30% of occupational diseases are related to exposure to chemical substances. 90% of occupational cancers were caused by chemicals (in 86% that is asbestos, in 4% other chemicals, for example aromatic amines, chromium and carbohydrates).

According to the incomplete data by the Labour Inspectorate of Slovenia, during the period between 1985 and 1987 there were on average 350 undiagnosed cases of occupational diseases in Slovenia (an incidence of 42 cases per 100,000 workers), two thirds of these cases concerned occupational hearing impairment and in little over one third of the cases there were occupational damages caused by contact with dangerous substances [8].

The true dimensions of the problem of occupational diseases are therefore not known in Slovenia. There is only very fragmentary information on the incidence of occupational diseases. The Pension and Disability Insurance Institute of Slovenia (ZPIZ) in their procedures for determining working disabilities recognizes 25 to 50 occupational diseases per year, while approximately 800 to 1000 are to be expected.

Chart 1: *The number of occupational diseases per 100,000 workers, verified by ZPIZ, 2010-2015.*

Year	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Number of occupational diseases	**45**	**50**	**32**	**25**	**38**	**27**
Number of occupational diseases per 100,000 workers	**5.3**	**6.1**	**3.9**	**3.2**	**4.8**	**3.4**

The most common are occupational skin diseases, however only 10 to 29 are verified per year or approximately 2 per 100,000 workers. In England, Germany or Scandinavian countries from 70 to 80 are verified. The conditions are even more serious in occupational asthma. The Pension and Disability Insurance Institute of Slovenia only verified two cases of occupational asthma from 2011 to 2015 and none in other years. Compared to other countries in the European Union, we expected approximately 300 cases of occupational asthma per year.

The Ministry of Health ordered the University Clinical Centre Ljubljana, Clinical Institute of Occupational, Traffic and Sports Medicine (UKCL KIMDPŠ) in 2003 to prepare guidelines, meaning the general and specific criteria for the verification of occupational diseases, defined by valid national legislation. The guidelines were supposed to become the basis for the establishment of a unified national register of occupational diseases and suspicions of occupational diseases, which would enable monitoring and protective measures for workers' health at work [1]. This objective has already been partly realized because the Clinical Institute of Occupation, Traffic and Sports Medicine has prepared guidelines for 16 occupational diseases and another group of guidelines is being prepared (musculoskeletal diseases). Unfortunately, the guidelines did not contribute to a higher rate of discovering occupational diseases which clearly show a lack of regulations and professional guidelines.

METHODS

Defining the concepts and definitions

Occupational disease: is caused by a long-term direct influence of the working process and working conditions in a certain workplace or during work, which falls directly into the framework of activities on the basis of which the worker is insured and is listed as an occupational disease [2].
Suspicion of occupational disease: is a disease caused by a long-term direct influence of the working process and conditions in a certain workplace or during work, which falls directly into the framework of activities on the basis of which the worker is insured and is listed as an occupational disease, however, not all conditions are currently fulfilled for the verification (the suspicion of occupational disease is not legally defined).
Work-related disease: is a medical defect conditioned by many causes, the occurrence of which was affected by the physical, psychosocial individual, socio-cultural factors and the factors of the working environment (it is not legally defined; the definition is summed up by WHO, 1985).

The incidence of occupational diseases (frequency): is the number of newly discovered proven cases of occupational diseases per 100,000 employees in the monitored period (usually 1st of January to 31th of December each year).
Prevalence of occupational diseases (range): is the number of all discovered proven cases of occupational diseases per 100,000 employees in the monitored period.
Specific mortality rate is the number of the deceased due to occupational diseases per 1000 employees in the monitored period (usually 1st of January to 31th of December each year).

The general criteria for the verification of occupational diseases

In their guidelines, the Clinical Institute of Occupational, Traffic and Sports Medicine designed the following scheme of general criteria for the verification of occupational diseases [1]:

A. The objectified causal relation between the exposure to an occupational factor (in a certain working environment), determined by a working anamnesis and the evaluation of risk of burdens and harmfulness which supposedly caused the disease, and the responsiveness of the worker to the occupational exposure. It is determined by a personal anamnesis, a clinical picture, laboratory and functional tests and other suitable diagnostic procedures and examinations.

B. The lowest intensity of the exposure, which according to the experts can cause an occupational disease.

C. The shortest period of exposure, which according to the experts can cause an occupational disease.

D. The latent period for the occurrence of an occupational disease: from the moment of last exposure to the causal factor until the moment of the occurrence of the first signs of an occupational disease.

E. Induction period: the shortest time from the beginning of exposure to causal factors to the beginning of an occupational disease.

For the verification of an occupational disease the criteria A, B, C and D must be fulfilled [2].
The specific criteria for the verification of occupational diseases are listed in the specific part of the guidelines at each individual occupational disease.
In case not all the criteria are fulfilled, only the suspicion of an occupational disease can be established.

RESULTS

The recommended system and course of discovery, verification and registration of occupational diseases in Slovenia

The basic question is the verification procedure of an occupational disease based on valid legislation.
The verification procedure is only exactly established for the suspicion of an environmental or occupational disease caused by asbestos exposure: the worker or a retired worker or resident in the vicinity of an asbestos source is checked by a specialist in occupational medicine who also examines where, how long and when the worker/resident was exposed and which disease he is affected by. Based on the exposure and the disease the specialist concludes whether there is a relation between the two. If during the expertise, he suspects an occupational disease caused by asbestos exposure (asbestosis, pleural diseases, lung cancer or mesothelioma) the expertise is sent to the Interdisciplinary group of experts for the verification of occupational diseases caused by asbestos exposure at the Clinical Institute for Occupational, Traffic and Sports Medicine, appointed by the Minister of Health. The group of experts examines the diagnosis and confirms or rejects the occupational disease based on the evidence. If the occupational disease is confirmed, the worker can send the certificate on the environmental or occupational disease to the Committee for Remedying the Consequences of Working with Asbestos at the Ministry of Work, Family, Social Affairs and Equal Opportunities. The Committee determines the worker's compensation, the amount of which depends on the worker's diagnosis, age and years of service.

There is no determined verification procedure of any other occupational disease. An occupational disease should be verified by the Committee for Disabilities at the Pension and Disabilities Insurance Institute (ZPIZ) in cooperation with a specialist in occupational medicine, however that happens very rarely. Even if a worker decides on the legal path of verification of occupational disease by paying for the verification himself or it is paid by the Union and the disease is verified by the experts at the Clinical Institute for Occupational, Traffic and Sports Medicine, their opinion might not be known to the court if they decided to only consider the opinion of a court-appointed specialist who usually does not have that much knowledge of the disease.

Currently, the Ministry of Health appointed a working group of experts who will write a list of occupational diseases and determine the method of their verification. There is a proposal that the verification process of occupational diseases should be started by the worker, his general practitioner, the employer or any other medical specialist through the general practitioner. The GP would refer the worker with the suspicion of an occupational disease to a specialist of occupational medicine, appointed by the Ministry of Health. He would acquire the information on exposure from the employer and the appointed specialist of occupational, traffic and sports medicine who would also forward the information on the previous exposure in the periodical medical check-ups. Based on all the information, the specialist would confirm or reject a reasonable suspicion of an occupational disease. In case of a reasonable suspicion the documentation would be sent to the interdisciplinary group of experts, comprising of two specialists of occupational medicine and a specialist in clinical medicine from the field of the worker's disease, who would ultimately confirm or reject the disease. The committee would be established at the Clinical Institute for Occupational, Traffic and Sports Medicine. The question of the payer of the complete process is not yet solved.

Considering the data of the European statistics on the frequency of occupational diseases in 2001 [7], for there is a lack of recent data even in Europe, there are approximately 1150 occurrences of suspicions of occupational diseases to be expected in Slovenia per year, approximately 290 of which would be verified as occupational diseases, 210 in men and 80 in women.
According to incomplete data, less than one third of all expected occupational diseases are verified in Slovenia every year, among which the most often are asbestos-related occupational diseases, the verification of which is legally defined.

DISCUSSION

Occupational diseases are an important indicator of the workers' negative health and reflect the medical endangerment of the worker in the workplace. The true dimensions of the problem of occupational diseases in Slovenia are not known, because we do not have a national register. There only exists incomplete individual information on the incidence of occupational diseases, suspicions of occupational diseases and work-related diseases. In accordance with valid legislation [2,9], an occupational disease is determined and verified through the workers' health control in preventive medical check-ups, performed by the appointed specialist of occupational, traffic and sports medicine. Occupational diseases are recognized by expert organs of the Pension and Disability Insurance Institute of Slovenia, where they cooperate with the worker's GP, the appointed specialist of occupational medicine and the employer or the institutions for training disabled people [5,6]. An occupational disease is reported to the inspection by the employer [10].
The manager of the Collection of data on occupational diseases, suspicions on occupational diseases and work-related diseases, according to the valid legislation, is supposed to be the National Institute of Public Health [11].

We observe that the greatest weakness of the statutory provisions so far is the absence of a common denominator, which would connect all the institutions, working in the verification processes of occupational diseases, in a meaningful and hierarchical way.
We believe that in order to start this system in practice, it would be most appropriate to establish a workers' insurance company, financed by the employers, which would insure the workers against injuries at work and occupational diseases separately from the system of general health insurance. This way, the professional and financial independence of the specialists of occupational, traffic and sports medicine would be guaranteed by the employers who finance preventive health activities related to the factors of risk in the workplace as well as discovering occupational diseases related to these risks [1]. However, this type of arrangement is partly disabled by the European legislation in the field of insurance.

The guidelines being created as a scheme of general criteria for verification of occupational diseases by the Clinical Institute for Occupational, Traffic and Sports Medicine represent an excellent doctrinal base for all authorized specialists of occupational, traffic and sports medicine. Until there are guidelines for all occupational diseases included in our Rules concerning the list of occupational diseases [2], we suggest that the European recommended criteria for the verification of occupational diseases, prepared by the Unit for occupational medicine and hygiene of the European Union are used [12]. The countries in the EU were instructed to acquire and standardize their records of statistical and epidemiological monitoring regarding the incidence of occupational diseases as soon as possible, which means that a common European register of suspicions of occupational diseases and occupational diseases should be established. This type of register is necessary for the monitoring and comparison of the incidence and for proper actions in EU countries for greater safety and health at work [12,13,14].

CONCLUSION

Due to the fact that there is no valid system of verification of occupational diseases in Slovenia, except for asbestos-related diseases, we suggested that the verification of occupational diseases, based on valid legislation should be performed so that the worker himself, his GP, employer or a specialist could be able to initiate the verification process of occupational diseases through the worker's GP. He would refer the worker with a suspicion of an occupational disease to a specialist of occupational medicine, appointed by the Ministry of Health. After acquiring the information on exposure, the previous and periodical check-ups, he could make a reasonable suspicion of an occupational disease or reject the suspicion. In case of a reasonable suspicion he would send the expert documentation to an interdisciplinary group of experts at the Medical Institute for Occupational, Traffic and Sports Medicine, which would ultimately confirm or reject the diagnosis of occupational disease.
The key question of the payer of the process is still not solved. This is why the path to success leads through the consensus of all stakeholders and especially political parties.

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