Preventing Occupational Disease: Designing a System that Works

Appendices to the Final Report to WorkSafeBC

Research Project RS2014-IG26

Anya Keefe[1], Barbara Neis[1], Stephen Bornstein[1], Victoria Arrandale[2], Hugh Davies[3], Paul Demers[2], Zhiwei Gao[4], D. Linn Holness[5], Susan Stock[6, 7], Mieke Koehoorn[3], Allen Kraut[8], Kevin Hedges[1], Kristen Romme[9], Colin Murray[10], Mary Shortall[11], Bill Hynd[11], Alec Farquhar[12], Ruth Buitrago[7], Omid Nobakht[3], Catherine Slavik[2], Amanda Veglia[2], Bethany Zack[5]

Affiliations:
[1]SafetyNet Centre for Occupational Health and Safety Research, Memorial University
[2]Occupational Cancer Research Centre, Cancer Care Ontario
[3]School of Population and Public Health, University of British Columbia
[4]Clinical Epidemiology, Faculty of Medicine, Memorial University
[5]Medicine and Public Health Sciences, St. Michael's Hospital / U. Toronto
[6]Institut national de santé publique du Québec
[7]Social & Preventive Medicine, U Montreal
[8]College of Medicine, Faculty of Health Science, University of Manitoba
[9]Health Sciences Library, Faculty of Medicine, Memorial University
[10]Worker and Employer Services, WorkSafeBC
[11]Newfoundland and Labrador Federation of Labour
[12]Office of the Worker Adviser, Ontario Ministry of Labour

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Appendix A: Methods

A1. INTRODUCTION

The purpose of this appendix is to outline the methodology supporting the findings of the Final Report to the Workers' Compensation Board of British Columbia (WorkSafeBC), entitled: '*Preventing Occupational Disease: Designing a System that Works*'. This project was supported with funds from WorkSafeBC through the *Innovation at Work* program.

This appendix includes a detailed and comprehensive description of the overarching and the database-specific search strategies, as well as information on how the scoping review was performed (i.e., inclusion/exclusion criteria, and the process by which information was extracted into disease-specific matrices).

A2. METHODS

A2.1 Literature searches

A2.1.1 Search terms

In general, the starting point was a broad list of terms pertinent to the problem (e.g., "occupational exposure" OR "occupational diseases" OR "occupational medicine" OR "occupational health"), the intervention (e.g., "primary prevention"), and the outcome (e.g., "program evaluation"). These terms were combined with disease-specific keywords (e.g., "noise" OR "sound" OR "acoustic" AND "occupation*" OR "work*" OR "industr*" OR "job*" OR "employ*") in various permutations to create database-specific search strings.

Search strings were built around the problem, the intervention, and the outcome. Many of the terms (i.e., the controlled vocabulary and keywords) used to structure the search strings were common to all searches, although they needed to be customized for the individual databases. Some, however, were terms that were specific to each disease of interest. The search strategy included both Meta Subject Heading (MeSH) terms and text words in case articles did not have MeSH terms associated with them. Table 1 lists the search terms used.

Searches were conducted iteratively, allowing for search strategies to be refined based on review of the findings and for the refinement of inclusion/exclusion criteria. Electronic databases of the peer-reviewed literature were targeted first. The findings of the peer-reviewed searches were then used to inform searches of the grey literature.

To increase capture of relevant information, a snowballing technique was used to identify promising programs and strategies from the reference lists of key studies.

Table 1: Search Terms

	Terms/Keywords Common Across Searches	Terms Specific To Disease Of Interest
THE PROBLEM	Occupational Exposure Occupational Diseases Occupational Medicine Occupational Health Exposure Disease occupation* work* industr* job* employ* worker* workplace* work related*	Noise Noise, Occupational Sound Acoustic Occupational Carcinogen Asbestos Asbestos, Occupational Diesel* Diesel Exhaust Diesel Engine Exhaust Silica Silica, Occupational Shift work shiftwork* shift*
THE INTERVENTION	Primary Prevention Prevention and Control Mass Screening Preventive Health Care Health Screening Screening Test prevent* screen* detect* monitor* surveillance surveill* risk*	Noise Control Hearing Conservation Hearing Loss Prevention Program Audiometry Hearing Protective Devices
THE OUTCOME	Program Development Program Evaluation Occupational Health Services Occupational Health Nursing Health Public Health Health Program Health Education Public Health Service program* strateg* intervention* intervene* initiative* implement* policy policies	Noise Induced Hearing Loss Hearing Loss Occupational Skin Diseases Dermatitis, Contact Contact Dermatitis Eczema Hand Eczema Occupational lung disease Asthma Asthma, Occupational Occupational allergy

A total of 12 peer-reviewed and grey literature databases were searched (Table 2). All searches were limited to articles in English and French, published since 1996.

Table 2: Databases Searched

Peer-reviewed literature		Grey literature
• MedLine (via PubMed) • Embase • Web of Science • Cumulative Index of Nursing & Allied Health Literature (CINAHL)	• Scopus • Public Affairs Information Service (PAIS) International • Health Policy Reference Centre • Cochrane Library • INRS	• Google Scholar • Sites listed in Canadian Agency for Drugs & Technologies in Health (CADTH) Grey Matters • Canadian Centre for Occupational Health & Safety (CCOHS)*

*Includes 7 databases: OSHLINE, NIOSHTIC, NIOSHTIC-2, HSELINE, CISILO, Canadiana, PubMed Subset

A2.2 Consultation with key informants and other experts

To supplement information collected in the literature searches and the scoping review, 14 key informants and experts were consulted via email and telephone (Table 3). Key informants were first given some background on the project's objectives along with a very high level summary of what was learned in the scoping review. As each 30–60 minute discussion unfolded, informants were prompted with questions about:

- What was going on in primary prevention in their jurisdiction or area of expertise
- Whether they were aware of any initiatives or major prevention strategies that may not have been captured in the scoping review
- Which primary prevention strategies they considered to be particularly good
- Whether they could suggest any regulatory, exposure control, surveillance, educational or multi-faceted strategies that should be included
- Whether there were campaigns targeting vulnerable workers in their jurisdiction (was it an issue? how is "vulnerability" defined?)
- What they felt to be key elements of a program to protect vulnerable workers
- Whether they had been involved in implementing any primary prevention programs and if so, what were the lessons learned?

At the end of the conversation, key informants were asked whether they would be interested in reviewing and/or receiving a copy of the final report.

Table 3: Key informants and experts consulted

Topic Area	Name & Affiliation	Contact Information
Noise-induced hearing loss	Peter Rabinowitz, MD, MPH Associate Professor Department of Environmental and Occupational Health Sciences University of Washington, School of Public Health	T: 206-616-0598 E: peterr7@uw.edu
	Noah Seixas, MS, PhD Professor Department of Environmental and Occupational Health Sciences University of Washington, School of Public Health	T: 206-685-7189 E: nseixas@uw.edu
Occupational contact dermatitis	John Cherrie, Prof Professor of Human Health School of Life Sciences Heriot-Watt University	T +44 7796261688 E: j.cherrie@hw.ac.uk
	Diane Llewellyn, BSc CMFOH HM Specialist Inspector Field Operations Directorate (FOD) Occupational Hygiene / Noise & Vibration Unit Health & Safety Executive	T: +44 (20) 3028 4777 E: Diane.Llewellyn@hse.gov.uk
Occupational cancer	Dr. Lesley Rushton Department of Epidemiology and Biostatistics Faculty of Medicine, School of Public Health Imperial College London	T: +44 (0)20 7594 1802 E: l.rushton@imperial.ac.uk
	Leslie Staynor, MS, PhD Professor Epidemiology and Biostatistics University of Illinois at Chicago	T: (312) 355-3692 E: lstayner@uic.edu
Occupational asthma	Susan Tarlo, MB, BS FRCPC Professor Gage Occupational and Environmental Health Unit University of Toronto	T: (416) 978-5883 E: susan.tarlo@utoronto.ca
	Susanna von Essen, MD, MPH Professor Department of Environmental, Agricultural and Occupational Health College of Public Health	T: 402 690-5757 E: svonesse@unmc.edu

Topic Area	Name & Affiliation	Contact Information
	Mohammed Jeebay, MBChB MPH (Occ Med) PhD Head of Department and Director School of Public Health and Family Medicine Faculty of Health Sciences, University of Cape Town, South Africa	T: +27 21 406 6309 / 6300 E: mohamed.jeebhay@uct.ac.za
Primary Prevention, more generally	Dianne Llewellyn	(see above)
	John Cherrie	(see above)
	Margaret Quinn, Sc.D., CIH Professor College of Health Sciences University of Massachusetts Lowell	T: 978-934-3196 E: Margaret_Quinn@uml.edu
	John Oudyk, MSc CIH ROH Occupational Hygienist Occupational Health Clinics for Ontario Workers	T: 905-549-2552 E: joudyk@ohcow.on.ca
	Marc-Andre Lavoie, M.Sc., ROH President Risk Marcker Inc.	T: 902-266-6664 E: marcandre.lavoie@outlook.com
	Susan Stock, MD MSc FRCPC Institut national de santé publique du Québec et Professeure agrégée de clinique, Département de médecine sociale et préventive, Université de Montréal	T: 514 864-1600, ext. 3206 E: susan.stock@inspq.qc.ca
Vulnerable workers	Lisa Brosseau, ScD, CIH Professor Environmental and Occupational Health Sciences University of Illinois at Chicago	T: 312-413-5185 E: brosseau@uic.edu

Appendix B: Descriptive Results

B1. INTRODUCTION

This appendix presents results of the literature searches, broken down by disease and database, and provides descriptive summaries of the articles retrieved.

B2. DESCRIPTIVE RESULTS

B2.1 Results of the literature searches, by disease and database

As noted in Section 2.3.1 of the Main Report, the searches of the peer-reviewed and grey literature databases generated over 40,000 hits. Approximately one-third (n=14,810) came from the peer-reviewed literature. The majority of the hits were captured in the English-language searches; however, the French-language searches turned up a number of promising strategies that might have otherwise been missed. Articles about NIHL accounted for nearly 40% of the hits identified in the peer-reviewed literature, while articles about asbestos accounted for just over 60% of the hits identified in the grey literature.

Table 4 presents the number of hits generated for each disease, by database/search engine. PubMed (MedLine) and Embase accounted for approximately two-thirds of the articles identified in the peer-reviewed literature. Google search engines accounted for over 90% of the articles/references identified in the grey literature.

Table 4: Results of the literature searches, by disease and database

Database	NIHL	Contact Dermatitis	Occupational Cancer (carcinogens)				Asthma	Total
			Asbestos	Diesel Exhaust	Silica	Shiftwork		
Peer-reviewed literature								
PubMed	3,297	269	374	264	384	316	837	4,904
Embase	1,332	132	794	1,280	691	663	1148	4,892
Scopus		0	584	0	708	210	1302	1,502
Web of Science		5						5
Cochrane	29	1			3	8		40
CINAHL	1,067	20						1,087
PAIS	48	1						49
Total:	**5,773**	**427**	**1,752**	**1,544**	**1,786**	**1,197**	**2,331**	**14,810**
Grey Literature								
Google**		140	15,500	4,200	3,120	1,290		24,110
CCOHS	762							762
CADTH		0	3	0	7	2		12
CISILO		58	248	51	93	231		623
Total:	**762**	**198**	**15,751**	**4,251**	**3,220**	**1,523**	**36**	**25,507**
Other Search Techniques								
Snowballing							233	**233**
Peer-reviewed + grey literature + snowball techniques								
Total:	**6,535**	**625**	**17,503**	**5,795**	**5,006**	**2,720**	**2,600**	**40,550**

**includes Google Scholar

B2.2 Descriptive results about the articles retrieved

B2.2.1 Primary vs. secondary prevention

Although some of the articles identified in the literature searches reported on the findings of systematic reviews of the literature, the majority reported on individual studies. This was not the case, however, for some of the searches (e.g., noise-induced hearing loss, asbestos) where the majority of the articles retrieved were articles that synthesized the literature on the topic (systematically or otherwise). As noted earlier, although secondary prevention was outside the scope of the project, articles were included if there was evidence of a feedback loop informing primary prevention activities. Of the 404 articles retrieved for in-depth review, 54 reported on a secondary or a combined primary/secondary prevention initiative or strategy.

B2.2.2 Study design and evaluation of effectiveness

The literature identified in the searches encompassed a variety of study designs (e.g., randomized controlled trials, other intervention studies, cohort studies, cross-sectional studies, qualitative studies, case studies/series, narrative reviews and systematic reviews) (Table 5). Just over half of the references retained for our scoping review described interventions that had been evaluated for effectiveness.

Table 5: Study designs and proportion of studies that evaluated effectiveness

Topic	# references retrieved	# evaluating effectiveness	Types of study designs
NIHL	120	69	Cross-sectional, intervention, qualitative, quasi-experimental, RCT, cohort (retrospective, prospective), review (systematic, literature), animal study, descriptive, comparative, secondary data analysis, modelling
Contact Dermatitis	53	43	Cross-sectional, intervention, experimental, modeling, qualitative, case study/series, longitudinal, descriptive, review (systematic)
Asbestos	59	20	Intervention, qualitative, retrospective, secondary data analysis, review (systematic, literature)
Diesel Exhaust	19	10	Qualitative, quantitative (exposure/emission measurement)
Silica	27	19	Cluster RCT, qualitative, quantitative (exposure measurement)
Shiftwork	22	6	Cross-sectional, qualitative, review
Asthma	108	55	Cross sectional, retrospective, prospective, case study/case series, intervention, systematic review, meta analysis, qualitative

B2.2.3 Level of the intervention(s) described

Articles were categorized by the level at which the described intervention was undertaken (i.e., national, regional, local, organizational). Of the 404 articles reviewed, 74 reported on initiatives undertaken at the national level and 93 reported on programs at the organizational level. The majority of the national level interventions were found in the literature on asbestos (n=24), noise-induced hearing loss (n=16) and asthma (n=13). The majority of organizational interventions were found in the literature on dermatitis (n=24), asthma (n=20), noise-induced hearing loss (n=18) and silica (n=14). For approximately 30% of the articles retrieved, the research assistants were not able to determine the level of the intervention. Of the 72 articles where the intervention was categorized as "unknown", 54 were on noise-induced hearing loss.

B2.3 Descriptive summaries of the articles retrieved (by disease)

This section expands on the information provided above by presenting a high level description of the articles retrieved for each of the four diseases.

B2.3.1 Noise-induced hearing loss

The 117 English-language articles examined fell into nine broad categories: hearing conservation programs (n=27), exposure assessment (n=8), educational (n=9), control measures (n=16), health outcome (i.e., hearing loss) assessment (n=10), ototoxic effects/susceptibility (n=18), drug interventions (n=7), program evaluation (n=3), and "other" (n=19). The numbers of interventions undertaken at the local, national and organizational levels were evenly distributed (n=20, 16 and 18, respectively). The level of intervention was categorized as "unknown" for just under half of the articles retrieved (n=54).

B2.3.2 Occupational contact dermatitis

The 38 English-language interventions identified fell into four broad categories: regulatory (n=5), educational (n=19), control measures (n=3), screening and surveillance (n=3) and "various" (n=8). This latter category primarily encompassed review articles, of which five were systematic reviews. The majority of the articles described interventions undertaken at the organizational level (n=24) or at the national level (n=9). Eight of the 15 French-language articles reported on secondary interventions. Studies were conducted in the United States, Australia and the European Union (specifically, the United Kingdom, Germany, Austria, Belgium and the Netherlands). All of the English-language and five of the French-language interventions incorporated an evaluation of effectiveness.

B2.3.3 Occupational cancer

Of the 125 English-language articles meeting the inclusion criteria, 56 reported on interventions to prevent asbestos exposure, 21 on diesel exhaust, 26 on silica, and 22 on shiftwork.

B2.3.3.1 Asbestos

Review articles were the most common type of publication retrieved in this search. The English-language interventions fell into 6 broad categories: asbestos bans (n=5), surveillance (n=4), educational/awareness campaigns (n=1), worker engagement (n=2), asbestos registry (n=1), and multi-faceted interventions (n=16). Multi-faceted interventions consisted of multiple concurrent approaches and include one or more of the following: interventions based on the hierarchy of controls (elimination, substitution, use reduction, engineering controls, administrative controls, personal protective

equipment), bans[1] (i.e., regulations prohibiting use of asbestos), reducing and ensuring compliance with occupational exposure limits, asbestos abatement and remediation in buildings, phasing out the importation of raw asbestos, worker education and training (especially for vulnerable populations), changes to product labelling, health surveillance (such as medical screening in non-symptomatic workers and biological monitoring), toxics use reduction legislation, national reporting systems and exposure databases, etc. Of the 56 articles retrieved, 33 reported on interventions undertaken at the national level.

Thirteen of the asbestos interventions had been evaluated (7 English language, 6 French language). All but two of the evaluations were informal[2]. Four of the informal evaluations examined: the impact of a regulatory ban in 5 different birth cohorts; the effectiveness of asbestos safety awareness training for building managers; estimates of how reducing exposure limits and improving compliance would influence attributable cancers and the proportion of population exposed to asbestos; and the effectiveness of the Finnish Asbestos Program between 1986 and 2005 in several areas (e.g., import and use of asbestos, asbestos abatement regulations, training and number of abatement workers, exposure limits, diagnosis of occupational diseases, compensation of occupational diseases, number of workers under surveillance and follow-up). The fifth informal evaluation was in a systematic review that examined the effectiveness of asbestos-related interventions (including dust reduction techniques, exposure-control policies, discontinuing use, and government bans). One of the formal evaluations evaluated the performance and effectiveness of the Finnish carcinogen registry. The other was a randomized, controlled trial with the worksite as the unit of assignment and intervention.

B2.3.3.2 Diesel exhaust

The 16 English-language interventions fell into 6 broad categories: reducing emissions through vehicle inspection and maintenance programs (n=1) and vehicle scrappage/retrofitting (n=2); mine ventilation (n=2); engineering controls to control emissions at source (n=1); emissions reduction programs like the Diesel Emissions Evaluation Program (DEEP) for underground miners (n=1); hazard/exposure surveillance programs (n=2); and multi-faceted interventions (n=7). Multi-faceted interventions include two or more of the following in combination: the hierarchy of controls (e.g., improving ventilation, enclosed cabins, personal protective equipment, administrative controls); regulatory changes; training for construction and transportation industries; controlling emissions at source (e.g., catalysts and exhaust filters, repowering vehicles, improving fuels, and vehicle maintenance); implementing and

[1] This is a type of exposure elimination.

[2] An evaluation was considered "informal" if it evaluated an intervention's effectiveness to some degree, but did not formally evaluate whether the intervention actually had a measured (or statistically significant, if stated) impact on reducing exposures and cancer risk.

ensuring compliance with exposure limits, water-filled scrubber tanks, chemical decoking of engines, etc. Studies were conducted at the local (n=4), national (n=5) and organizational (n=4) levels in the United States, the United Kingdom, Australia and Mexico.

Ten of the sixteen studies incorporated an evaluation of effectiveness. Evaluations consisted of assessing reductions in: air pollution after installing a local exhaust ventilation system in a mine; oxygen supply and hazardous gas emissions; atmospheric black and brown carbon using a source dilution sampling system; and emissions due to scrappage and retrofitting. Surveys were also undertaken to assess people's perceptions of vehicle-related emissions control policies (e.g., effectiveness, acceptability, cost, time, etc.).

In contrast to the other carcinogens and diseases, the diesel exhaust literature search did not identify any stand-alone education and training interventions explicitly aimed at reducing the likelihood of disease.

B2.3.3.3 Silica

The 23 English-language interventions fell into 6 broad categories: engineering controls (n=11), substitution (n=2), personal protective equipment (n=1), international agreements to lower exposure limits (n=1), training (n= 2), and multi-faceted interventions (n=6). Engineering controls included: misting, local exhaust ventilation, and wet dust control. Multi-faceted interventions included one or more of the following in combination with each other: engineering control, training programs, personal protective equipment, enforcement of exposure limits, effective inspections and application of technical standards. The majority of the interventions were undertaken at the organizational (n=14) and national (n=6) levels.

Nineteen of the studies evaluated the effectiveness of the interventions. Most were informal evaluations and examined the effectiveness of: various engineering controls by measuring respirable silica dust concentrations before and after their implementation; employee training workshops using surveys; and an educational/training program aimed at influencing worker perceptions on dust and ventilation technology.

B2.3.3.4 Shiftwork

The 21 English-language interventions identified fell into 5 broad categories: organizational interventions/administrative controls (n=3); circadian rhythm adjustment using melatonin or light treatment (n=2); education and training (n=1); sleep interventions, including research on sleep aids and stimulants (n=3), and multi-faceted interventions (n=12). Administrative controls included flexible working arrangements, increasing the number of teams on shift to reduce the number of shifts other than day work per person, and organizational interventions like shift work scheduling and rotations. Multi-faceted interventions included two or more of the following in

combination: napping, stimulants (i.e., caffeine), sleep aids (e.g., melatonin, hypnotics), reducing consecutive night shifts, consultation over shift scheduling, nutrition programs, light-darkening shades, self-scheduling shifts, employee training and sleep disorder management, light exposure during night shift, rotating shift work, educating workers on dangers of circadian disruption, matching of shift work to employee preferences and their ability to cope, and suitable lighting. Of the 21 articles, 9 reported on interventions undertaken at the organizational level and 1 reported on an intervention undertaken at the national level. The level of intervention of the remaining 11 was categorized as "unknown".

Six of the studies evaluated the efficacy of the interventions. Four were survey-based and involved: workers completing questionnaires after additional teams of workers were added to ease rotating shift schedule; workers filling out surveys pre- and post-intervention (training and self-scheduling); nurses surveyed after being voluntarily exposed to brief periods of bright light at scheduled times during every night shift; and police officers on shift work responding to a survey about sleep behaviour, use of sleep- and wake-promoting drugs, mental health, work-related performance and safety. In the other two studies, experimental subjects were given controls or no controls and their effect on fatigue, mood and performance was evaluated; and shift workers' sleep quality was evaluated at baseline and at 6 and 12 months after receiving a telephone-delivered sleep hygiene intervention.

All of the primary prevention activities to modify shift work were reported to have a positive impact on the intermediate health outcomes studied; however, none of these studies measured impact on cancer outcomes, which is the focus of this project.

B2.3.4 Occupational asthma

The 90 English-language articles were categorized into 3 broad intervention categories[3]: industrial hygiene risk assessment (n=1), the hierarchy of controls (n = 34) and administrative measures (n=75). This latter category included the following types of interventions: education and training, medical/health screening and surveillance, hazard identification, exposure monitoring, exposure modelling, control banding[4], questionnaires and surveys, removal from exposure, regulatory frameworks (includes regulation setting and assessment/enforcement of compliance). Of the 90 papers examined, 54% included an evaluation of the effectiveness of the intervention.

[3] Note: some articles described more than one intervention. As a result, the numbers add up to more than 90.
[4] Control banding is defined and described in Appendix C3.1.1.

Appendix C: Findings of the Scoping Reviews

C1. INTRODUCTION

This section presents the findings of the scoping reviews. Information is organized and presented by broad category of primary prevention activity or intervention (i.e., legislation and regulation, control of exposures, surveillance of exposures or health outcomes, education and training, and multi-faceted approaches). Under each heading, the findings move from the general (i.e., strategies aimed at preventing 'occupational disease' more broadly) to the specific (i.e., promising strategies identified for each disease). See Appendix D for tables listing the articles retrieved for review.

C2. LEGISLATION AND REGULATIONS

C2.1 General strategies

We found few studies evaluating the effectiveness of regulations at preventing 'occupational disease'. The relatively few articles identified in the scoping review focussed on either (a) evaluating the impact of specific regulations on specific occupational disease outcomes or (b) examining the impact of inspections and enforcement on compliance. Examples include: a UK study that demonstrated that the introduction of workplace exposure limits (WELs) coincided with a significant reduction in the incidence of work-related short latency respiratory diseases associated with agents having a WEL vs. those that didn't (1); a UK study which found that some targeted interventions undertaken by the regulatory agency were more effective than others at reducing short latency respiratory diseases reported to the Health and Occupation Reporting network (2); a Cochrane review that concluded inspections as an enforcement tool have inconsistent effects on decreasing injuries in the short term, but appear to decrease injury rates in the long term (i.e., after more than three years of follow-up) (3); and a systematic review that found strong evidence that actual citations and penalties reduce injuries (4).

A recent evaluation of the practical implementation of the European Union's (EU) Occupational Safety and Health (OSH) Directives assessed the effectiveness of the EU's 24 OSH directives (referred to as the "OSH acquis") at improving the health and safety of workers (5). Based on available data[5], the core evaluation team concluded the following: there is limited evidence that the Chemical Agents Directive has markedly

[5] The report noted the lack of available data and the limitations of the data that were available (e.g., lack of quantitative data).

improved skin and respiratory outcomes; no firm conclusions about the efficacy of the Biological Agents Directive can be drawn; it is not possible to draw any clear inferences at this time about the impact of the Asbestos Directive on asbestos-related diseases (because of the long latency period between exposure and onset of disease); there are no quantitative data on the impact of the Carcinogens and Mutagens Directive on relevant work-related cancer outcomes (however, longitudinal data on exposure to carcinogens show a slight reduction, suggesting little or no effect of the Directive); there is no clear indication that the Noise Directive has resulted in lower exposures and in a decreased incidence of noise-induced hearing loss; and it is not possible to ascertain the impact of the vulnerable worker directives (i.e., the Young Worker Directive[6], the Temporary Agency Work Directive[7]). The evaluation also concluded that all of the evidence indicates that enforcement significantly influences compliance, particularly when inspectors have combined enforcement and advisory roles. Factoring in the limited data sources available, the evaluation concluded that, overall, the OSH acquis has not been effective at targeting occupational diseases, despite a generally high level of reported compliance.

C2.2 Disease-specific findings

For each of the diseases, the scoping review identified a number of published studies that evaluated the impact of legislation and/or regulatory interventions. However, relatively few of them met the "gold standard" of evaluative research (i.e., a randomized controlled trial).

C2.2.1 Noise-induced hearing loss

All but one of the studies examining the impact of legislation and regulation were focussed on exposure outcomes (i.e., noise levels). Findings were mixed and appeared to be dependent on context. For example, studies in multiple industries (including manufacturing) found that regulations were ineffective because of over-reliance on hearing protective devices (HPDs) vs. engineered noise control (6-8); and studies in foundries and mines found that measured noise levels routinely exceeded permissible levels, sometimes despite the presence of engineering controls (9-11). In contrast, another study (examined in a systematic review) found that stricter regulations showed a favourable effect on measured noise levels (12).

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[6] The Directive on Young Workers (94/33/EC) sets out minimum requirements for the protection of young people at work in the European Union and provides legal definitions of the following terms: child, adolescent, young person, light work, working time and rest period. More information can be found at: https://osha.europa.eu/en/legislation/directives/18.

[7] The Directive on Temporary Agency Work (2008/104/EC) sets out a general framework that applies to the working conditions of temporary workers in the European Union. Its aim is to guarantee a minimum level of effective protection to temporary workers and to contribute to the development of the temporary work sector as a flexible option for employers and workers. More information can be found at: https://osha.europa.eu/en/legislation/directives/directive-2008-104-ec-temporary-agency-work.

A comparison of noise legislation in 22 countries in the Americas, published in 2014, found notable differences between jurisdictions in the permissible exposure limit and the noise exchange rates (6). The authors noted that although most countries have adopted "mandatory" noise legislation, there was limited information available about the degree to which the noise standards and regulations are actually enforced. They conclude that millions of workers across the Americas are potentially at risk of losing their hearing because (a) regulations do not exist; (b) the regulations that do exist are not protective enough; (c) enforcement of the regulations is insufficient; and/or (d) a lack of information or will, or a combination of the two, on the part of employers, workers and governmental agencies.

C2.2.2 Contact dermatitis

Studies examining the impact of legislation and regulation on health outcomes (i.e., urticaria, dermatitis) found, for the most part, that these interventions had a positive impact. For example, studies in the UK demonstrated that after the implementation of regulations restricting exposure, cases of latex-related urticaria and dermatitis among health care workers decreased (13) and the incidence of dermatitis attributed to chromate exposure among chromate workers declined (14). Another study documented that France's 2005 ban on the use of cement with chromium VI was effective at reducing the incidence of occupational dermatitis and the number of workdays lost due to this disorder in the construction industry (15).

European directives on personal protective equipment (PPE) provide standards of manufacture and use of protective gloves to prevent contact dermatitis and information that must be provided about the allergenic components of gloves (16). Data generated by a contact allergy surveillance system in the EU indicate a decrease in chromium allergy prevalence among the building trades, suggesting that the chromate regulation has been successful (17). Conclusions regarding the effectiveness of the EU Nickel Directive are mixed. The contact allergy surveillance system identified heterogeneous trends in nickel allergy among the building trades (suggesting a partial failure of the nickel regulation) (17), while another study concluded that the regulation is starting to change the epidemiology of nickel allergy in the EU (18).

C2.2.3 Occupational cancer

Review articles found that legislation (i.e., bans) and regulations (i.e., lower occupational exposure limits combined with increased enforcement of compliance) reduced asbestos-related diseases (19) and decreased the risk of cancer from exposure to diesel exhaust (20). One primary research study found a reduction in mesothelioma risk in Swedish workers who started working after Sweden implemented a ban on exposure to asbestos in the mid 1970's (21). A Finnish study found that levels of respirable silica decreased after a new occupational exposure limit came into effect and after the signing of an international agreement/social contract creating the

European Network on Silica (NEPSI)[8] (22). No studies examining the impact of legislative or regulatory interventions were found for shiftwork.

C2.2.4 Occupational asthma

Positive outcomes (i.e., reduction in exposure levels, prevalence of symptoms and/or in the incidence rate of cases diagnosed) have been observed following the introduction of legislation or regulations to prevent exposure to allergens and asthmagens. Examples include: a decrease in the number of occupational asthma cases after the introduction of the *Control of Substances Hazardous to Health (COSHH)* regulations in the UK; a reduction in exposure levels, accompanied by reduced symptoms and the number of cases, following the introduction of regulations to control latex exposure in Germany, the EU, the UK, and the US. In the latter case, these interventions also resulted in glove manufacturing improvements (i.e., they were a driver of product innovation).

One study examined the impact of special preventive medical check-ups for employees exposed to experimental animal dust as required by law in Germany. The authors confirmed the necessity of regular medical check-ups, but noted that the check-ups must be part of a comprehensive prevention strategy involving education, engineering controls, administrative controls, PPE and vocational integration (23).

A recent review commented on the fact that very few standards have been set for workplace sensitizers and it specifically notes that the REACH[9] legislation exempts several groups of known occupational asthmagens from registration (e.g., enzymes in food and in animal feed and agents that have 'no owner (producer)' such as animal allergens) (24). This means, they argue, "that several major allergens with major public health impact are not covered by REACH, especially high-molecular weight (HMW) sensitizers, and that conventional standard setting under existing policies is crucial".

C3. EXPOSURE CONTROL MEASURES

C3.1 General strategies

Numerous studies have examined how effective the hierarchy of control (and in particular, specific elements of the hierarchy) is at preventing exposure and subsequent disease outcomes. It is outside the scope of this project to review and summarize this literature in detail. However, in the course of the literature searches, several useful resources were identified, including a searchable Engineering Controls Database created by the US National Institute for Occupational Safety and Health (25).

[8] Information on NEPSI can be found at: http://www.nepsi.eu/.
[9] REACH is the acronym for the EU's *Registration, Evaluation, Authorisation and Restriction of Chemicals* legislation.

C3.1.1 Control banding

In searching for exposure control approaches that could address the challenges faced by small employers, a number of articles were identified that either described systems of control banding or examined their effectiveness. Control banding is a qualitative assessment and performance-based exposure control technique developed by the pharmaceutical industry (26). It is primarily used to determine control measures when occupational exposure limits are not known (27). Chemicals are grouped according to similar physical or chemical characteristics, how the chemical will be handled or processed, and what the anticipated exposure is expected to be. The method then determines a set of controls chosen to help prevent harm to workers. Generally, there are three types of bands that represent: health hazard or risk (e.g., carcinogen), potential for exposure (e.g., quantity used), and recommended control measure (e.g., containment, ventilation, etc.) (27). A number of control banding systems exist in the EU and elsewhere (28-30). The most widely known are the UK's COSHH Essentials[10] (31) and the ILO's International Chemical Control Toolkit[11] (32).

The scoping review identified several studies that had been undertaken to determine the level of agreement between measured concentrations of hazardous substances and the exposure ranges predicted by the COSHH Essentials model. Examples include studies of exposure to: three volatile organic chemicals at a small printing plant (33); five chemical components in a mixture (acetone, ethylbenzene, methyl ethyl ketone, toluene, and xylenes) at a medium-sized plant producing paint materials (34); a range of liquids (e.g., volatile organic solvents) and solid substances (e.g., dusts, powders) in various German industries (e.g., printing, textiles, chemical, plastics, rubber) (35); nine volatile solvents in 12 chemical handling tasks in refineries, a petrochemical plant, oil terminals and the laboratory of a petrochemical company in Japan (36); and seven volatile solvents in vapor degreasing and nineteen chemical substances in bag filling operations (37). Despite inconsistent levels of agreement between the model and measured levels in the first three studies (i.e., good agreement was found for some tasks/processes and moderate or poor agreement for others), the authors concluded that the COSHH model worked reasonably well. In contrast, the fifth study (by Jones et al.) found a high prevalence of both "under-controlled" and "over-controlled" misclassification errors[12], leading the authors to conclude that their findings do not "support the view that COSHH Essentials will accurately identify operations in need of

[10]The Health and Safety Executive (HSE) developed COSHH Essentials following the implementation of the *Control of Substances Hazardous to Health (COSHH)* legislation. Information is available online at: http://www.hse.gov.uk/coshh/essentials/.

[11]The International Chemical Control Toolkit was designed to assist small and medium sized enterprises in developing countries prevent exposure to hazardous chemicals in the workplace. Information is available online at: http://www.ilo.org/legacy/english/protection/safework/ctrl_banding/toolkit/icct/.

[12]Under-controlled errors occurred when the airborne concentration exceeded the upper limit of the chemical's exposure band in the presence of control technology; and over-controlled errors occurred when the airborne concentration was within or below the chemical's exposure band in the absence of control technology (although conditions of use prompt COSHH Essentials to recommend controls).

control technologies, and that the control technologies will, in practice, adequately control exposures". In comparing their findings to the German study (by Tischer et al.), the authors acknowledge that the contradictory conclusions may be due to differences in available data or to systematic inter-jurisdictional differences in OHS performance. The Japanese study also found a high prevalence of "over-controlled" judgments (but no "under-controlled" ones) but concluded that control banding is feasible in Japan.

To determine whether control banding would be useful in the US, the National Institute for Occupational Safety and Health (NIOSH) reviewed and critically analyzed the literature on control banding (38). Factoring in available evidence about control banding (CB) strategies, NIOSH observed that they "...cannot provide appropriate solutions for the assessment and management of all occupational hazards. There are situations in which CB cannot provide the precision and accuracy necessary to protect worker health; alternatively, there are undoubtedly situations in which CB will provide a higher level of control than is necessary" [page 71]. Despite these limitations, NIOSH concluded that control banding is a potentially valuable tool for assessing and controlling exposure to some, but not all, occupational hazards[13]. Based on its potential utility and the fact that most chemical substances do not have established exposure limits, NIOSH recommended that additional research, development and validation be undertaken before control banding was widely implemented in US workplaces. To facilitate the implementation of control banding strategies in the US, the following recommendations were made: improve awareness about control banding among end users and develop user-specific dissemination strategies; standardize control banding concepts[14]; validate control banding methods[15]; expand the model to address additional hazards (e.g., complex or mixed exposures, dermal hazards, and physical hazards, like noise) and to incorporate economic analyses; and foster national[16] and international[17] collaborations.

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[13] At the time of NIOSH's review, most control banding strategies were limited to controlling inhalation hazards, although work was ongoing to expand the technique to other hazards (e.g., dermal hazards, airborne crystalline silica, asthmagens, and asbestos).

[14] Specific recommendations included harmonizing terminology and adopting the Globally Harmonized System of Classification and Labelling of Chemicals (GHS), which defines and classifies the hazards of chemical products and communicates OHS information on labels and safety data sheets. Canada has implemented the Workplace Hazardous Materials Information System (WHMIS 2015), a national chemical classification and hazard communication standard for workplace chemicals. While WHMIS 2015 incorporates the GHS for workplace chemicals, only the elements of GHS that have been explicitly adopted by Canadian legislation are enforceable. (Source: http://www.ccohs.ca/oshanswers/chemicals/ghs.html).

[15] Specific recommendations included: ensuring that the effectiveness of a given toolkit and its controls is evaluated, validating and comparing various implementation methods, validating each step of the control banding strategy independently (i.e., exposure prediction, hazard prediction, control recommendations, training, and control implementation), and assessing errors (with, for example, hazard classification, exposure assessment, and control recommendations) to determine the accuracy of the model.

[16] To develop, for example, task-based toolkits, as well as a participatory process that engages workers in control banding strategies.

[17] Specific recommendations included: coordinating the development and creation of an integrated system for both national and international databases; adopting the ITG implementation strategy to coordinate occupational risk management concepts with international collaborative efforts, to harmonize efforts and build capacity; and linking control banding strategies to an existing system of Occupational Safety and Health Management Systems for implementation.

The literature highlights the strengths and weaknesses of control banding. Its advantages include that it provides an easy to understand and easy to apply approach to controlling hazards in small- and medium- sized workplaces that have limited expertise in workplace health and safety, industrial hygiene, or chemical control (38-40); and that it allows for control recommendations to be made for products that do not have occupational exposure limits (27, 38). The limitations of control banding include that it has not been fully validated (38) and that there is not a universally adopted approach (i.e., hazard bands vary by jurisdiction (41) with each jurisdiction's method having its own limitations (27)). Detractors of control banding note that it (a) does not recommend control technology on the basis of quantitative data (i.e., it is occupational hygiene, without the numbers) (42); and (b) may recommend expensive control technology in situations where the actual exposure levels don't warrant it (i.e., the "over-controlled" misclassification scenario) or (c) may recommend insufficient protection, resulting in inadequate protection of worker health (38, 42, 43). A recently published commentary in the Annals of Occupational Health noted: "Control banding works in dire circumstances where any control measure will improve the situation. However, in the ‘grey bands’ where most European workers operate, simple guidance for control measures can be either insufficient (leading to unnecessary health risks for workers) or too extreme (resulting in skyhigh operational costs for employers). Furthermore, moving away from numbers creates the threat of ‘hygienists without numbers’ who will be ill-prepared to interpret an abundance of numbers from unsolicited measurements that workers and consumers eventually will collect themselves" (42).

C3.2 Disease-specific strategies

None of the studies identified were designed to evaluate how effective the entire hierarchy of controls was at preventing any of the four occupational diseases of interest. Rather, studies were designed to examine specific aspects of the hierarchy in relation to exposure outcomes, health outcomes, and/or behavioural outcomes at the individual level.

C3.2.1 Noise-induced hearing loss

Of the exposure control studies identified in the NIHL literature, most focussed on examining the impact of engineering controls on noise levels at the workplace. Studies in hospitals and the steel industry found that engineering controls reduced noise levels (44), while a study in the tire manufacturing industry found that engineering controls coupled with monthly inspections led to a reduction in noise power level (45). Only two articles about the effectiveness of personal protective equipment were reviewed. One study in the construction industry found that the use of a single form of hearing protection (i.e., earplugs or earmuffs) resulted in significantly more audiometric abnormalities than the combined use of earplugs and earmuffs (46). The other study, conducted in South America, found that if women perceived their workplace to be safe, they were more likely to use hearing protective devices (47).

C3.2.2 Contact dermatitis

Three exposure control studies and one systematic review were identified in the scoping review. Of the exposure control studies, one examined the impact of exposure elimination on health outcomes, one assessed the impact of personal protective equipment on health outcomes, and the other examined the relationship between improved glove use and exposure outcomes. In the first, a decrease in the number of suspected skin and respiratory diseases was observed in German healthcare workers after exposure to latex was eliminated (48). The second study found improvements in the skin status of German metal workers with skin care and skin protection (49). In the third study, improved glove use reduced exposure to paratoluenediamine in Belgium (50).

The systematic review examined the evidence for the use of personal protective equipment and personal hygiene measures. The reviewers concluded that there were some positive effects of barrier creams, moisturizers, after work creams, and complex educational interventions in the primary prevention of contact dermatitis (despite a lack of statistical significance in the studies published) and that there was a lack of evidence to support or refute the use of protective gloves to prevent contact dermatitis (51).

C3.2.3 Occupational cancer

No studies were identified in the asbestos literature that specifically examined the impact of the hierarchy of controls on disease, exposure or behavioural outcomes. All of the exposure control studies identified in the diesel exhaust literature focussed on evaluating the impact of engineering controls, like local exhaust ventilation, on levels of exposure. The majority of these studies were conducted in the mining industry and in underground mines in particular. Findings included: engineering controls (e.g., local exhaust ventilation) or controls at the source (e.g., engines fitted with particulate filters) decreased emissions and were effective at reducing exposure to sulphur dioxide, hydrogen sulphide and dusts (52-54); engineering controls combined with preventive maintenance and regular emission testing decreased exposure levels (55); and diesel exhaust emissions decreased with the use of modern engines (56), low emission engines (57) or retrofitted engines (58).

Exposure control studies identified in the silica literature examined the impact of elimination/substitution, engineering controls, and personal protective equipment. None of the studies retrieved for review evaluated the use of administrative controls to prevent silica exposure. The one study examining a silica substitute (i.e., a non-silica abrasive) found that it contained low levels of crystalline silica and as a consequence, its use could unexpectedly contribute to airborne silica levels (59). The use of engineering controls, either individually or in combination, was found to positively impact the levels of silica exposure in firing ranges (60), foundries (61), and a range of activities in the

construction industry (e.g., brick cutting, masonry cutting, mortar removal, concrete cutting and grinding)(62-69). Examples of engineering controls that were found to be effective at reducing silica exposure included: water controls (e.g., misting, wet suppression), vacuum cleaners, and local exhaust ventilation (LEV) in combination with other controls (e.g., a jig). Two studies in the construction industry reported that, although LEV reduces personal exposure levels, it provides incomplete dust control (70, 71). In a study of Swedish foundry workers, actual measured levels of silica exposure exceeded the occupational exposure limit, suggesting that the potential for over-exposure exists despite the use of personal protective equipment (such as respirators) (72).

A task-based silica risk assessment tool has been developed by researchers in British Columbia (one of whom is a member of our project team), in collaboration with the BC Construction Safety Alliance and the local regulator (WorkSafeBC). Although not yet evaluated for effectiveness, this tool, which combines quantitative methods with a control banding approach, appears to be a promising solution for assisting small enterprises in the selection of appropriate control measures and the development of exposure control plans (as required by regulation) (73).

The majority of the exposure control articles in the literature on shiftwork focussed on the impact of administrative controls on either exposure outcomes or short-term health outcomes. One study examined the impact of an engineering control on nurses working nightshifts. It found that controlled light exposure resulted in decreases in subjective distress associated with nightshift work (74). Other studies found that administrative controls had positive impacts on exposure and health outcomes. In the former, rotating shift schedules and increasing the number of teams reduced the number of shifts outside day work (i.e., reduced the exposure), but it produced more irregular schedules (75); in the latter, flexible working arrangements and three types of organizational interventions (i.e., switching from slow to fast rotation, changing from backward to forward rotation, and self-scheduling of shifts) improved health outcomes (76, 77).

C3.2.4 Occupational asthma

Engineering controls were found to reduce levels of exposure to flour dust in South African bakeries (78) as well as symptoms of bakers' asthma in both the UK (79) and South Africa (80). In the former, the greatest reduction in exposures was observed when five control measures (mixer lid, divider oils, gentle bag handling, low level bag handling and rubbing of surfaces) were implemented together. Similarly, studies have documented that changes to ventilation, equipment and work practices are effective in reducing exposure to glutaraldehyde in disinfecting (81). The authors of a study cited in the OSHA Best Practices publication (81) indicated that the changes that appeared to have the most impact on reducing mixing exposures were the addition of a waste pump and new filters in the ventilation hood. Studies conducted on farms in the US and

Finland found a reduction in asthma symptoms with the use of personal protective equipment (82).

C4. SURVEILLANCE OF HAZARDS AND/OR DISEASES

C4.1 General strategies

In the context of hazard and disease surveillance, "general" strategies were those that had been implemented at a national level. While a number of surveillance systems were identified in the literature, few had been evaluated for effectiveness. Examples of hazard surveillance systems included: the Canadian National Dose Registry (a radiation exposure registry); the Ontario Asbestos Workers Registry; the Finnish Information System on Occupational Exposure (FINJEM); the Finnish Register of Employees Exposed to Carcinogens (*aka* the ASA Register[18]); CAREX Canada; and the Thesaurus on Occupational Exposures created by ANSES, the French Agency for Food, Environmental and Occupational Health and Safety.

The scoping review identified studies evaluating the National Dose Registry (83), and the ASA Register (84). In both instances, the authors point to declining trends in disease over the time period for which data have been collected, concluding that the registries had contributed to protecting workers from exposure. Similarly, a review article examining the impact of FINJEM concluded that the registry was useful for monitoring trends in exposure over time and for predicting potential exposures in the future; for generating national level estimates of exposure (e.g., prevalence of exposure and over-exposure, as well as average levels) that can be used to compare with existing exposure limits and to inform prevention policy and practice at the jurisdictional level; for assessing occupational exposure for epidemiological studies; and for assessing health risks and the burden of disease (85). FINJEM has also been used as the model for the creation of similar systems in the EU (e.g., the Nordic countries, Spain, France) and New Zealand.

A recent survey identified 33 occupational disease surveillance systems in 20 countries across the EU (86). Some are compensation-based (e.g., the Belgium Compensation Fund for Occupational Diseases (FBZ), the German Statutory Accident Insurance (DGUV)), while others are based on physician reports or household surveys (e.g., the Health and Occupation Research (THOR) Network in the UK and the Republic of Ireland; the MALPROF[19] system in Italy, various disease-specific registries (e.g., the French National Program for Mesothelioma Surveillance) and a network of registries (le Réseau National de Vigilance et de Prévention des Pathologies Professionnelles

[18]This is the Finnish abbreviation.
[19]'MALattie PROFessionali' (or, 'occupational diseases' in English).

(RNV3P)) in France). Many of these systems are also members of MODERNET[20], a collaboration founded in 2008 between academic centres investigating occupational disease and work-related ill-health incidence in the United Kingdom, Netherlands, France, Italy, Finland and the Czech Republic. It has now grown to include 12 more European countries and 1 institute from Australia.

Several of the systems, including MODERNET, have been evaluated (86-93). The findings of a study examining trends in the EU between 2000 and 2012 included: an overall decline in the incidence of shorter latency diseases (e.g., contact dermatitis, occupational asthma) across the EU; and inter-jurisdictional variability in the incidence of noise-induced hearing loss (e.g., the incidence was increasing in Belgium, Spain, Switzerland and the Netherlands and decreasing elsewhere) (89). A study assessing the prevalence of uncompensated work-related diseases in France observed differences over time by gender, age and disease (88); while another examining the MALPROF system in Italy determined that over the period 1999 to 2012, noise-induced hearing loss was the most frequently reported disease (n=4378, accounting for 32% of the reported diseases) (93). All of these studies concluded that the surveillance systems had been useful at identifying the incidence of known occupational diseases (and in some cases, at illuminating emergent diseases (87)), at stimulating occupational health research, and at informing the development of preventive measures (including the setting of priorities and targets). Surveillance data were also used in another study to illustrate the positive impact of legislation on chromate allergy in the UK (14).

Linked administrative databases[21] are promising approaches for occupational disease surveillance among vulnerable workers. Linked databases are considered to be invaluable because they give insights into what is happening in the entire population, they facilitate interdisciplinary and policy-relevant research on the social determinants of health, and they are far more cost-effective than traditional methods of data collection. There are many linked (or linkable) datasets in Canada and elsewhere and occupational health researchers have used record linkage on an *ad hoc* (i.e., project-specific) basis to explore questions of causality, to evaluate the impact of interventions, and to target prevention activities. Examples include: research conducted in the United States linking state-level workers' compensation data with data from the US Bureau of Labor Statistics (94, 95) and research conducted in Canada by the UBC Partnership for Work, Health and Safety and the Institute for Work and Health. Population Data (PopData) BC is the only Canadian linked dataset that includes workers' compensation and firm-level data, in addition to multiple other data sources (e.g., hospitalizations, emergency room visits, prescription usage, education, etc.). This has enabled a number of research studies to

[20]MODERNET is the acronym for Monitoring trends in Occupational Diseases and tracing new and Emerging Risks in a NETwork.

[21]Linked health databases are centralized repositories of population-based, longitudinal administrative records from multiple sources that enable linkage of data across sectors (such as health, education, workplace and the environment).

be undertaken examining occupational health in a broader social context and has fostered the development of a unique research partnership on work and health at the University of British Columbia (the Partnership for Work, Health and Safety).

C4.2 Disease-specific strategies

Relatively few articles evaluating the effectiveness of disease-specific surveillance systems were identified. The ones focussing on hazard surveillance were predominantly found in the literature on noise-induced hearing loss, while the majority of the articles focussing on disease surveillance were found in the literature on noise-induced hearing loss and contact dermatitis.

C4.2.1 Noise-induced hearing loss

Across a range of industries, monitoring of noise levels was found to positively affect exposure, health and behavioural outcomes. For example, reductions in noise levels and noise-induced hearing loss were observed in a variety of industries, including manufacturing (96) and aluminum smelting (97), with daily or continuous monitoring of exposure. Another study found that noise audits and reports were effective at changing behaviour (e.g., increased awareness and noise management) in farmers in Australia (98). Screening for noise-induced hearing loss (through audiometric testing) was found to have a positive impact on behavioural outcomes in musicians (99). Specifically, their use of hearing protective devices increased after NIHL was detected. Another study detected an increased prevalence of NIHL in farmers through audiometric testing (100). Three studies identified exposure surveillance strategies for identifying ototoxic exposures at work that contribute to NIHL (101-103).

C4.2.2 Contact dermatitis

No studies were identified that examined the effectiveness of hazard surveillance/exposure monitoring in preventing contact dermatitis. Two articles were identified that examined the effectiveness of disease surveillance systems and symptoms screening tools. Their findings/conclusions were mixed. A review article developing evidence-based guidelines for the prevention, identification and management of occupational contact dermatitis and urticaria concluded that there was no direct evidence (a) that health surveillance is effective in the early detection of occupational contact dermatitis or occupational contact urticaria or (b) of the comparative effectiveness of different screening methods (104). In contrast, a study of German metal workers found that a tool to screen for work-related eczema was effective, increasing awareness and the use of protective measures (105).

C4.2.3 Occupational cancer

No articles were identified in the silica or shiftwork literature on whether hazard or disease surveillance systems were effective at preventing cancer outcomes. One article

was found in the diesel exhaust literature that discussed a hazard surveillance system (the Diesel Emission Evaluation Program (DEEP[22])) (106) and one article was found in the asbestos literature about a mesothelioma registry in Italy (107). The diesel exhaust article highlighted an organizational level example of a Montana mine that effectively controlled diesel exhaust exposure by emissions testing and engine maintenance testing every 28 days. The Italian study described the creation of a mesothelioma registry, documenting its usefulness for identifying cases and informing prevention efforts through the development of exposure histories.

The only other article that addressed the topic of surveillance was found in the asbestos literature. Although not an evaluative study, it was included because it provided information on a strategy that was shown to be effective at influencing policy makers to adopt legislation creating an asbestos exposure registry in Saskatchewan. The "Empathy in Advocacy" campaign created a public awareness campaign based on an individual's personal cancer experience (108). By integrating it with a comprehensive strategy to mobilize research/policy/knowledge into action and a collaborative process of stakeholder engagement, the issue was kept in the public domain.

C4.2.4 Occupational asthma

Very few, and no concurrent, comparison studies have been reported of the efficacy of periodic health surveillance for occupational asthma. This type of surveillance aims to identify sensitised workers or cases of asthma at early and reversible stages of disease. A recent evidence review by the British Occupational Health Research Foundation concluded that pre-placement examinations should be used to establish a baseline for periodic health surveillance rather than to detect and exclude susceptible individuals from high-risk workplaces (109). A study by Brant et al. (which was considered in that evidence review) compared a standard cross-sectional survey with routine surveillance. Its findings suggest that health surveillance can underestimate the frequency of occupational asthma. A UK multi-centre hospital study revealed a mean delay of approximately four years between the onset of symptoms and a confirmed diagnosis (110). This contrasts with a mean of nine months in those whose symptoms were detected by health surveillance and who attended for subsequent investigations (111). Kopferschmitt-Kubler et al. describe a wide range of active asthma health surveillance programs in England, France, Italy, Finland, Germany, and the US, based on specialist physician reporting (112). Some programs focus on measuring incidence; others are associated with medical follow-up of identified cases; still others link case identification with follow-up preventive interventions in the workplace (112).

In a Canadian study, regular health surveillance of isocyanate-exposed workers was linked to a mandatory workplace exposure control program (113). Cases of isocyanate-

[22]A consortium between government, industry, labour, research, and the manufacturing sectors in mining, DEEP is focused on controlling diesel exhaust emissions in underground mines.

induced asthma were diagnosed sooner after the onset of symptoms, had better lung function and a better outcome than asthma attributed to other workplace agents not subject to the control program. It is difficult to dissociate the effects of health surveillance from the effects of other risk management procedures and the authors acknowledged that the improved outcomes in the isocyanate workers might, at least in part, be attributable to the concomitant reduction in exposure.

A 2016 study found that health surveillance for occupational asthma can allow early case identification and remediation of the causative exposure (114). In that study, health surveillance was more common in larger enterprises; health surveillance had been carried out in 19% of workplaces that had reported exposures to occupational asthmagens; and there appeared to be significant variation in how the requirement for health surveillance was decided, how it was subsequently developed and carried out, and in communication between workplaces and their occupational health service providers.

Several additional articles were identified that examined asthma surveillance systems in the context of more comprehensive prevention programs. They are described below in the section on multi-faceted primary prevention approaches.

C5. EDUCATION AND TRAINING

C5.1 General strategies

A recent systematic review published in the Cochrane Database of Systematic Reviews assessed whether behavioural interventions (directed either at organizations or at individual workers) had an impact on workers' observed or self-reported use of respiratory protective equipment (RPE) (115). Based on a review of 14 studies meeting their inclusion criteria, the authors concluded: "there is very low quality evidence that behavioural interventions, namely education and training, do not have a considerable effect on the frequency or correctness of RPE use in workers". Acknowledging that the included studies had methodological limitations and that there were no studies on incentives or organisational-level interventions, the authors identify a need for further research (specifically, large randomized controlled trials with clearer methodology) and note that further studies should "consider some of the barriers to the successful use of RPE, such as experience of health risk, types of RPE and the employer's attitude to RPE use".

The scoping review also identified another systematic review that was published in 2010 by the Institute for Work and Health (116). In that review, 16 researchers examined the findings of 20 unique randomized controlled trial studies to determine whether OHS training has a beneficial effect on workers and firms and whether higher (vs. lower) engagement has a greater beneficial effect on workers and firms. The reviewers also

considered the methodological quality of the available research literature. The reviewers drew the following conclusions: there is strong evidence supporting the effectiveness of OHS training on targeted OHS behaviours of workers, but insufficient evidence on the effectiveness of OHS training on: (a) knowledge and attitudes and beliefs (because there are too few studies of sufficient quality), and (b) injuries or symptoms (because the effects are inconsistent and small). There is also insufficient evidence that high (vs. medium/low) engagement training is more effective on targeted behaviours (either because there are too few studies of sufficient quality or because the observed effects are very small). The reviewers concluded that there is a lack of high quality randomized trial research examining the question of OHS training effectiveness. This lack of useable evidence impeded their ability to draw conclusions in some areas.

C5.2 Disease-specific strategies

C5.2.1 Noise-induced hearing loss

Studies in the NIHL literature documenting the impact of education and training on behavioural outcomes had consistent findings: education and training interventions were effective at increasing awareness about NIHL as well as the use of (or the intent to use) hearing protective devices (HPD). For example, studies in agriculture and construction indicated that, following education and training, the intention to wear HPD doubled and the percentage of time that workers wore HPD nearly doubled (117-120) (although in one study of construction workers, the intervention had no effect on intent to wear in the future (121)).

One key finding of the NIHL scoping review was that the effectiveness of educational interventions appears to depend on the context in which it is delivered. For example, studies evaluating uptake in construction or among carpenters found that generic programs do not work (122, 123). Tailored, multi-media, computer-based programs were found to be more effective than basic programs at changing behaviour in a variety of industries and occupations, including the military, firefighters, and factory workers (124-127). These studies found that (a) computer-based training was no more effective than video training and (b) while tailored interventions increase the use of HPD in the short-term, there is no difference (between intervention group and controls) in use after one year.

C5.2.2 Contact dermatitis

Educational interventions delivered to workers in a variety of workplaces in the United States and the European Union were effective at improving measures of skin condition, reducing the frequency or incidence of skin diseases, and in changing behaviour (i.e., increasing knowledge and the use of personal protective equipment, decreasing the use of hand disinfectants). The majority of these interventions (7 of 11) were based on the Danish 'Skin Protection Programme'.

Studies in Denmark (hospital cleaners (128, 129), wet workers (130), hairdressers (131, 132)), in the US (hospital workers (133)) and in Germany (high school students (134)) found that educational interventions increased knowledge about skin hazards and improved work habits. Examples of improved work habits identified in the literature include: increased use of protective measures among German nurses and baker apprentices (135, 136); decreased use of hand disinfectants by nurses in Germany (137) and Denmark (138); and decreased use of latex gloves by Australian food handlers (139).

Studies also demonstrated that educational interventions resulted in improved health outcomes. Examples include: improvements in multiple skin condition measurements in US manufacturing workers (140); reduced skin disease frequency or symptoms in Germany (nurse trainees (141), hairdressers (142)) and in Denmark (wet workers, swine slaughterhouse workers (143), and hairdressers (131, 132)); and decreased incidence of new cases of occupational dermatoses in UK chemical workers (144).

A systematic review concluded that there is evidence that employee education and training programs help to reduce the incidence of occupational contact dermatitis and that educational interventions induce important behavioural changes in latex glove use among healthcare workers (145).

C5.2.3 Occupational cancer

The literature on whether educational interventions are effective at preventing cancers associated with the four carcinogens of interest is sparse. This is not surprising given the long latency between exposure and outcome. No articles were identified in the diesel exhaust literature. The few studies identified in the asbestos and silica literature focussed on evaluating knowledge uptake, while those identified in the shiftwork literature measured the impact of the interventions on self-reported short-term health outcomes (like sleep disturbances) (146-148). A study of building managers in Ireland found increased levels of awareness among "Asbestos Safety Awareness" trained managers about their legal obligations towards workers potentially exposed to asbestos (149). Similarly, educational interventions in construction in the Netherlands and elsewhere were found to increase levels of awareness, as well as trust and readiness to adopt a ventilation tool (150).

C5.2.4 Occupational asthma

No articles were identified that specifically evaluated the effectiveness of educational campaigns aimed at preventing occupational asthma. However, several were identified that examined education in the context of more comprehensive prevention programs. They are described below in the section on multi-faceted approaches to primary prevention. Three educational interventions were identified that were specific to the Canadian context. The first concluded that educational interventions related to OHS knowledge and practices to prevent exposure on farms are feasible (151). The second,

published in 2013, described the development of a web-based tool designed to educate adult asthma patients about the possible work-relatedness of their disease (152); the third, published in 2016, evaluated that tool and concluded that the educational tool's effect was positive (on knowledge about work-related asthma and on the apparent long-term retention of that knowledge (153).

C6. MULTI-FACETED APPROACHES TO PRIMARY PREVENTION

C6.1 General strategies

Few studies have been undertaken to evaluate the effectiveness of multi-faceted approaches to preventing "occupational disease". Most of the literature identified in the scoping review identified multi-faceted approaches to dealing with specific diseases. Examples of multi-faceted prevention models that are more general in scope include the Finnish Institute for Occupational Health, the Québec occupational health model, and the NIOSH Total Worker Health model. By recognizing that work is a social determinant of overall health, all of these models place occupational health in the broader social and public health context.

C6.1.1 The Finnish Institute of Occupational Health

The Finnish Institute of Occupational Health (FIOH) is a national organization, which specializes in wellbeing at work, research, advisory services and training[23]. As illustrated by a number of articles identified in the scoping review, the FIOH has created and implemented several national level surveillance systems that have been effective in tracking the prevalence of exposure and disease, in identifying workplaces that could benefit from targeted prevention activity, in raising awareness about occupational hazards and occupational disease, and in reducing exposures and disease outcomes. Although Canada is a federation of provinces, a national model, like the FIOH, can be adapted to the Canadian context. For example, CAREX Canada[24], a national surveillance project that estimates the number of Canadians exposed to substances associated with cancer in workplace and community environments, evolved out of and improved upon the Finnish carcinogen surveillance model.

C6.1.2 The Québec Public Health Network in Occupational Health

Québec's approach to occupational health is unique within Canada. Unlike the other provinces, which tend to separate occupational and public health, Québec has integrated occupational health services into the broader public health framework. Three pieces of legislation govern the delivery of OHS and occupational disease prevention

[23]Information on the FIOH's programs can be found at: https://www.ttl.fi/en/.
[24]Information on CAREX Canada can be found at: http://www.carexcanada.ca/en/.

services in the province. The *Public Health Act*[25] and the *Health Services and Social Services Act*[26] fall under the governing authority of the Ministry of Health and Social Services (Ministère de la santé et des services sociaux, MSSS). The *Occupational Health and Safety Act*[27], adopted in 1979, falls under the jurisdiction of the Ministry of Labour (Ministère du Travail) and is regulated by the Commission for Labour Standards, Pay Equity and Occupational Health and Safety (Commission des normes, de l'équité, de la santé et de la sécurité du travail, CNESST). The *OHS Act* mandates doctors in the public health system to carry out occupational disease prevention.

The CNESST is the regulatory body that oversees OHS prevention and workers' compensation in the province. It delegates responsibility for implementing occupational disease prevention services in each region of the province to the Public Health Network in Occupational Health (the Réseau de santé publique en santé au travail, RSPSAT[28]) through a contract with the MSSS. (154)

In each region, local teams of occupational health physicians, nurses and hygienists or hygiene technicians and sometimes ergonomists visit workplaces in high priority sectors to identify risks to health and negotiate prevention strategies with the employer and/or occupational health and safety committee. They carry out risk identification and assessment, information and training sessions on work-related risks, their consequences and the control measures to protect against worker exposure, occupational disease screening activities and worker health surveillance as well as first aid and emergency response support activities. They are supported by regional occupational health professionals, a provincial OHS coordinating committee (TCNSAT)[29], provincial discipline-specific coordinating committees and the Occupational Health Unit of the Québec Institute of Public Health (Institut national de santé publique du Québec,[30] INSPQ) who provide back-up expertise, develop prevention protocols, analyze and disseminate surveillance information and/or provide training to the RSPSAT professionals. Collectively these local, regional and provincial resources make up the Québec Public Health Network in Occupational Health (RSPSAT). Although each organization has its own legislated mandate, they share the

[25] *chapter S-2.2, Public Health Act* can be found at: http://legisQuébec.gouv.qc.ca/en/showdoc/cs/S-2.2.
[26] *chapter S-4.2, Act Respecting Health and Social Services* can be found at: http://legisQuébec.gouv.qc.ca/en/showdoc/cs/S-4.2
[27] *chapter S-2.1, Act Respecting Occupational Health and Safety* can be found at: http://legisQuébec.gouv.qc.ca/en/ShowDoc/cs/S-2.1.
[28] The RSPSAT activities include health assessment and monitoring, health promotion, surveillance and research, as well as the development and maintenance of core occupational health competencies among its professionals.
[29] A tripartite committee, the TCNSAT develops and tables opinions and positions on issues related to occupational health in Québec and works strategically to promote more coherence across the province in occupational health actions and to harmonize practices.
[30] The INSPQ is Québec's public health expertise and reference centre.

common goal of reducing risks[31] and preventing occupational disorders among workers across a range of industry sectors[32] in Québec. (154)

C6.1.3 The NIOSH Total Worker Health Model

The NIOSH Total Worker Health approach to prevention is built on the recognition that work is a social determinant of health[33]. It prioritizes a hazard-free work environment for all workers and is designed to integrate organizational-level interventions that protect workers' safety and health with activities that advance and enhance their overall wellbeing. The model adapts and expands the traditional hierarchy of controls (HOC) to include controls and prevention strategies that advance worker health and wellbeing more broadly. In the Total Worker Health approach, the five levels of the HOC become (in decreasing order of effectiveness):

1. *Eliminate* working conditions that threaten health, safety and wellbeing (includes organizational factors related to supervision, etc.).
2. *Substitute* safer, health-enhancing policies for unsafe, unhealthy working conditions or practices (in order to improve the culture of health and safety in the workplace)
3. *Redesign* the work environment, where necessary, for safety, health and wellbeing (e.g., enhance employer-sponsored benefits, provide flexible work schedules).
4. *Educate* for safety and health (i.e., provide safety and health education and resources to enhance individual knowledge for all workers)
5. *Encourage* personal change for improvements to health, safety and well-being (i.e., assist workers with individual risks and challenges and provide support for healthier choice-making).

This hierarchy is meant to supplement the traditional HOC, not replace it.

NIOSH has funded four Centres of Excellence for Total Worker Health. Research measuring the effectiveness of the Total Worker Health model is still emerging. Guidelines for implementing integrated programs are available on the NIOSH website, along with a comprehensive range of resources and a database of best or promising practices in small, medium and large businesses.

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[31] Risk factors include occupational exposure to chemical, physical, biological, ergonomic, organizational, psychosocial, and accidental hazards.

[32] The RSPSAT's interventions are in those workplaces targeted by the CNESST and typically include priority groups identified by legislation and in management agreements.

[33] Detailed information on the Total Worker Health model, as well as a range of resources, is available on NIOSH's website at: https://www.cdc.gov/NIOSH/twh/.

C6.2 Disease-specific strategies

These types of interventions represented the majority of the studies identified for the four carcinogens and a small proportion of the NIHL interventions.

C6.2.1 Noise-induced hearing loss

The majority of the NIHL studies retrieved for review were about hearing conservation/hearing loss prevention programs. The evidence is mixed on how effective hearing conservation/hearing loss prevention programs are at preventing NIHL. This is illustrated by the results of a systematic review examining the effectiveness of hearing loss prevention programs (HLPPs) (12). The reviewers considered whether there was evidence that:

a) interventions (e.g., engineering controls, legislation) had an impact on noise levels
b) the use of personal protective devices (e.g., earmuffs vs. earplugs) reduced the incidence of NIHL
c) the implementation of HLPPs had an impact on NIHL[34] or on noise levels[35]
d) being in a HLPP or use of hearing protection (*vs*. non-exposed workers) had an impact on NIHL.

Of the 19 studies examined in the systematic review, three reported no impact of HLPPs on NIHL, four reported that the risk of NIHL decreased with better use of hearing protective devices, four reported that workers in the program had 0.5 dB greater hearing loss at 4 kHz than non-exposed workers, and two concluded that a substantial risk of NIHL exists despite HLPP (12). The scoping review also identified one primary research study that showed that hearing conservation programs decreased the risk of NIHL in musicians (155), while another reported no evidence of a reduction in agriculture (156).

The research shows that multi-faceted programs have a positive impact on behavioural outcomes (e.g., the use of hearing protection). HCPs have been shown to increase the use of hearing protection in agriculture (119, 120, 157) and construction (117) but had no effect on the intention of construction workers to use hearing protection in the future (121). Similarly, multimedia interventions have led to increased use of hearing protection in manufacturing (124). The scoping review also identified two promising interventions that were undertaken with apprentice carpenters and with construction workers. In the former, apprentice carpenters showed improved attitudes, beliefs and behaviour regarding the use of hearing protection following an intervention that

[34]Specific comparisons included: HLPPs *vs*. audiometric testing only, HLPPs with daily noise exposure monitoring *vs*. audiometric testing only.
[35]Specific comparisons included: hearing loss prevention training with noise level indicators *vs*. training only, programs with extensive information *vs*. information only, well-implemented *vs*. less well-implemented programs (long-term *vs.* very long-term follow-up),

combined training and audiometry with a survey (122, 123). Similarly, the use of hearing protective devices increased among construction workers following an intervention that combined training and real-time information about measured noise levels with reminders to wear hearing protection (118).

C6.2.2 Contact dermatitis

Studies evaluating multi-faceted approaches to preventing contact dermatitis consistently found that multiple combined interventions had a positive impact on health outcomes (i.e., decreased symptoms and/or prevalence of disease) and behavioural change. Generally, these multi-faceted interventions combined education and training with another prevention activity. Examples include: a decreased prevalence of dermatitis in German food processing trades apprentices with training and UVB hardening (136); a reduction in symptoms and severity in UK print workers with screening and training (158); a decrease in symptoms in Danish dairies with a top down (i.e., the implementation of a skin risks occupational health and safety management system) and bottom up (i.e., local project group) approach combined with gloves and an educational campaign (159); and improved awareness, knowledge, work habits and symptom self-reports in Dutch hospital workers with a program that combined education, participatory working groups and role model training (i.e., "Dermacoaches") (160, 161).

C6.2.3 Occupational cancer

Examples of promising multi-faceted primary prevention activities were identified in the literature on all four carcinogens of interest. Of the two references identified in the asbestos literature, one was a systematic review, which concluded that the combination of a government ban, the elimination of asbestos, and the control of exposure resulted in a decreased incidence of lung cancer and mesothelioma (19). The other article concluded that the Finnish Institute of Occupational Health's (FIOH) Asbestos Program had reduced exposure but that its impact on disease incidence was not yet measurable (162). A cooperative effort that began in the late 1980's, the FIOH's program incorporated the following components: regulation and enforcement of asbestos abatement companies, a ban on the import of asbestos and health monitoring.

Reductions in exposure to diesel exhaust were observed for programs combining (a) inspections and preventative maintenance (163) and (b) scrappage and implemented early emissions standards (164). A review article concluded that the risk of cancer decreased with the combination of regulatory change, exposure control and training.

Two studies in the silica literature, both in the mining industry, examined the impact of multi-faceted approaches on exposure outcomes (70, 165). Reductions in miners' exposure were observed with approaches combining risk communication and video assessment or dust assessment technology. The latter study also found that the combined intervention led to behaviour change.

Most of the interventions identified in the shiftwork literature were multi-faceted and focussed on assessing the impact of the interventions on short-term health outcomes. Improved health outcomes were observed in various occupations/industries with interventions combining (a) napping, nutrition, and flexible shifts (166-168); (b) training and self-scheduled shifts (76, 147, 148); (c) fewer consecutive night shifts, bright light during night shifts, sleeping in a dark room, use of melatonin, and on-duty naps (168-170). One study reported negative outcomes (e.g., poorer mental health, work-related performance and safety outcomes) in police officers with the use of sleep and wake-promoting drugs (171). A review article concluded that approaches using a combination of interventions (such as changes to shift scheduling, controlled light exposure, healthy diet and physical activity, and sleep aids like melatonin) had positive effects on chronic disease outcomes (172).

C6.2.4 Occupational asthma

Several examples of promising multi-faceted approaches to preventing occupational asthma were identified. A prevention program in Ontario that combined information for employers and workers with exposure standards and systematic monitoring of workers resulted in a reduction in accepted OA compensation claims due to isocyanate exposure from 1990 onwards (173). The authors concluded that primary prevention alone aimed at reducing exposure to sensitizing agents might not be entirely effective, noting that there is also a need for education and medical surveillance of exposed workers. Multi-faceted interventions in bakeries in the Netherlands (that combined education, engineering controls and medical surveillance) reported total benefits resulting from a reduced disease burden valued at 44,659,352€ (174).

Both Switzerland and Québec have developed a multi-component strategy to occupational asthma prevention. The Swiss "STOP" strategy proposes medical surveillance, as well as follow-up and advice by occupational medicine physicians. Its principles for prevention are based on: Substitution (of sensitizers); Technology (improved ventilation at the source, closed systems, etc.); Organization (information and training of workers); Protection (PPE, such as masks) (175). The French-language searches identified two publications that describe a multi-faceted approach developed for the Québec Public Health Network in Occupational Health. The Québec approach includes identification of workplaces with sensitizers and irritants that can cause occupational asthma or rhinitis, education of workplace actors, case finding of symptomatic cases by questionnaire, a referral and evaluation process for symptomatic workers, support with compensation cases if needed, and elimination and control of exposures that can cause occupational asthma through preventive measures in the workplace (176).

A recent UK study in the motor vehicle repair (MVR) industry reported positive outcomes with the use of a combination of pre- and post-safety health and awareness days (SHADS), questionnaires and biological monitoring (177). The success of the

program was attributed to the use of a staged approach, supported by a research phase as well as targeted support for behavioural change. Another study in Switzerland reported that reductions in isocyanate exposure levels, along with the use of respiratory prevention equipment and health surveillance over a 5-year period, resulted in only 4 individuals out of 5000 being diagnosed with occupational asthma in a large company (178).

Laboratory animal allergy (LAA) and OA incidence have been reduced by addressing routes of exposure, developing and implementing appropriate policies and practices, and education. Fisher et al., for example, reported that the implementation of a comprehensive LAA prevention program (that combined education, engineering controls, administrative controls, use of PPE, and medical surveillance) reduced the prevalence of LAA from 12-22% to 0 during the last 2 years of observations (179). A 2003 review article concluded that the incidence of LAA, which can reach 30% among exposed workers, can be reduced by effective, integrated health risk management, with the conscientious use of engineering, procedural and personal control measures (180).

Perhaps the most success in preventing OA has been reported by studies undertaken in the health care sector. In that sector, a much lower incidence of occupational asthma has been achieved by replacing natural rubber latex (NRL) gloves with powder free latex gloves and latex-free alternatives, in combination with education and health surveillance. The management of NRL and substantial reduction in the risk of OA in the health sector can be regarded as a model for the reduction of other types of OA such as baker’s asthma and OA caused by isocyanate exposure, although it is not possible to substitute for flour in bakeries.

Appendix D: Articles retrieved for review

D1. INTRODUCTION

This appendix provides bibliographies for each of the occupational diseases studied in this project. Articles are listed alphabetically and include only those that were retrieved and reviewed.

D2. NOISE-INDUCED HEARING LOSS BIBLIOGRAPHY

Abel SM. Barriers to hearing conservation programs in combat arms occupations. Aviat Space Environ Med. 2008;79:591-8.

Ahmed HO, Dennis JH, Balla SG. The accuracy of self-reported high noise exposure level and hearing loss in a working population in Eastern Saudi Arabia. Int J Hyg Environ Health. 2004;207:227-34.

Aliabadi M, Farhadian M, Darvishi E. Prediction of hearing loss among the noise-exposed workers in a steel factory using artificial intelligence approach. Int Arch Occup Environ Health. 2015;88:779-87.

Arenas JP, Suter AH. Comparison of occupational noise legislation in the Americas. An overview and analysis. Noise and Health 2014;16(72):306-19.

Attias J, Karawani H, Shemesh R, Nageris B. Predicting hearing thresholds in occupational noise-induced hearing loss by auditory steady state responses. Ear & Hearing. 2014;35:330-8.

Basner M, Babisch W, Davis A, Brink M, Clark C, Janssen S, et al. Auditory and non-auditory effects of noise on health. The Lancet. April 12, 2014;Vol 383 1325–32.

Beckett W, Chamberlain D, Hallman E, May J, Hwang S-A, Gomez M, et al. Hearing Conservation for Farmers: Source Apportionment of Occupational and Environmental Factors Contributing to Hearing Loss. Journal of Occupational and Environmental Medicine. 2000;42(8):806-13.

Beckett WS, Chamberlain D, Hallman E, May J, Hwang S-A, Gomez M, et al. Hearing Conservation for Farmers: Source Apportionment of Occupational and Environmental Factors Contributing to Hearing Loss. Journal of Occupational and Environmental Medicine. 2000;42(8):806-13.

Berg R, Pickett W, Fitz-Randolph M, Broste S, Knobloch M, Wood D, et al. Hearing conservation program for agricultural students: short-term outcomes from a cluster-randomized trial with planned long-term follow-up. Preventive Medicine. 2009;49:546–52.

Bielefeld EC, Kopke RD, Jackson RL, Coleman JKM, Liu J, Henderson D. Noise protection with N-acetyl-l-cysteine (NAC) using a variety of noise exposures, NAC doses, and routes of administration. Acta Oto-Laryngologica. 2007;127:914_-9.

Bohnker BK, Page JC, Rovig GW, Betts LS, Sack DM. Navy hearing conservation program 1995-1999 retrospective analysis of threshold shifts for age, sex, and officer/enlisted status. Military Medicine. January 2004;169:73-6.

Bruit et vibrations: impacts et stratégies de prévention. Proceedings of a conference on protection against noise and vibration at the place of work; (Tunis, Tunisia, 23-25 May 2006).

Brumby S, Hogan A, Williams W, Mercer-Gran C, Calvano A. Careful—They Can't Hear You: Intervention of Vulnerable Populations Working in Agriculture. Journal of Agromedicine. 2014;19(2):204-5.

Campo P, Venet T, Thomas A, Cour C, Brochard C, Cosnier F. Neuropharmacological and cochleotoxic effects of styrene. Consequences on noise exposures. Neurotoxicology and Teratology. 2014;44:113-20.

Cason EM. Air Force Hearing Conservation Program data 1998-2008: A Cross-Sectional Analysis of Positive Threshold Shifts. Military Medicine. 2012;177(5):589-93.

Chalupka S. Preventing Noise-Induced Hearing Loss in Firefighters. Workplace Health Saf. 2013;61(9):420.

Cockrell Jr. W, Balanay J, Dawkins W. Engineering Control of Noise From 4-Roll Calender Operations in Tire Manufacturing. Journal of Occupational and Environmental Hygiene. 2015;12(9):D193-D200.

Cook-Cunningham S. Personal noise dosimeters: accuracy and reliability in varied settings. Noise and Health. May-June 2014;16(70):143.

Daniell W, Swan S, McDaniel M, Camp J, Cohen M, Stebbins J. Noise exposure and hearing loss prevention programmes after 20 years of regulations in the United States. Occup Environ Med. 2006;63:343–51.

Daniell W, Swan S, McDaniel M, Stebbins J, Seixas N, Morgan M. Noise Exposure and Hearing Conservation Practices in an Industry With High Incidence of Workers' Compensation Claims for Hearing Loss. American Journal Of Industrial Medicine. 2002;42:309-17.

Davies HW, Louie A, Nahid M, Shoveller J. Potential barriers to engineered noise control in food and beverage manufacturing in British Columbia, Canada: A qualitative study. International Journal of Audiology. 2012;51(sup 1):S43-S50.

Davies HW, Marion S, Teschke K. The impact of hearing conservation programs on incidence of noise-induced hearing loss in Canadian workers. American Journal Of Industrial Medicine. 2008;51:923–31.

Dobie RA, Wojcik NC. Age correction in monitoring audiometry: method to update OSHA age-correction tables to include older workers. BMJ Open. 2015;5:e007561.

Doosti A, Lotfi Y, Moossavi A, Bakhshi E, Talasaz A, Hoorzad A. Comparison of the effects of N-acetyl-cysteine and ginseng in prevention of noise induced hearing loss in male textile workers. Noise and Health. 2014;16(71):223.

Dudarewicz A, Pawlaczyk-Łuszczyńska M, Zamojska-Daniszewska M, Zaborowski K. Exposure to excessive sounds during orchestra reheaersals and temporary changes in hearing among musicians. Medycyna Pracy. 2015;66(4):479-86.

Ehlers J, Graydon P. Noise-induced hearing loss in agriculture: Creating partnerships to overcome barriers and educate the community on prevention. Noise and Health. March-April 2011;13(51):142.

El Dib R, Atallah A, Andriolo R, Garcia de Oliveira Soares B, Verbeek J. A systematic review of the interventions to promote the wearing of hearing protection. Sao Paulo Med J. 2007;125(6):362-9.

Fausti SA, Wilmington DJ, Helt PV, Helt WJ, Konrad-Martin D. Hearing health and care the need for improved hearing loss prevention and hearing conservation practices. Journal of Rehabilitation Research & Development. July/August 2005, Supplement 2;42(4):45-62.

Fernandez ME, Bartholomew LK, Alterman T. Planning a multilevel intervention to prevent hearing loss among farmworkers and managers: a systematic approach. Journal of Agricultural Safety and Health. 2009;15(1):49-74.

Fetoni AR, Paciello F, Rolesi R, Eramo SLM, Mancuso C, Troiani D, et al. Rosmarinic acid up-regulates the noise-activated activatedNrf2/HO-1pathway and protects against noise-induced injury in rat cochlea. Free Radical Biology and Medicine. 2015;85:269–81.

Finegold LS, von Gierke HE, Schomer PD, Berryd BF. Proposal for monitoring worldwide noise exposure and assessing the effectiveness of noise exposure policies and noise control technologies. Noise Control Eng J. 2001;49 (4):199-203.

Folmer RL, Saunders GH, Dann SM, Griest SE, Porsov E, Fausti SA. Computer-based hearing loss prevention education program for veterans and military personnel. Journal of Rehabilitation Research & Development. July-August 2012;49(4):vii.

Foster G. Factors influencing the implementation of noise control programs in industry. Journal of Occupational Health and Safety - Australia and New Zealand. Aug. 1996;12(4):471-5.

Frank T, Bise CJ, Michael K. A hearing conservation program for coal miners. Occupational Health & Safety. 2003;72(6):106-10.

Garvey DJ. New ideas in construction hearing conservation. Professional Safety. 2000;45(2):26-31.

Gates D, Jones M. A pilot study to prevent hearing loss in farmers. Public Health Nursing. 2007;24(6):547–53.

Golmohammadi R, Giahi O, Aliabadi M, Darvishi E. An Intervention for Noise Control of Blast Furnace in Steel Industry. J Res Health Sci. 2014;14(4):287-90.

Green DR, Anthony TR. Occupational Noise Exposure of Employees at Locally-Owned Restaurants in a College Town. Journal of Occupational and Environmental Hygiene. 2015;12(7):489-99.

Groenewold MR, _Masterson EA, Themann CL, Davis RR. Do hearing protectors protect hearing? American Journal Of Industrial Medicine. 2014;57:1001-10.

Guthrie OW, Wong BA, McInturf SM, Reboulet JE, Ortiz PA, Mattie DR. Background noise contributes to organic solvent induced brain dysfunction. Neural Plasticity. Volume 2016. Article ID 8742725, 11 pages.

Halonen J, Hinton AS, Frisina RD, Ding B, Zhu X, Walton JP. Long-term treatment with aldosterone slows the progression of age-related hearing loss. Hearing Research. 2016;336:63-71.

Hass-Slavin l, McColl MA, Pickett W. Challenges and strategies related to hearing loss among dairy farmers. The Journal of Rural Health. Fall 2005;21(4):329-36.

Hong O, Chin DL, Ronis DL. Predictors of Hearing Protection Behavior Among Firefighters in the United

States. IntJ Behav Med. 2013;20:121-30.

Hong O, Eakin B, Chin D, Feld J, Vogel S. An Internet-based tailored hearing protection intervention for firefighters. Health Promotion Practice. 2013;14(4):572–9.

Hong O, Fiola LA, Feld J. Challenges and Successes in Recruiting Firefighters for Hearing Loss Prevention Research. Workplace Health Saf. 2013;61(6):257-63.

Hong O, Ronis D, Lusk S, Kee G-S. Efficacy of a computer-based hearing test and tailored hearing protection intervention. International Journal of Behavioral Medicine. 2006;13(4):304–14.

Hong O, Samo D, Hulea R, Eakin B. Perception and attitudes of firefighters on noise exposure and hearing loss. Journal of Occupational and Environmental Hygiene. 2008;5(3):210-5.

Honkura Y, Matsuo H, Murakami S, Sakiyama M, Mizutari K, Shiotani A, et al. NRF2 Is a Key Target for Prevention of Noise-Induced Hearing Loss by Reducing Oxidative Damage of Cochlea. Scientific Reports. 2016;6:19329.

Huth ME, Popelka GR, Blevins NH. Comprehensive measures of sound exposures in cinemas using smart phones. Ear & Hearing. 2014;35:680-6.

Jansen S, Luts H, Dejonckere P, van Wieringen A, Wouters J. Efficient Hearing Screening in Noise-Exposed Listeners Using the Digit Triplet Test. Ear & Hearing. 2013;34:773-8.

Kesici GG, Ünlü I, Topçu AB, Bal CD, Tutkun E, Yılmaz OH. Arsenic related hearing loss in miners..pdf>. American Journal of Otolarynology – Head and Neck Medicine and Surgery. 2016;37:6-11.

Knobloch M, Broste S. A hearing conservation program for Wisconsin youth working in agriculture. J Sch Health. 1998;68(8):313-8.

Konrad-Martin D, Reavis KM, McMillan G, Helt WJ, Dille M. Proposed comprehensive ototoxicity monitoring program for VA healthcare (COMP-VA). Journal of Rehabilitation Research & Development. 2014;51(1):81-100.

Kopke RD. Pharmacological approaches to the prevention and treatment of cochlear injury due to noise. Audiological Medicine. 2007;5(1):66-80.

Kramer SE, Kapteyn TS, Houtgast T. Occupational performance: Comparing normally-hearing and hearing-impaired employees using the Amsterdam Checklist for Hearing and Work. International Journal of Audiology. 2006;45(9):503-12.

Leensen MCJ, Dreschler WA. The applicability of a speech-in-noise screening test in occupational hearing conservation. International Journal of Audiology. 2013;52(7):455-65.

Lobato DCB, De Lacerda ABM, De Oliveira Gonçalves CG, Coifman H. Auditory effects of exposure to noise and solvents: a comparative study. Int Arch Otorhinolaryngol. 2014;18:136-41.

Loukzadeh Z, Shojaoddiny-Ardekani A, Mehrparvar AH, Yazdi Z, Mollasadeghi A. Effect of exposure to a mixture of organic solvents on hearing thresholds in petrochemical industry workers. Iranian Journal of Otorhinolaryngology. Oct 2014;26(4):Serial No. 77.

Lusk S, Ronis D, Kazanis A, Eakin B, Hong O, Raymond D. Effectiveness of a tailored intervention to

increase factory workers' use of hearing protection. Nursing Research. 2005;52(5):289-95.

Lusk S, Saeng Hong O, Ronis D, Eakin B, Kerr M, Early M. Effectiveness of an Intervention to Increase Construction Workers' Use of Hearing Protection. Human Factors. 1999;41(3):487–94.

Lutz EA, Reed RJ, Turner D, Littau SR, Lee V, Hu C. Effectiveness Evaluation of Existing Noise Controls in a Deep Shaft Underground Mine. Journal of Occupational and Environmental Hygiene. 2015;12(5):287-93.

Malchaire J. Strategy for prevention and control of the risks due to noise. Occup Environ Med. 2000;57:361–9.

Malchaire J. Strategy for prevention and control of the risks due to noise. Occup Environ Med. 2000;57:361–9.

Marlenga B, Linneman J, Pickett W, Wood D, Kirkhorn S, Broste S, et al. Randomized trial of a hearing conservation intervention for rural students long-term outcomes. Pediatrics 2011;128(5):e1139-e46.

Masterson EA, Bushnell PT, Themann CL, Morata TC. Hearing Impairment Among Noise-Exposed Workers - United States, 2003-2012. Morbidity and Mortality Weekly Report. April 22, 2016;65(15):389-94.

McCullagh M. Preservation of hearing among agricultural workers: a review of literature and recommendations for future research. Journal of Agricultural Safety and Health. 2002;8(3):297-318.

McTague M, Galusha D, Dixon-Ernst C, Kirsche S, Slade M, Cullen M, et al. Impact of daily noise exposure monitoring on occupational noise exposures in manufacturing workers. International Journal of Audiology. 2013;52:sup1:S3-S8.

Meinke DK, Morata TC. Awarding and promoting excellence in hearing loss prevention. International Journal of Audiology. 2012;51(sup 1):S63-S70.

Meira T, Santana V, Ferrite S. Gender and other factors associated with the use of hearing protection devices at work. Rev Saúde Pública. 2015;49:76.

Michikawa T, Nishiwaki Y, Asakura K, Hillebrand G, Miyamoto K, Ono M, et al. Sunlight Exposure May Be a Risk Factor of Hearing Impairment: A Community-Based Study in Japanese Older Men and Women. J Gerontol A Biol Sci Med Sci. 2013;68(1):96-103.

Młyński R, Kozłowski E. Determining Attenuation of Impulse Noise With an Electrical Equivalent of a Hearing Protection Device. International Journal of Occupational Safety and Ergonomics. 2013;19(1):127-41.

Mohammadi G. Hearing Conservation Programs In Selected Metal Fabrication Industries. Applied Acoustics. 2008;69:287–92.

Morata TC. Promoting hearing health and the combined risk of noise-induced hearing loss and ototoxicity. Audiological Medicine. 2007;5(1):33-40.

Morata TC, Sliwinska-Kowalska M, Johnson A-C, Starck J, Pawlas K, Zamyslowska-Szmytke E, et al. A multicenter study on the audiometric findings of styrene-exposed workers. International Journal of Audiology. 2011;50(10):652-60.

Mrena R, Savolainen S, Kiukaanniemi H, Ylikoski J, Mäkitie AA. The effect of tightened hearing protection regulations on military noise induced tinnitus. International Journal of Audiology. 2009;48(6):394-400.

Mrena R, Ylikoski M, Makitie A, Pirvola U, Ylikoski J. Occupational noise-induced hearing loss reports and tinnitus in Finland. Acta Oto-Laryngologica. 2007;127:729-35.

Nassiri P, Dehghan SF, Monazzam MR. A prioritization approach for noise risk management in a petrochemical complex. J Occup Health. 2013;55:204-10.

Neitzel R, _Meischke H, Daniell W, Trabeau M, Somers S, Seixas N. Development and pilot test of hearing conservation training for construction workers. American Journal Of Industrial Medicine. 2008;51:120–9

Neitzel RL, Galusha D, Dixon-Ernst C, Rabinowitz PM. Methods for evaluating temporal trends in noise exposure. International Journal of Audiology. 2014;53(sup2):S76-S83.

NIOSH. Preventing occupational hearing loss : a practical guide. Franks JR, Stephenson MR, Merry CJ, editors. Cincinnati, OH: U.S. Dept. of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Division of Biomedical and Behavioral Science, Physical Agents Effects Branch; 1996.

O'Brien I, Ackermann B, Driscoll T. Hearing and hearing conservation practices among Australia's professional orchestral musicians. Noise and Health. May-June 2014;16(70):189.

O'Brien I, Driscoll T, Ackermann B. Description and Evaluation of a Hearing Conservation Program in Use in a Professional Symphony Orchestra. Ann Occup Hyg. 2015;59(3):265–76.

Pelegrin A, Canuet L, Morales M. Predictive factors of occupational noise-induced hearing loss in Spanish workers A prospective study. Noise and Health. 17.78 (2015): 343. Health Reference Center Academic. Web. 20 June 2016.

Pourbakht A. Effect of N-acetylcysteine in protecting from simultaneous noise and carbon monoxide induced hair cell loss. Audiol. 2011;20(1):107-15.

Pyykkö I, Toppila E, Zou J, Kentala E. Individual susceptibility to noise-induced hearing loss. Audiological Medicine. 2007;5(1):41-53.

Pyykko IV, Toppila EE, Starck JP, Juhola M, Auramo Y. Database for a hearing conservation program. Scand Audiol 2000;29(52-8).

Rabinowitz P, Galusha D, Kirsche S, Cullen M, Slade M, Dixon-Ernst C. Effect of daily noise exposure monitoring on annual rates of hearing loss in industrial workers. Occupational and Environmental Medicine. 2011;68(6):414-8.

Rao D, Fechter LD. Protective effects of phenyl-N-tert-butylnitrone on the potentiation of of Noise-Induced Hearing Loss by Carbon Monoxide. Toxicol Appl Pharmacol. 2000;167:125–31.

Robertson C, Kerr M, Garcia C, Halterman E. Noise and hearing protection: Latino construction workers' experiences. AAOHN Journal. April 2007;55(4):153-60.

Rocha CH, Santos LHD, Moreira RR, Neves-Lobo IF, Samelli AG. Effectiveness verification of an educational program on hearing protection for noise-exposed workers. J Soc Bras Fonoaudiol.

2011;23(1):38-43.

Rogers B, Meyer D, Summey C, Scheessele D, Atwell T, Ostendorf J, et al. What makes a successful hearing conservation program? AAOHN Journal. 2009;57(8):321-37.

Rubak T, Kock S, Koefoed-Nielsen B, Lund SP, Bonde JP, Kolstad HA. The risk of tinnitus following occupational noise exposure in workers with hearing loss or normal hearing. International Journal of Audiology. 2008;47(3):109-14.

Rus RM, Daud A, Musa KI, Naing L. Knowledge, attitude and practice of sawmill workers towards noise-induced hearing loss in Kota Bharu, Kelantan. Malaysian Journal of Medical Sciences. 2008;15(4):28-34.

Saunders GH, Griest S. A multimedia hearing loss prevention program for older adults: theoretical basis and development. Journal of the Academy of Rehabilitative Audiology. 2007;Volume XL:47-61.

Saunders GH, Griest S. Hearing loss in veterans and the need for hearing loss prevention programs. Noise and Health. January-March 2009;11(42):14.

Sedat Sakat M, Kilic K, Bercin S. Pharmacological agents used for treatment and prevention in noise-induced hearing loss. Eur Arch Otorhinolaryngol Published online: 16 February 2016.

Seixas N, Neitzel R, Stover B, Sheppard L, Daniell B, Edelson J, et al. A multi component intervention to promote hearing protector use among construction workers. International Journal of Audiology. 2011;50:sup1:S46-S56.

Sherman CR, Azulay Chertok I. Review of interventions to increase hearing protective device use in youth who live or work on farms. Journal of Clinical Nursing. 2013;23:3-12.

Sriwattanatamma P, Breysse P. Comparison of NIOSH noise criteria and OSHA hearing conservation criteria. American Journal of Industrial Medicine. 2000;37:334-8.

Starck J, Toppila E, Pyykko I. Management of a Sophisticated Hearing Conservation Program. American Journal of Industrial Medicine. 1999;Supplement 1:47-50.

Stephenson C, Stephenson M. Hearing loss prevention for carpenters: Part 1 - Using health communication and health promotion models to develop training that works. Noise and Health 1351 2011:113.

Stephenson M, Shaw P, Stephenson C, Graydon P. Hearing loss prevention for carpenters Part 2 - Demonstration projects using individualized and group training. Noise and Health 1351. 2011:122.

Stephenson MR, Byrne DC, Ohiin DW, Murphy WJ, Chandler DW, Davis RR, et al. Perspectives on "Efficacy of the U.S. Army Policy on Hearing Conservation Programs". Military Medicine. 2010 Jan;175(1):xii-xvi.

Suter AH. Construction noise exposure, effects, and the potential for remediation; a review and analysis. AIHA Journal. 2002;63(6):768-89.

Tamin Nor Saleha I, Noor Hassim I. A study on compliance to hearing conservation programme among industries in Negeri Sembilan, Malaysia. Industrial Health. 2006;44:584-91.

Tantranont K, Srisuphan W, Kaewthummanukul T, Suthakorn W, Jormsri P, Salazar MK. Factors affecting

Thai workers' use of hearing protection. AAOHN Journal. November 2009;57(11):455-63.

Thompson A, Pakulski L, Price J, Kleinfelder J. Health Teachers' Perceptions and Teaching Practices Regarding Hearing Loss Conservation. American Journal of Health Education. 2013;44(6):335-42.

Turcot A, Girard SA, Courteau M, Baril J, Larocque R. Noise-induced hearing loss and combined noise and vibration exposure. Occupational Medicine. 2015;65:238–44.

Verbeek JH, Kateman E, Morata TC, Dreschler WA, Mischke C. Interventions to prevent occupational noise-induced hearing loss: a Cochrane systematic review. International Journal of Audiology. 2014;53(sup2):S84-S96.

Vogel I, van der Ploeg CPB, Brug J, Raat H. Music venues and hearing loss: opportunities for and barriers to improving environmental conditions. International Journal of Audiology. 2009;48(8):531-6.

Williams SC, Rabinowitz PM. Usability of a Daily Noise Exposure Monitoring Device for Industrial Workers. Ann Occup Hyg. 2012;56(8):925-33.

Williams W, Brumby S, Calvano A, Hatherell T, Mason H, Mercer-Grant C, et al. Farmers' work-day noise exposure. The Australian Journal of Rural Health. 2015.

Yang H-Y, Shie R-H, Chen P-C. Hearing loss in workers exposed to epoxy adhesives and noise: a cross-sectional study. BMJ Open 2016;6:010533.

D3. OCCUPATIONAL CONTACT DERMATITIS BIBLIOGRAPHY

Allmers H, Schmengler J, Skudlik C. Primary prevention of natural rubber latex allergy in the German health care system through education and intervention. J Allergy Clin Immunol 2002;110(2):318-323.

Arbogast JW, Fendler EJ, Hammond BS, Cartner TJ, Dolan MD, Ali Y, et al. Effectiveness of a hand care regimen with moisturizer in manufacturing facilities where workers are prone to occupational irritant dermatitis. Dermatitis 2004 Mar;15(1):10-17.

Bauer A, Kelterer D, Bartsch R, Schlegel A, Pearson J, Stadeler M, et al. Prevention of hand dermatitis in bakers' apprentices: different efficacy of skin protection measures and UVB hardening. Int Arch Occup Environ Health 2002;75(7):491-499.

Bauer A, Schmitt J, Bennett C, Coenraads P, Elsner P, English J, et al. Interventions for preventing occupational irritant hand dermatitis. The Cochrane Library 2010.

Bregnbak D, Johansen JD, Jellesen MS, Zachariae C, Menné T, Thyssen JP. Chromium allergy and dermatitis: prevalence and main findings. Contact Derm 2015;73(5):261-280.

Bregnhoj A, Menne T, Johansen JD, Sosted H. Prevention of hand eczema among Danish hairdressing apprentices: an intervention study. Occup Environ Med 2012 May;69(5):310-316.

Brown TP, Rushton L, Williams HC, English JS. Intervention implementation research: an exploratory study of reduction strategies for occupational contact dermatitis in the printing industry. Contact Derm 2007;56(1):16-20.

Clemmensen KK, Randbøll I, Ryborg MF, Ebbehøj NE, Agner T. Evidence-based training as primary prevention of hand eczema in a population of hospital cleaning workers. Contact Derm 2015;72(1):47-54.

Diepgen T, Buettner M, Kuhn H, Doerr W, Krueger H, Bernhard-klimt C, et al. Hand dermatitis in the meat processing industry: frequency, risk factors and results of an intervention study. Contact Derm 2010;63:18.

Dulon M, Pohrt U, Skudlik C, Nienhaus A. Prevention of occupational skin disease: a workplace intervention study in geriatric nurses. Br J Dermatol 2009;161(2):337-344.

Flyvholm MA, Mygind K, Sell L, Jensen A, Jepsen KF. A randomised controlled intervention study on prevention of work related skin problems among gut cleaners in swine slaughterhouses. Occup Environ Med 2005 Sep;62(9):642-649.

Geens T, Aerts E, Borguet M, Haufroid V, Godderis L. Exposure of hairdressers to aromatic diamines: an interventional study confirming the protective effect of adequate glove use. Occup Environ Med 2016 Apr;73(4):221-228.

Held E, Wolff C, Gyntelberg F, Agner T. Prevention of work-related skin problems in student auxiliary nurses. Contact Derm 2001;44(5):297-303.

Held E, Mygind K, Wolff C, Gyntelberg F, Agner T. Prevention of work related skin problems: an intervention study in wet work employees. Occup Environ Med 2002 Aug;59(8):556-561.

Heron RJ. Worker education in the primary prevention of occupational dermatoses. Occup Med (Lond) 1997 Sep;47(7):407-410.

Ibler KS, Jemec GB, Diepgen TL, Gluud C, Lindschou Hansen J, Winkel P, et al. Skin care education and individual counselling versus treatment as usual in healthcare workers with hand eczema: randomised clinical trial. BMJ 2012 Dec 12;345:e7822.

Jungbauer FHW, Van Der Harst J, Groothoff J, Coenraads P. Skin protection in nursing work: promoting the use of gloves and hand alcohol. Contact Derm 2004;51(3):135-140.

Kütting B, Baumeister T, Weistenhöfer W, Pfahlberg A, Uter W, Drexler H. Effectiveness of skin protection measures in prevention of occupational hand eczema: results of a prospective randomized controlled trial over a follow-up period of 1 year. Br J Dermatol 2010;162(2):362-370.

Lee A, Nixon R, Frowen K. Reduction of use of latex gloves in food handlers: an intervention study. Contact Derm 2001;44(2):75-79.

Löffler H, Bruckner T, Diepgen T, Effendy I. Primary prevention in health care employees: A prospective intervention study with a 3-year training period. Contact Derm 2006;54(4):202-209.

Maxfield AM, Lewis MJ, Tisdale JA, Lachenmayr S, Lum M. Effects of a preventive message in the organizational context: Occupational latex allergy in hospitals. Am J Ind Med 1999;36:125-127.

Mygind K, Sell L, Flyvholm M, Jepsen KF. High-fat petrolatum-based moisturizers and prevention of work-related skin problems in wet-work occupations. Contact Derm 2006;54(1):35-41.

Nicholson PJ, Llewellyn D, English JS. Evidence-based guidelines for the prevention, identification and management of occupational contact dermatitis and urticaria. Contact Derm 2010;63(4):177-186.

QI C, LO L. Engineering Control of Silica Dust from Stone Countertop Fabrication and Installation.

Radulescu M, Bock M, Bruckner T, Ellsäßer G, Fels H, Diepgen TL. Health education about occupational allergies and dermatoses for adolescents. JDDG: Journal der Deutschen Dermatologischen Gesellschaft 2007;5(7):576-581.

Saary J, Qureshi R, Palda V, DeKoven J, Pratt M, Skotnicki-Grant S, et al. A systematic review of contact dermatitis treatment and prevention. J Am Acad Dermatol 2005;53(5):845. e1-845. e13.

Schnuch A, Geier J, Lessmann H, Arnold R, Uter W. Surveillance of contact allergies: methods and results of the Information Network of Departments of Dermatology (IVDK). Allergy 2012;67(7):847-857.

Schwanitz HJ, Riehl U, Schlesinger T, Bock M, Skudlik C, Wulfhorst B. Skin care management: educational aspects. Int Arch Occup Environ Health 2003;76(5):374-381.

Sell L, Flyvholm M, Lindhard G, Mygind K. Implementation of an occupational skin disease prevention programme in Danish cheese dairies. Contact Derm 2005;53(3):155-161.

Steengaard SS, Bregnhøj A, Johansen JD. Hand eczema among hairdressing apprentices in Denmark following a nationwide prospective intervention programme: 6-year follow-up. Contact Derm 2016;75(1):32-40.

Stocks SJ, McNamee R, Turner S, Carder M, Agius RM. Has European Union legislation to reduce exposure to chromate in cement been effective in reducing the incidence of allergic contact dermatitis attributed to chromate in the UK? Occup Environ Med 2012 Feb;69(2):150-152.

Thyssen JP, Uter W, McFadden J, Menné T, Spiewak R, Vigan M, et al. The EU Nickel Directive revisited—future steps towards better protection against nickel allergy. Contact Derm 2011;64(3):121-125.

Turner S, McNamee R, Agius R, Wilkinson SM, Carder M, Stocks SJ. Evaluating interventions aimed at reducing occupational exposure to latex and rubber glove allergens. Occup Environ Med 2012 Dec;69(12):925-931.

van der Meer, Esther WC, Boot CR, van der Gulden, Joost WJ, Knol DL, Jungbauer FH, Coenraads PJ, et al. Hands4U: the effects of a multifaceted implementation strategy on hand eczema prevalence in a healthcare setting. Results of a randomized controlled trial. Contact Derm 2015;72(5):312-324.

van der Meer EW, Boot CR, Twisk JW, Coenraads PJ, Jungbauer FH, van der Gulden JW, et al. Hands4U: the effectiveness of a multifaceted implementation strategy on behaviour related to the prevention of hand eczema-a randomised controlled trial among healthcare workers. Occup Environ Med 2014 Jul;71(7):492-499.

van Gils RF, Boot CR, van Gils PF, Bruynzeel D, Coenraads PJ, van Mechelen W, et al. Effectiveness of prevention programmes for hand dermatitis: a systematic review of the literature. Contact Derm 2011;64(2):63-72.

Weistenhöfer W, Baumeister T, Drexler H, Kütting B. How to quantify skin impairment in primary and secondary prevention? HEROS: a proposal of a hand eczema score for occupational screenings. Br J Dermatol 2011;164(4):807-813.

D4. OCCUPATIONAL CANCERS BIBLIOGRAPHY

D4.1 Asbestos

Bahk J, Choi Y, Lim S, Paek D. Why some, but not all, countries have banned asbestos. International journal of occupational and environmental health 2013;19(2):127-135.

Bonneterre V, Faisandier L, Bicout D, Bernardet C, Piollat J, Ameille J, et al. Programmed health surveillance and detection of emerging diseases in occupational health: contribution of the French national occupational disease surveillance and prevention network (RNV3P). Occup Environ Med 2010 Mar;67(3):178-186.

Camus M. A ban on asbestos must be based on a comparative risk assessment. CMAJ 2001 Feb 20;164(4):491-494.

Chen Y, Osman J. Occupational cancer in Britain. Br J Cancer 2012;107:S104-S108.

Fary G. what Is The Future Of Dealing With Asbestos In Australia? Asia-pacific Journal of Clinical Oncology 2011;7:72.

Hickey J, Saunders J, Davern P. The extent and influence of Asbestos Safety Awareness training among managers who had previously commissioned an asbestos survey in their workplace buildings. Ind Health 2015;53(5):398-409.

Hnizdo E, Berry A, Hakobyan A, Beeckman-Wagner LA, Catlett L. Worksite wellness program for respiratory disease prevention in heavy-construction workers. J Occup Environ Med 2011 Mar;53(3):274-281.

Hohenadel K, Straif K, Demers P, Blair A. The effectiveness of asbestos-related interventions in reducing rates of lung cancer and mesothelioma: a systematic review. Occup Environ Med 2011;68(Suppl 1):A71-A71.

Hutchings S, Cherrie JW, Van Tongeren M, Rushton L. Intervening to reduce the future burden of occupational cancer in britain: what could work? Cancer Prev Res (Phila) 2012 Oct;5(10):1213-1222.

Huuskonen MS, Rantanen J. Finnish Institute of Occupational Health (FIOH): Prevention and detection of asbestos-related diseases, 1987–2005. Am J Ind Med 2006;49(3):215-220.

Järvholm B, Burdorf A. Emerging evidence that the ban on asbestos use is reducing the occurrence of pleural mesothelioma in Sweden. Scand J Public Health 2015;43(8):875-881.

Kauppinen T, Saalo A, Pukkala E, Virtanen S, Karjalainen A, Vuorela R. Evaluation of a national register on occupational exposure to carcinogens: effectiveness in the prevention of occupational cancer, and cancer risks among the exposed workers. Ann Occup Hyg 2007 Jul;51(5):463-470.

LaDou J, Landrigan P, Bailar JC,3rd, Foa V, Frank A, Collegium Ramazzini. A call for an international ban on asbestos. CMAJ 2001 Feb 20;164(4):489-490.

LaMontagne A, Hunter C, Vallance D, Holloway A. Asbestos Disease in Australia: Looking Forward and Looking Back. NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy 2008;18(3):361-373.

LaMontagne AD, Herrick RF, Dyke MVV, Martyny JW, Ruttenber AJ. Exposure databases and exposure surveillance: promise and practice. AIHA journal 2002;63(2):205-212.

LaMontagne AD, Barbeau E, Youngstrom RA, Lewiton M, Stoddard AM, McLellan D, et al. Assessing and intervening on OSH programmes: effectiveness evaluation of the Wellworks-2 intervention in 15 manufacturing worksites. Occup Environ Med 2004 Aug;61(8):651-660.

Montagne AD, Christiani DC. Prevention of work-related cancers. Cancer Prevention: The Causes and Prevention of Cancer 2002:281-300.

O'neill R, Pickvance S, Watterson A. Burying the evidence: how Great Britain is prolonging the occupational cancer epidemic. International journal of occupational and environmental health 2007;13(4):428-436.

Pasiechnik D, Ziegler D. The Power Of Empathy In Advocating For Cancer Control Policy: Combining Evidence And A Personal Cancer Story To Motivate Stakeholders To Advocate For The First Asbestos Registry In Canada. Asia-pacific Journal of Clinical Oncology 2014;10:22.

Ramazzini C. Asbestos is still with us: repeat call for a universal ban. Am J Ind Med 2011;54(2):168-173.

Seniori Costantini A, Chellini E. The experience of the Mesothelioma Registry of Tuscany in assessing health hazard associated with asbestos exposure. Med Lav 1997 Jul-Aug;88(4):310-315.

Silvestri S. Managing asbestos in Italy: twenty years after the ban. NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy 2013;22(4):489-496.

Sofie JK. Creating a successful occupational health and safety program: Using workers' perceptions. AAOHN J 2000;48(3):125-130.

Stayner L, Kuempel E, Rice F, Prince M, Althouse R. Approaches for assessing the efficacy of occupational health and safety standards. Am J Ind Med 1996;29(4):353-357.

Tomatis L. The identification of human carcinogens and primary prevention of cancer. Mutation Research/Reviews in Mutation Research 2000;462(2):407-421.

Tomatis L. Etiologic evidence and primary prevention of cancer. Drug Metab Rev 2000;32(2):129-137.

Vallance DA. The phase-out of asbestos in the Australian manufacturing environment. International journal of occupational and environmental health 2004;10(2):209-211.

Verma DK, Purdham JT, Roels HA. Translating evidence about occupational conditions into strategies for prevention. Occup Environ Med 2002 Mar;59(3):205-13; quiz 214.

World Health Organization. Cancer control: knowledge into action: WHO guide for effective programmes. World Health Organization; 2007.

Impact of prevention on future cancer incidence in Australia. Cancer Forum: The Cancer Council Australia

D4.2 Diesel exhaust

Bugarski AD, Janisko SJ, Cauda EG, Noll JD, Mischler SE. Controlling exposure to diesel emissions in underground mines. : SME; 2012.

Cherrie JW. Reducing occupational exposure to chemical carcinogens. Occup Med (Lond) 2009 Mar;59(2):96-100.

Corley EA, DeHart-Davis L, Lindner J, Rodgers MO. Inspection/Maintenance program evaluation: Replicating the Denver step method for an Atlanta fleet. Environ Sci Technol 2003;37(12):2801-2806.

Davies H. Capacity Development for a Canadian Workplace Exposure Database. 2014.

He J, Hung W. Perception of policy-makers on policy-making criteria: The case of vehicle emissions control. Sci Total Environ 2012;417:21-31.

Diesel Particulate Matter in Underground Mines–Controlling the Risk (an update). tekijä: Queensland Mining Industry Health & Safety Conference; 2007.

Hutchings S, Cherrie JW, Van Tongeren M, Rushton L. Intervening to reduce the future burden of occupational cancer in britain: what could work? Cancer Prev Res (Phila) 2012 Oct;5(10):1213-1222.

Kauppinen T, Uuksulainen S, Saalo A, Makinen I, Pukkala E. Use of the Finnish Information System on Occupational Exposure (FINJEM) in epidemiologic, surveillance, and other applications. Ann Occup Hyg 2014 Apr;58(3):380-396.

Kurnia JC, Sasmito AP, Wong WY, Mujumdar AS. Prediction and innovative control strategies for oxygen and hazardous gases from diesel emission in underground mines. Sci Total Environ 2014;481:317-334.

Liu ZG, Wall JC, Barge P, Dettmann ME, Ottinger NA. Investigation of PCDD/F emissions from mobile source diesel engines: impact of copper zeolite SCR catalysts and exhaust aftertreatment configurations. Environ Sci Technol 2011;45(7):2965-2972.

McGinn S. Controlling Diesel Emissions in Underground Mining within an Evolving Regulatory Structure in Canada and the United States of America.

Monforton C. Weight of the evidence or wait for the evidence? Protecting underground miners from diesel particulate matter. Am J Public Health 2006;96(2):271-276.

Pratt SL, Grainger AP, Todd J, Meena GG, Rogers AJ, Davies B. Evaluation and control of employee exposure to diesel particulate at several Australian coal mines. Appl Occup Environ Hyg 1997;12(12):1032-1037.

Robinson MA, Olson MR, Liu ZG, Schauer JJ. The effects of emission control strategies on light-absorbing carbon emissions from a modern heavy-duty diesel engine. J Air Waste Manage Assoc 2015;65(6):759-766.

Robinson MA, Olson MR, Liu ZG, Schauer JJ. The effects of emission control strategies on light-absorbing carbon emissions from a modern heavy-duty diesel engine. J Air Waste Manage Assoc 2015;65(6):759-766.

Shahna FG, Bahrami A, Farasati F. Application of local exhaust ventilation system and integrated collectors for control of air pollutants in mining company. Ind Health 2012;50(5):450-457.

Stevens G, Wilson A, Hammitt JK. A Benefit-Cost Analysis of Retrofitting Diesel Vehicles with Particulate Filters in the Mexico City Metropolitan Area. Risk Analysis 2005;25(4):883-899.

Yan F, Bond TC, Streets DG. Effectiveness of Mitigation Measures in Reducing Future Primary Particulate Matter Emissions from On-Road Vehicle Exhaust. Environ Sci Technol 2014;48(24):14455-14463.

D4.3 Silica

Akbar-Khanzadeh F, Brillhart RL. Respirable crystalline silica dust exposure during concrete finishing (grinding) using hand-held grinders in the construction industry. Ann Occup Hyg 2002 Apr;46(3):341-346.

Alexander BM, Esswein EJ, Gressel MG, Kratzer JL, Feng HA, King B, et al. The development and testing of a prototype mini-baghouse to control the release of respirable crystalline silica from sand movers. Journal of occupational and environmental hygiene 2016;13(8):628-638.

Andersson L, Bryngelsson I, Ohlson C, Nayström P, Lilja B, Westberg H. Quartz and dust exposure in Swedish iron foundries. Journal of occupational and environmental hygiene 2008;6(1):9-18.

Beamer BR, Shulman S, Maynard A, Williams D, Watkins D. Evaluation of misting controls to reduce respirable silica exposure for brick cutting. Ann Occup Hyg 2005 Aug;49(6):503-510.

Carlo RV, Sheehy J, Feng HA, Sieber WK. Laboratory evaluation to reduce respirable crystalline silica dust when cutting concrete roofing tiles using a masonry saw. Journal of occupational and environmental hygiene 2010;7(4):245-251.

Collingwood S, Heitbrink WA. Field evaluation of an engineering control for respirable crystalline silica exposures during mortar removal. Journal of occupational and environmental hygiene 2007;4(11):875-887.

Cooper MR, Susi P, Rempel D. Case Study: Evaluation and Control of Respirable Silica Exposure During Lateral Drilling of Concrete. Journal of occupational and environmental hygiene 2012;9(2):D35-D41.

Croteau GA, Guffey SE, Flanagan ME, Seixas NS. The effect of local exhaust ventilation controls on dust exposures during concrete cutting and grinding activities. AIHA Journal 2002;63(4):458-467.

Golla V, Heitbrink W. Control technology for crystalline silica exposures in construction: wet abrasive blasting. J Occup Environ Hyg 2004 Mar;1(3):D26-32.

Haas EJ, Cecala AB, Hoebbel CL. Using Dust Assessment Technology to Leverage Mine Site Manager-Worker Communication and Health Behavior: A Longitudinal Case Study. J Progress Res Soc Sci 2016 Jan 6;3(1):154-167.

IH JM. The challenge of controlling lead and silica exposures from firing ranges in a special operations force. Mil Med 2008;173(2):182.

Meeker JD, Cooper MR, Lefkowitz D, Susi P. Engineering control technologies to reduce occupational silica exposures in masonry cutting and tuckpointing. Public Health Rep 2009;124(4_suppl1):101-111.

Morteza MM, Hossein K, Amirhossein M, Naser H, Gholamhossein H, Hossein F. Designing, construction, assessment, and efficiency of local exhaust ventilation in controlling crystalline silica dust and particles, and formaldehyde in a foundry industry plant. Archives of Industrial Hygiene and Toxicology 2013;64(1):123-131.

QI C, LO L. Engineering Control of Silica Dust from Stone Countertop Fabrication and Installation.

Radnoff D, Todor MS, Beach J. Exposure to crystalline silica at Alberta work sites: review of controls. Journal of occupational and environmental hygiene 2015;12(6):393-403.

Radnoff DL, Kutz MK. Exposure to crystalline silica in abrasive blasting operations where silica and non-silica abrasives are used. Ann Occup Hyg 2014 Jan;58(1):19-27.

South African Department of Labour. National Programme on Elimination of Silicosis - South Africa. 2005.

Tjoe Nij E, Hilhorst S, Spee T, Spierings J, Steffens F, Lumens M, et al. Dust control measures in the construction industry. Ann Occup Hyg 2003 Apr;47(3):211-218.

Tuomi T, Linnainmaa M, Vaananen V, Reijula K. Application of good practices as described by the NEPSI agreement coincides with a strong decline in the exposure to respiratory crystalline silica in Finnish workplaces. Ann Occup Hyg 2014 Aug;58(7):806-817.

van Deurssen E, Pronk A, Spaan S, Goede H, Tielemans E, Heederik D, et al. Quartz and respirable dust in the Dutch construction industry: a baseline exposure assessment as part of a multidimensional intervention approach. Ann Occup Hyg 2014 Jul;58(6):724-738.

van Deurssen EH, Pronk A, Meijster T, Tielemans E, Heederik D, Oude Hengel KM. Process evaluation of an intervention program to reduce occupational quartz exposure among Dutch construction workers. J Occup Environ Med 2015 Apr;57(4):428-435.

Weidman J, Dickerson DE, Koebel CT. Effective Intervention Strategy to Improve Worker Readiness to Adopt Ventilated Tools. J Constr Eng Manage 2016;142(8):04016028.

International Labour Organization (ILO). Outline for a National Programme for the Elimination of Silicosis (NPES). Available at: http://www.ilo.org/safework/projects/WCMS_110469/lang--en/index.htm. Accessed March/30, 2016.

D4.4 Shiftwork

Bambra CL, Whitehead MM, Sowden AJ, Akers J, Petticrew MP. Shifting schedules: the health effects of reorganizing shift work. Am J Prev Med 2008;34(5):427-434. e30.

Gotay, C., Aronson, K., Campbell, K., Demers, P., Fleming, J., Gelmon, K., Spinelli, J. (2015) Improving sleep to reduce breast cancer risk in shift workers. Thirty-Eighth Annual CTRC-AACR San Antonio Breast Cancer Symposium, December 8-12, 2015.

Horrocks N, Pounder R, RCP Working Group. Working the night shift: preparation, survival and recovery--a guide for junior doctors. Clin Med (Lond) 2006 Jan-Feb;6(1):61-67.

Jeppesen HJ, Kleiven M, Bøggild H. Can varying the number of teams in a shift schedule constitute a preventive strategy? Revista de Saúde Pública 2004;38:47-55.

Joyce K, Pabayo R, Critchley JA, Bambra C. Flexible working conditions and their effects on employee health and wellbeing. The Cochrane Library 2010.

Kerin A, Aguirre A. Improving health, safety, and profits in extended hours operations (shiftwork). Ind Health 2005;43(1):201-208.

Knauth P, Hornberger S. Preventive and compensatory measures for shift workers. Occup Med (Lond) 2003 Mar;53(2):109-116.

KOGI K. Healthy shiftwork, healthy shiftworks. J Hum Ergol 2001;30(1/2):3-8.

Kogi K. International regulations on the organization of shift work. Scand J Work Environ Health 1998:7-12.

Leppämäki S, Partonen T, Piiroinen P, Haukka J, Lönnqvist J. Timed bright-light exposure and complaints related to shift work among women. Scand J Work Environ Health 2003:22-26.

Lerman SE, Eskin E, Flower DJ, George EC, Gerson B, Hartenbaum N, et al. Fatigue risk management in the workplace. J Occup Environ Med 2012 Feb;54(2):231-258.

Liira J, Verbeek J, Ruotsalainen J. Pharmacological interventions for sleepiness and sleep disturbances caused by shift work. JAMA 2015;313(9):961-962.

Neil-Sztramko SE, Pahwa M, Demers PA, Gotay CC. Health-related interventions among night shift workers: a critical review of the literature. Scand J Work Environ Health 2014 Nov;40(6):543-556.

Novak RD, Auvil-Novak SE. Focus group evaluation of night nurse shiftwork difficulties and coping strategies. Chronobiol Int 1996;13(6):457-463.

Peate I. Strategies for coping with shift work. Nurs Stand 2007 Oct 3-9;22(4):42-45.

Reed VA. Shift Work, Light at Night, and the Risk of Breast Cancer: A Guide to Administrative Action for Health Care Institutions. AAOHN J 2011;59(1):37-47.

Richter K, Acker J, Kamcev N, Bajraktarov S, Piehl A, Niklewski G. Recommendations for the prevention of breast cancer in shift workers. : Technische Hochschule Nürnberg Georg Simon Ohm; 2011.

Smith MR, Fogg LF, Eastman CI. A compromise circadian phase position for permanent night work improves mood, fatigue, and performance. Sleep 2009 Nov;32(11):1481-1489.

Van Reeth O. Sleep and circadian disturbances in shift work: strategies for their management. Hormone Research in Paediatrics 1998;49(3-4):158-162.

D5. OCCUPATIONAL ASTHMA BIBLIOGRAPHY

Agius RM. Informing public policy in occupational health through disease surveillance data-the 'THOR' example. (Minisymposium: Occupational disease surveillance). Occup Environ Med 2013 /;70.

Allmers H, Schmengler J, Skudlik C. Primary prevention of natural rubber latex allergy in the German health care system through education and intervention. J Allergy Clin Immunol 2002;110(2):318-323.

Allmers H, Schmengler J, John SM, Schwanitz HJ. Primary prevention of allergy caused by natural rubber latex in the German health care system. Allergo J 2005;14(5):329-336.

Baatjies R, Meijster T, Heederik D, Doekes G, Jeebhay M. A group randomised controlled intervention study of workplace exposure control measures to reduce flour dust exposure in supermarket bakeries with a high baker's allergy and asthma burden. Allergy Eur J Allergy Clin Immunol 2012 /;67:74-75.

Baatjies R, Meijster T, Heederik D, Sander I, Jeebhay MF. Effectiveness of interventions to reduce flour dust exposures in supermarket bakeries in South Africa. Occup Environ Med 2014 Dec;71(12):811-818.

Basketter DA, Kruszewski FH, Mathieu S, Kirchner DB, Panepinto A, Fieldsend M, et al. Managing the Risk of Occupational Allergy in the Enzyme Detergent Industry. J Occup Environ Hyg 2015;12(7):431-437.

Brosseau LM, Parker DL, Lazovich D, Milton T, Dugan S. Designing intervention effectiveness studies for occupational health and safety: The Minnesota Wood Dust Study. Am J Ind Med 2002;41(1):54-61.

Coppieters Y, Parent F, Piette D. Development and evaluation of the use of an interactive CD-ROM for students at risk of disease related to occupational hazards: the case of asthma. Promot Educ 2003;10(2):89-93, 73, 105.

Cullinan P, Tarlo S, Nemery B. The prevention of occupational asthma. Eur Respir J 2003 Nov;22(5):853-860.

de Groene GJ, Pal TM, Beach J, Tarlo SM, Spreeuwers D, Frings-Dresen MH, et al. Workplace interventions for treatment of occupational asthma: a Cochrane systematic review. Occup Environ Med 2012 May;69(5):373-374.

De Raeve H, Vandenbroeck , Godderis . Impact of a campaign on the correct use of protective personal equipment in car body repair shops. Occup Environ Med 2013 /;70.

Donham KJ, Lange JL, Kline A, Rautiainen RH, Grafft L. Prevention of occupational respiratory symptoms among certified safe farm intervention participants. J Agromedicine 2011;16(1):40-51.

Donnay C, Denis MA, Magis R, Fevotte J, Massin N, Dumas O, et al. Under-estimation of self-reported occupational exposure by questionnaire in hospital workers. Occup Environ Med 2011 Aug;68(8):611-617.

Filon FL, Radman G. Latex allergy: A follow up study of 1040 healthcare workers. Occup Environ Med 2006;63(2):121-125.

Fisher R, Saunders WB, Murray SJ, Stave GM. Prevention of laboratory animal allergy. Journal of occupational and environmental medicine 1998;40(7):609-613.

Fishwick D, Harris-Roberts J, Robinson E, Evans G, Barraclough R, Sen D, et al. Impact of worker education on respiratory symptoms and sensitization in bakeries. Occup Med (Lond) 2011 Aug;61(5):321-327.

Fishwick D, Sen D, Barker P, Codling A, Fox D, Naylor S. Uptake and quality of health surveillance for occupational asthma in the UK. Thorax 2015 /;70:A106.

Fransman W, Schinkel J, Meijster T, Van Hemmen J, Tielemans E, Goede H. Development and evaluation of an exposure control efficacy library (ECEL). Ann Occup Hyg 2008 Oct;52(7):567-575.

Gordon S, Fisher SW, Raymond RH. Elimination of mouse allergens in the working environment: Assessment of individually ventilated cage systems and ventilated cabinets in the containment of mouse allergens. J Allergy Clin Immunol 2001;108(2):288-294.

Grammer LC, Harris KE, Yarnold PR. Effect of respiratory protective devices on development of antibody and occupational asthma to an acid anhydride. Chest 2002 Apr;121(4):1317-1322.

Heederik D, Henneberger PK, Redlich CA, ERS Task Force on the Management of Work-related Asthma. Primary prevention: exposure reduction, skin exposure and respiratory protection. Eur Respir Rev 2012 Jun 1;21(124):112-124.

Jonaid BS, Rooyackers J, Heederik D. Predicting sensitization and allergy in bakery workers participating a surveillance programme. Eur Respir J 2015 2015/09;46.

Kelly KJ, Wang ML, Klancnik M, Petsonk EL. Prevention of IgE sensitization to latex in health care workers after reduction of antigen exposures. J Occup Environ Med 2011 /;53(8):934-940.

Kim J, Arrandale VH, Kudla I, Mardell K, Lougheed D, Holness DL. Educational intervention among farmers in a community health care setting. Occup Med (Lond) 2012 Sep;62(6):458-461.

Kim J, Arrandale VH, Kudla IN, Van Dyk D, Fulford A, Mardell K, et al. Preventative practices in occupational asthma: An educational intervention in farmers. Am J Respir Crit Care Med 2010 2010/05;181(1).

Klein Entink RH, Meijster , Pronk , Tan , Warren , Heederik . A dynamic population-based model for the development of work-related respiratory health effects among motor vehicle repair workers exposed to isocyanates. Occup Environ Med 2013 /;70.

LaMontagne AD, Radi S, Elder DS, Abramson MJ, Sim M. Primary prevention of latex related sensitisation and occupational asthma: a systematic review. Occup Environ Med 2006 May;63(5):359-364.

Latza U, Haamann F, Baur X. Effectiveness of a nationwide interdisciplinary preventive programme for latex allergy. Int Arch Occup Environ Health 2005 Jun;78(5):394-402.

Lazovich D, Parker DL, Brosseau LM, Milton FT, Dugan SK, Pan W, et al. Effectiveness of a worksite intervention to reduce an occupational exposure: the Minnesota wood dust study. Am J Public Health 2002 Sep;92(9):1498-1505.

Liss GM, Tarlo SM. Natural rubber latex-related occupational asthma: association with interventions and glove changes over time. Am J Ind Med 2001 Oct;40(4):347-353.

Meijster T, Tielemans E, Heederik D. Effect of an intervention aimed at reducing the risk of allergic respiratory disease in bakers: Change in flour dust and fungal alpha-amylase levels. Occup Environ Med 2009;66(8):543-549.

Meijster T, van Duuren-Stuurman B, Heederik D, Houba R, Koningsveld E, Warren N, et al. Cost-benefit analysis in occupational health: a comparison of intervention scenarios for occupational asthma and rhinitis among bakery workers. Occup Environ Med 2011 Oct;68(10):739-745.

Meijster T, Warren N, Heederik D, Tielemans E. What is the best strategy to reduce the burden of occupational asthma and allergy in bakers? Occup Environ Med 2011 Mar;68(3):176-182.

Merget R, Caspari C, Dierkes-Globisch A, Kulzer R, Breitstadt R, Kniffka A, et al. Effectiveness of a medical surveillance program for the prevention of occupational asthma caused by platinum salts: a nested case-control study. J Allergy Clin Immunol 2001;107(4):707-712.

NIOSH. Health hazard evaluation report: An evaluation of respiratory health at a syntactic foam manufacturing facility. By Stanton ML, LeBouf R, Schuler CR, Cummings KJ. 2015;HHE Report No. 2012-0107-3233.

O'Brien DM. Aerosol mapping of a facility with multiple cases of hypersensitivity pneumonitis: demonstration of mist reduction and a possible dose/response relationship. Appl Occup Environ Hyg 2003 Nov;18(11):947-952.

Piney M, Llewellyn D, O'Hara R, Saunders J, Cocker J, Jones K, et al. Reducing isocyanate exposure and asthma risk in motor vehicle repair. International Journal of Workplace Health Management 2015;8(4):272-283.

Provencher S. Physician based surveillance system for occupational respiratory diseases: The experience of PROPULSE, Quebec, Canada. Respir Care 1997;42(12):1154.

Reed PL, Rosenman K, Gardiner J, Reeves M, Reilly MJ. Evaluating the Michigan SENSOR Surveillance Program for work-related asthma. Am J Ind Med 2007 Sep;50(9):646-656.

Rees D, Phillips JI. Investigating the effectiveness of occupational health interventions in the workplace. Occup Environ Med 2014 Dec;71(12):809-810.

Renstrom A, Mattsson ML, Blidberg K, Doekes G, Bogdanovic J, Tovey E. Nasal air sampling for measuring inhaled wheat allergen in bakeries with and without facemask use. J Occup Environ Med 2006 Sep;48(9):948-954.

Sarlo K. Control of occupational asthma and allergy in the detergent industry. Ann Allergy Asthma Immunol 2003 May;90(5 Suppl 2):32-34.

Schinkel J, Fransman W, McDonnell PE, Klein Entink R, Tielemans E, Kromhout H. Reliability of the Advanced REACH Tool (ART). Ann Occup Hyg 2014 May;58(4):450-468.

Schmid K, Jungert B, Hager M, Drexler H. Is there a need for special preventive medical check-ups in employees exposed to experimental animal dust? Int Arch Occup Environ Health 2009 Feb;82(3):319-327.

Siriruttanapruk S, Burge PS. The impact of the COSHH regulations on workers with occupational asthma. Occup Med (Lond) 1997 Feb;47(2):101-104.

Smith TA. Preventing baker's asthma: an alternative strategy. Occup Med (Lond) 2004 Jan;54(1):21-27.

Stocks SJ, McNamee R, Turner S, Carder M, Agius RM. Assessing the impact of national level interventions on workplace respiratory disease in the UK: part 2--regulatory activity by the Health and Safety Executive. Occup Environ Med 2013 Jul;70(7):483-490.

Stocks SJ, McNamee , Carder , Agius . Adapting an interrupted time series design to voluntarily reported surveillance data: Advantages of statistical interactions in reducing bias. Occup Environ Med 2013 /;70.

Suarthana E, Malo J-, Heederik D. Which tools best predict the incidence of work-related sensitisation and symptoms? (Occupational and Environmental Medicine (2009) 66, (111-117)). Occup Environ Med 2009;66(10):711-712.

Taivainen AT, Tukianinen HO, Terho EO, Husman KR. Powered dust respirator helmets in the prevention of occupational asthma among farmers. Pneumologie 1999;53(9):M71-M72.

Tarlo SM, Easty A, Eubanks K, Parsons CR, Min F, Juvet S, et al. Outcomes of a natural rubber latex control program in an Ontario teaching hospital. J Allergy Clin Immunol 2001 Oct;108(4):628-633.

Van Deurssen EHAM. Occupational exposure to isocyanates; a baseline exposure assessment as basis for an intervention strategy. Occup Environ Med 2013 /;70.

Vandenplas O. Reduction of exposure in the management of occupational asthma. Curr Opin Allergy Clin Immunol 2011 Apr;11(2):75-79.

Vandenplas O, Dressel H, Wilken D, Jamart J, Heederik D, Maestrelli P, et al. Management of occupational asthma: Cessation or reduction of exposure? A systematic review of available evidence. Eur Respir J 2011;38(4):804-811.

Walters GI, Kirkham A, McGrath EE, Moore VC, Robertson AS, Burge PS. Twenty years of SHIELD: decreasing incidence of occupational asthma in the West Midlands, UK? Occup Environ Med 2015 Apr;72(4):304-310.

Westall LA. A risk-based approach to reducing exposure of staff to laboratory animal allergens. J Am Assoc Lab Anim Sci 2015 2015/10;54(5):656.

Wilken D, Baur X, Barbinova L, Preisser A, Meijer E, Rooyackers J, et al. What are the benefits of medical creening and surveillance? Eur Respir Rev 2012 /;21(124):105-111.

Appendix E: Potentially Useful Resources

E1. Prevention by Design

- Toxics Use Reduction Institute (Massachusetts, US): http://www.turi.org/
- Registration, Evaluation, Authorisation and Restriction of Chemicals (European Union): https://echa.europa.eu/regulations/reach
- Prevention Through Design (NIOSH, US): https://www.cdc.gov/niosh/topics/ptd/

E2. Control Banding/Exposure Control

- COSHH Essentials (HSE, UK): http://www.hse.gov.uk/coshh/essentials/
- International Chemical Control Toolkit (ILO): http://www.ilo.org/legacy/english/protection/safework/ctrl_banding/toolkit/icct/
- Control Banding (NIOSH, US): https://www.cdc.gov/niosh/topics/ctrlbanding/
- Chemical Exposure Management and Assessment System[36] (EU): http://cefic-lri.org/lri_toolbox/cemas-database/
- European Centre For Ecotoxicology and toxicology of Chemicals' Targeted Risk Assessment (TRA) tool: http://www.ecetoc.org/tools/targeted-risk-assessment-tra/
- SOBANE (Screening, Observation, Analysis, Expertise) (Belgium): http://www.deparisnet.be/DeparisEngl.htm
- NIOSH Engineering Controls Database (US): https://wwwn.cdc.gov/niosh-ecd/

E3. Hazard and/or Disease Surveillance

- CAREX Canada: http://www.carexcanada.ca/en/
- The Health and Occupation Research Network (THOR, UK): http://research.bmh.manchester.ac.uk/epidemiology/COEH/research/thor/
- Worker Health Surveillance (NIOSH, US): https://www.cdc.gov/niosh/topics/surveillance/program.html
- Health Hazard Evaluation Program (NIOSH, US): https://www.cdc.gov/niosh/hhe/
- Monitoring Occupational Diseases and tracing New and Emerging Risks in a NETwork (MODERNET, EU): http://www.modernet.org/
- Netherlands Centre for Occupational Diseases (Netherlands): http://www.occupationaldiseases.nl/

[36] As noted on the CEMAS website, the aim of the database is to enable organizations, particularly SMEs, to collect information that is relevant for the control of workplace risks in a manner that is both user-friendly and is consistent with prevailing regulatory expectations.

E4. EDUCATION AND TRAINING

- Occupational Health Clinics for Ontario Workers (OHCOW, Canada): http://www.ohcow.on.ca/
- UCLA Labor Occupational Safety and Health Program[37] (California, US): http://losh.ucla.edu/
- Centers for Agricultural Disease and Injury Research, Education, and Prevention (NIOSH, US): https://www.cdc.gov/niosh/oep/agctrhom.html
- Canadian Centre for Occupational Health and Safety (CCOHS): http://ccohs.ca/

E5. MULTI-FACETED APPROACHES

- Finnish Institute of Occupational Health (Finland): https://www.ttl.fi/en/
- French Agency for Food, Environmental and Occupational Health & Safety (ANSES, France): https://www.anses.fr/en
- Institut National de Recherche et de Securite (INRS, France): http://en.inrs.fr/
- Health and Safety Executive (HSE, UK): http://www.hse.gov.uk/
- Total Worker Health (NIOSH, US): https://www.cdc.gov/niosh/twh/centers.html
- Population Data BC (British Columbia, Canada): https://www.popdata.bc.ca/
- Partnership for Work, Health and Safety (British Columbia, Canada): http://pwhs.ubc.ca/
- Institut National de Sante Publique (INSPQ, Québec): https://www.inspq.qc.ca/en
- Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST, Québec): http://www.irsst.qc.ca/en/

E6. MISCELLANEOUS

- European Network on Silica (NEPSI, EU): http://www.nepsi.eu/
- Haz-Map[38] (US): https://hazmap.nlm.nih.gov/
- Institute for Work and Health (Canada) OHS Vulnerability Measure[39]: http://www.iwh.on.ca/ohs-vulnerability-measure

[37] As noted on its website, LOSH training and education emphasizes interactive activities, worker and group leadership, collective problem solving, and the development of joint labor-management health and safety programs. Through its community outreach (education, training, research and policy), LOSH strives to reach young workers, recent immigrants, those in traditionally underserved or high-risk occupations, and small businesses.

[38] Haz-Map is an occupational health database designed for health and safety professionals and for consumers seeking information about the adverse effects of workplace exposures to chemical and biological agents.

[39] The OHS Vulnerability Measure measures the extent to which a worker may be vulnerable to occupational health and safety risks at work.

References

1. Stocks SJ, McNamee R, Turner S, Carder M, Agius RM. Assessing the impact of national level interventions on workplace respiratory disease in the UK: part 1--changes in workplace exposure legislation and market forces. Occupational and environmental medicine. 2013;70(7):476-82.
2. Stocks SJ, McNamee R, Turner S, Carder M, Agius RM. Assessing the impact of national level interventions on workplace respiratory disease in the UK: part 2--regulatory activity by the Health and Safety Executive. Occupational and environmental medicine. 2013;70(7):483-90.
3. Mischke C, Verbeek JH, Job J, Morata TC, Alvesalo-Kuusi A, Neuvonen K, et al. Occupational safety and health enforcement tools for preventing occupational diseases and injuries. The Cochrane database of systematic reviews. 2013(8):Cd010183.
4. Tompa E, Trevithick S, McLeod C. Systematic review of the prevention incentives of insurance and regulatory mechanisms for occupational health and safety. Scandinavian journal of work, environment & health. 2007;33(2):85-95.
5. DG Employment, Social Affairs And Inclusion. Evaluation of the Practical Implementation of the EU Occupational Safety and Health (OSH) Directives in EU Member States. Main Report. June 2015.
6. Arenas JP, Suter AH. Comparison of occupational noise legislation in the Americas. An overview and analysis. Noise and Health 2014;16(72):306-19.
7. Finegold LS, von Gierke HE, Schomer PD, Berryd BF. Proposal for monitoring worldwide noise exposure and assessing the effectiveness of noise exposure policies and noise control technologies. Noise Control Eng J. 2001;49 (4):199-203.
8. Daniell W, Swan S, McDaniel M, Camp J, Cohen M, Stebbins J. Noise exposure and hearing loss prevention programmes after 20 years of regulations in the United States. Occup Environ Med. 2006;63:343–51.
9. Daniell W, Swan S, McDaniel M, Stebbins J, Seixas N, Morgan M. Noise Exposure and Hearing Conservation Practices in an Industry With High Incidence of Workers' Compensation Claims for Hearing Loss. American Journal Of Industrial Medicine. 2002;42:309-17.
10. Tamin Nor Saleha I, Noor Hassim I. A study on compliance to hearing conservation programme among industries in Negeri Sembilan, Malaysia. Industrial Health. 2006;44:584-91.
11. Mohammadi G. Hearing Conservation Programs In Selected Metal Fabrication Industries. Applied Acoustics. 2008;69:287–92.
12. Verbeek JH, Kateman E, Morata TC, Dreschler WA, Mischke C. Interventions to prevent occupational noise-induced hearing loss: a Cochrane systematic review. International Journal of Audiology. 2014;53(sup2):S84-S96.
13. Turner S, McNamee R, Agius R, Wilkinson SM, Carder M, Stocks SJ. Evaluating interventions aimed at reducing occupational exposure to latex and rubber glove allergens. Occupational and environmental medicine. 2012;69(12):925-31.
14. Stocks SJ, McNamee R, Turner S, Carder M, Agius RM. Has European Union legislation to reduce exposure to chromate in cement been effective in reducing the incidence of allergic contact dermatitis attributed to chromate in the UK? Occup Environ Med. 2012.
15. Halioua B, Bensefa-Colas L, Crepy MN, Bouquiaux B, Assier H, Billon S, et al. L'application du decret interdisant l'utilisation de ciments a forte teneur en chrome VI, a-t-il entraine une diminution des dermatoses professionnelles au ciment chez les travailleurs salaries du batiment et des travaux publics? Presse Medicale. 2013 Mar;42(3):e78-84.

16. Cleenewerck MB. Gants de protection et santé au travail. Archives des maladies professionnelles et de l'environnement. 2010;71(3):398-400.
17. Schnuch A, Geier J, Lessmann H, Arnold R, Uter W. Surveillance of contact allergies: methods and results of the Information Network of Departments of Dermatology (IVDK). European Journal of Allergy and Clinical Immunology. 2012.
18. Thyssen JP, Uter W, McFadden J, Menne T, Spiewak R, Vigan M, et al. The EU Nickel Directive revisited--future steps towards better protection against nickel allergy. Contact Dermatitis. 2011;64(3):121-5.
19. Hohenadel K, Straif K, Demers P, Blair A. The effectiveness of asbestos-related interventions in reducing rates of lung cancer and mesothelioma: A systematic review. Occupational and Environmental Medicine. 2011;68:A71.
20. Hutchings S, Cherrie JW, Van Tongeren M, Rushton L. Intervening to reduce the future burden of occupational cancer in britain: what could work? Cancer Prev Res (Phila). 2012;5(10):1213-22.
21. Jarvholm B, Burdorf A. Emerging evidence that the ban on asbestos use is reducing the occurrence of pleural mesothelioma in Sweden. Scand J Public Health. 2015;43(8):875-81.
22. Tuomi T, Linnainmaa M, Vaananen V, Reijula K. Application of good practices as described by the NEPSI agreement coincides with a strong decline in the exposure to respiratory crystalline silica in Finnish workplaces. The Annals of occupational hygiene. 2014;58(7):806–17.
23. Schmid K, Jungert B. Is there a need for special preventive medical checkups in employees exposed to experimental animal dust? Int Arch Environ Health. 2008;82:319-27.
24. Heederik D, Houba R, Liss G, Millerick-Ma M. Protecting the worker and modifying the work environment. In: Malo J-L, Chan-Yeung M, Bernstein D, editors. Asthma in the Workplace, 4th Edition. Boca Raton: CRC Press Taylor and Francis Group; 2013. p. 138-49.
25. The National Institute for Occupational Safety and Health (NIOSH). Engineering Controls Database [Available from: https://wwwn.cdc.gov/niosh-ecd/. [Last update: November 25, 2015].
26. Naumann B. Control banding in the pharmaceutical industry, paper prepared for the Australian Institute of Occupational Hygienists (AIOH) 2008 [Available from: https://ftp.cdc.gov/pub/Documents/OEL/12. Niemeier/References/Naumann (ControlBanding)_2008_AIOH.pdf]. Accessed 3 December 2016.
27. Canadian Centre for Occupational Health and Safety. OSH Answers Fact Sheets. Control Banding [Available from: https://www.ccohs.ca/oshanswers/chemicals/control_banding.html. Last update: February 7, 2017].
28. Money C. European Experiences in the Development of Approaches for the Successful Control of Workplace Health Risks. Ann Occup Hyg. 2003;47(7):533-40.
29. Landberg HE, Berg P, Andersson L, Bergendorf U, Karlsson J-E, Westberg H, et al. Comparison and Evaluation of Multiple Users' Usage of the Exposure and Risk Tool: Stoffenmanager 5.1. Ann Occup Hyg. 2015;59(7): 821–35.
30. Lavoie J, Neesham-Grenon E, Debia M, Cloutier Y, Marchand G. IRSST Report R-804. Development of a Control Banding Method for Selecting Respiratory Protection Against Bioaerosols. Montreal, QC: Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST); December 2013.
31. Health and Safety Executive. COSHH Essentials [Available from: http://www.hse.gov.uk/coshh/essentials/].
32. International Labour Organization. International Chemical Control Toolkit [Available from: http://www.ilo.org/legacy/english/protection/safework/ctrl_banding/toolkit/icct/. Last update: 20.06.2006].

33. Lee E, Harper M, Bowen R, Slaven J. Evaluation of COSHH Essentials: Methylene Chloride, Isopropanol, and Acetone Exposures in a Small Printing Plant. Ann Occup Hyg. 2009;53(5):463–74.
34. Lee E, Slaven J, Bowen R, Harper M. Evaluation of the COSHH Essentials Model with a Mixture of Organic Chemicals at a Medium-Sized Paint Producer. Ann Occup Hyg. 2011;55(1):16–29.
35. Tischer M, Bredendiek-Kämper S, Poppek U. Evaluation of the HSE COSHH Essentials Exposure Predictive Model on the Basis of BAuA Field Studies and Existing Substances Exposure Data. Ann Occup Hyg. 2003;47(7):557–69.
36. Hashimoto H, Goto T, Nakachi N, Suzuki H, Takebayashi T, Kajiki S, et al. Evaluation of the control banding method - comparison with measurement-based comprehensive risk assessment. J Occup Health. 2007;49:482-92.
37. Jones RM, Nicas M. Evaluation of COSHH Essentials for Vapor Degreasing and Bag Filling Operations. Ann Occup Hyg. 2006;50(2):137-47.
38. NIOSH. Qualitative Risk Characterization and Management of Occupational Hazards: Control Banding (CB). A Literature Review and Critical Analysis. Department Of Health And Human Services, Centers for Disease Control and Prevention; 2009.
39. Canadian Centre for Occupational Health and Safety. OSH Answers Fact Sheets. Control Banding. [updated February 7, 2017].
40. The National Institute for Occupational Safety and Health (NIOSH). Control Banding [Available from: https://www.cdc.gov/niosh/topics/ctrlbanding/. [Last update: March 24, 2015].
41. Scheffers T, Doornaert B, Berne N, van Breukelen G, Leplay A, van Miert E. On the Strength and Validity of Hazard Banding. Ann Occup Hyg. 2016;60(9):1049–61.
42. Kromhout H. Commentary: Hygiene Without Numbers. Ann Occup Hyg. 2016;60(4):403–4.
43. Jones RM, Nicas M. Margins of Safety Provided by COSHH Essentials and the ILO Chemical Control Toolkit. Ann Occup Hyg. 2006;50(2):149-56.
44. Golmohammadi R, Giahi O, Aliabadi M, Darvishi E. An Intervention for Noise Control of Blast Furnace in Steel Industry. J Res Health Sci. 2014;14(4):287-90.
45. Cockrell Jr. W, Balanay J, Dawkins W. Engineering Control of Noise From 4-Roll Calender Operations in Tire Manufacturing. Journal of Occupational and Environmental Hygiene. 2015;12(9):D193-D200.
46. Pelegrin A, Canuet L, Morales M. Predictive factors of occupational noise-induced hearing loss in Spanish workers A prospective study. Noise and Health. 17.78 (2015): 343. Health Reference Center Academic. Web. 20 June 2016.
47. Meira T, Santana V, Ferrite S. Gender and other factors associated with the use of hearing protection devices at work. Rev Saúde Pública. 2015;49:76.
48. Allmers H, Schmengler J, Skudlik C. Primary prevention of natural rubber latex allergy in the German health care system through education and intervention. The Journal of allergy and clinical immunology. 2002;110(2):318-23.
49. Kutting B, Baumeister T, Weistenhofer W, Pfahlberg A, Uter W, Drexler H. Effectiveness of skin protection measures in prevention of occupational hand eczema: results of a prospective randomized controlled trial over a follow-up period of 1 year. Br J Dermatol. 2010;162(2):362-70.
50. Geens T, Aerts E, Borguet M, Haufroid V, Godderis L. Exposure of hairdressers to aromatic diamines: an interventional study confirming the protective effect of adequate glove use. Occup Environ Med. 2016;73(4):221-8.
51. Bauer A, Schmitt J, Bennett C, Coenraads PJ, Elsner P, English J, et al. Interventions for preventing occupational irritant hand dermatitis. The Cochrane database of systematic reviews. 2010(6):Cd004414.

52. Ghorbani Shahna F, Bahrami A, Farasati F. Application of local exhaust ventilation system and integrated collectors for control of air pollutants in mining company. Ind Health. 2012;50(5):450-7.
53. Pratt SL, Grainger AP, Todd J, Meena GG, Rogers AJ, Davies B. Evaluation and control of employee exposure to diesel particulate at several Australian coal mines. Applied Occupational and Environmental Hygiene. 1997;12(12):1032-7.
54. Liu ZG, Wall JC, Barge P, Dettmann ME, Ottinger NA. Investigation of PCDD/F emissions from mobile source diesel engines: impact of copper zeolite SCR catalysts and exhaust aftertreatment configurations. Environ Sci Technol. 2011;45(7):2965-72.
55. Hedges1 K, Djukic2 F, Irving3 G. Diesel Particulate Matter in Underground Mines–Controlling the Risk (an update) 2007.
56. Robinson MA, Olson MR, Liu ZG, Schauer JJ. The effects of emission control strategies on light-absorbing carbon emissions from a modern heavy-duty diesel engine. J Air Waste Manag Assoc. 2015;65(6):759-66.
57. Bugarski AD. Controlling exposure to diesel emissions in underground mines Englewood, Colorado: Society for Mining, Metallurgy, and Exploration, Inc.; 2012 [Available from: http://site.ebrary.com/id/10742718.
58. Stevens G, Wilson A, Hammitt JK. A benefit-cost analysis of retrofitting diesel vehicles with particulate filters in the Mexico City metropolitan area. Risk Analysis. 2005;25(4):883-99.
59. Radnoff DL, Kutz MK. Exposure to crystalline silica in abrasive blasting operations where silica and non-silica abrasives are used. The Annals of occupational hygiene. 2014;58(1):19-27.
60. Mancuso JD, McCoy J, Pelka B, Kahn PJ, Gaydos JC. The challenge of controlling lead and silica exposures from firing ranges in a special operations force. Mil Med. 2008;173(2):182-6.
61. Morteza MM, Hossein K, Amirhossein M, Naser H, Gholamhossein H, Hossein F. Designing, construction, assessment, and efficiency of local exhaust ventilation in controlling crystalline silica dust and particles, and formaldehyde in a foundry industry plant. Arh Hig Rada Toksikol. 2013;64(1):123-31.
62. Cooper MR, Susi P, Rempel D. Evaluation and control of respirable silica exposure during lateral drilling of concrete. Journal of occupational and environmental hygiene. 2012;9(2):D35-41.
63. Golla V, Heitbrink W. Control Technology for Crystalline Silica Exposures in Construction: Wet Abrasive Blasting. Journal of Occupational and Environmental Hygiene. 2004;1(3):D26-D32.
64. Tjoe Nij E, Hilhorst S, Spee T, Spierings J, Steffens F, Lumens M, et al. Dust control measures in the construction industry. Annals of Occupational Hygiene. 2003;47(3):211-8.
65. van Deurssen E, Pronk A, Spaan S, Goede H, Tielemans E, Heederik D, et al. Quartz and respirable dust in the Dutch construction industry: a baseline exposure assessment as part of a multidimensional intervention approach. The Annals of occupational hygiene. 2014;58(6):724-38.
66. Akbar-Khanzadeh F, Brillhart R. Respirable Crystalline Silica Dust Exposure During Concrete Finishing (Grinding) Using Hand-held Grinders in the Construction Industry. Annals of Occupational Hygiene. 2002;46(3):341-6.
67. Beamer BR, Shulman S, Maynard A, Williams D, Watkins D. Evaluation of misting controls to reduce respirable silica exposure for brick cutting. Ann Occup Hyg. 2005;49(6):503-10.
68. Meeker JD, Cooper MR, Lefkowitz D, Susi P. Engineering control technologies to reduce occupational silica exposures in masonry cutting and tuckpointing. Public Health Rep. 2009;124 Suppl 1:101-11.
69. Alexander BM, Esswein EJ, Gressel MG, Kratzer JL, Feng HA, King B, et al. The development and testing of a prototype mini-baghouse to control the release of respirable

crystalline silica from sand movers. Journal of Occupational and Environmental Hygiene. 2016;13(8):628-38.
70. Collingwood S, Heitbrink WA. Field evaluation of an engineering control for respirable crystalline silica exposures during mortar removal. J Occup Environ Hyg. 2007;4(11):875-87.
71. Croteau GA, Guffey SE, Flanagan ME, Seixas NS. The effect of local exhaust ventilation controls on dust exposures during concrete cutting and grinding activities. AIHA journal : a journal for the science of occupational and environmental health and safety. 2002;63(4):458-67.
72. Andersson L, Bryngelsson IL, Ohlson CG, Naystrom P, Lilja BG, Westberg H. Quartz and dust exposure in Swedish iron foundries. Journal of occupational and environmental hygiene. 2009;6(1):9-18.
73. Gorman Ng M, Davies H. A task-based silica exposure modelling tool for construction companies. 9th biennial meeting of the Canadian Association for Research on Work and Health (CARWH), October 16-18, 2016; Toronto, ON.
74. Leppamaki S, Partonen T, Piiroinen P, Haukka J, Lonnqvist J. Timed bright-light exposure and complaints related to shift work among women. Scand J Work Environ Health. 2003;29(1):22-6.
75. Jeppesen HJ, Kleiven M, Boggild H. Can varying the number of teams in a shift schedule constitute a preventive strategy? Rev Saude Publica. 2004;38 Suppl:47-55.
76. Joyce K, Pabayo R, Critchley JA, Bambra C. Flexible working conditions and their effects on employee health and wellbeing. Cochrane Database Syst Rev. 2010(2):Cd008009.
77. Bambra CL, Whitehead MM, Sowden AJ, Akers J, Petticrew MP. Shifting Schedules. The Health Effects of Reorganizing Shift Work. American Journal of Preventive Medicine. 2008;34(5):427-34.
78. Baatjies R, Meijster T, Heederik D, Sander I, Jeebhay M. Effectiveness of interventions to reduce flour dust exposures in supermarket bakeries in South Africa. Occup Environ Med 72. 2014;72:811 – 8.
79. Smith T. Preventing baker's asthma: an alternative strategy. Occupational Medicine. 2004;54:21-7 [accessed 3 December 2016].
80. Baatjies R, Meijster T, Heederik D, Doekes G, Jeebhay M. A group randomised controlled intervention study of workplace exposure control measures to reduce flour dust exposure in supermarket bakeries with a high baker's allergy and asthma burden. Allergy. 2012;67:74-5.
81. OSHA. Best Practices for the Safe Use of Glutaraldehyde in Health Care. 2006. [Available at: https://www.osha.gov/Publications/3258-08N-2006-English.html. Accessed 3 December 2016].
82. Donham K, Lange J, Kline A, Rautianen R, Grafft L. Prevention of Occupational Respiratory Symptoms Among Certified Safe Farm Intervention Participants. Journal of Aeromedicine. 2011;16:40-51. [Available at: https://www.ncbi.nlm.nih.gov/pubmed/21213163. Accessed 30 Nov 2016].
83. Zielinski J, Garner M, Band P, Krewski D, Shilnikova N, Jiang H, et al. Health Outcomes of Low-Dose Ionizing Radiation Exposure Among Medical Workers: A Cohort Study of The Canadian National Dose Registry of Radiation Workers. International journal of occupational medicine and environmental health. 2009;22(2):149-56.
84. Kauppinen T, Saalo A, Pukkala E, Virtanen S, Karjalainen A, Vuorela R. Evaluation of a National Register on Occupational Exposure to Carcinogens: Effectiveness in the Prevention of Occupational Cancer, and Cancer Risks among the Exposed Workers. Ann Occup Hyg. 2007;51(5):463-70.
85. Kauppinen T, Uuksulainen S, Saalo A, Mäkinen I, Pukkala E. Use of the Finnish Information System on Occupational Exposure (FINJEM) in Epidemiologic, Surveillance, and Other Applications. Ann Occup Hyg. 2014;58(3):380-96.

86. Carder M, Bensefa-Colas L, Mattioli S, Noone P, Stikova E, Valenty M, et al. A review of occupational disease surveillance systems in Modernet countries. Occupational Medicine 2015;65:615–25.
87. Weissman DN. Medical surveillance for the emerging occupational and environmental respiratory diseases. Current opinion in allergy and clinical immunology. 2014;14(2):119-25.
88. Valenty M, Homère J, Lemaitre A, Plaine J, Ruhlman M, Cohidon C, et al. Surveillance programme for uncompensated work-related diseases in France. Occupational Medicine. 2015;65:642-50.
89. Stocks SJ, McNamee R, van der Molen HF, Paris C, Urban P, Campo G, et al. Trends in incidence of occupational asthma, contact dermatitis, noise-induced hearing loss, carpal tunnel syndrome and upper limb musculoskeletal disorders in European countries from 2000 to 2012. Occupational and environmental medicine. 2015;72(4):294-303.
90. Money A, Carder M, Hussey L, Agius RM. The utility of information collected by occupational disease surveillance systems. Occupational Medicine. 2015;65:626-31.
91. Lenderink AF, Keirsbilck S, van der Molen HF, Godderis L. Online reporting and assessing new occupational health risks in SIGNAAL. Occupational medicine (Oxford, England). 2015;65(8):638-41.
92. Godderis L, Mylle G, Coene M, Verbeek C, Viaene B, Bulterys S, et al. Data warehouse for detection of occupational diseases in OHS data. Occupational Medicine. 2015;65:651–8.
93. Campo G, Papale A, Baldasseroni A, Di Leone G, Magna B, Martini B, et al. The surveillance of occupational diseases in Italy: the MALPROF system. Occupational medicine (Oxford, England). 2015;65(8):632-7.
94. Joe L, Roisman R, Beckman S, Jones M, Beckman J, Frederick M, et al. Using Multiple Data Sets for Public Health Tracking of Work-Related Injuries and Illnesses in California. American journal of industrial medicine. 2014;57:1110–9.
95. Wuellner S, Bonauto D. Injury Classification Agreement in Linked Bureau of Labor Statistics and Workers' Compensation Data. American journal of industrial medicine. 2014;57:1100–9.
96. McTague M, Galusha D, Dixon-Ernst C, Kirsche S, Slade M, Cullen M, et al. Impact of daily noise exposure monitoring on occupational noise exposures in manufacturing workers. International Journal of Audiology. 2013;52:sup1:S3-S8.
97. Rabinowitz P, Galusha D, Kirsche S, Cullen M, Slade M, Dixon-Ernst C. Effect of daily noise exposure monitoring on annual rates of hearing loss in industrial workers. Occupational and Environmental Medicine. 2011;68(6):414-8.
98. Williams W, Brumby S, Calvano A, Hatherell T, Mason H, Mercer-Grant C, et al. Farmers' work-day noise exposure. The Australian Journal of Rural Health. 2015.
99. Dudarewicz A, Pawlaczyk-Łuszczyńska M, Zamojska-Daniszewska M, Zaborowski K. Exposure to excessive sounds during orchestra reheaersals and temporary changes in hearing among musicians. Medycyna Pracy. 2015;66(4):479-86.
100. Beckett W, Chamberlain D, Hallman E, May J, Hwang S-A, Gomez M, et al. Hearing Conservation for Farmers: Source Apportionment of Occupational and Environmental Factors Contributing to Hearing Loss. Journal of Occupational and Environmental Medicine. 2000;42(8):806-13.
101. Campo P. Les ototoxiques exacerbent les surdites induites par le brui. Environnement, Risques et Sante. 2015;14(2):125-34.
102. Konrad-Martin D, Reavis KM, McMillan G, Helt WJ, Dille M. Proposed comprehensive ototoxicity monitoring program for VA healthcare (COMP-VA). Journal of rehabilitation research and development. 2014;51(1):81-100.
103. Morata TC. Promoting hearing health and the combined risk of noise-induced hearing loss and ototoxicity. Audiological Medicine. 2007;5(1):33-40.

104. Nicholson PJ, Llewellyn D, English JS. Evidence-based guidelines for the prevention, identification and management of occupational contact dermatitis and urticaria. Contact Dermatitis. 2010;63(4):177-86.
105. Weistenhofer W, Baumeister T, Drexler H, Kutting B. How to quantify skin impairment in primary and secondary prevention? HEROS: a proposal of a hand eczema score for occupational screenings. Br J Dermatol. 2011;164(4):807-13.
106. Sean M. Controlling diesel emissions in underground mining with an evolving regulatory structure in Canada and the United States of America.
107. Seniori Costantini A, Chellini E. The experience of the Mesothelioma Registry of Tuscany in assessing health hazard associated with asbestos exposure. Med Lav. 1997;88(4):310-5.
108. Pasiechnik D, Ziegler D. The power of empathy in advocating for cancer control policy: Combining evidence and a personal cancer story to motivate stakeholders to advocate for the first asbestos registry in Canada. Asia-Pacific Journal of Clinical Oncology. 2014;10:22.
109. Nicholson P, Cullinan P, Burge P, Boyle C. Occupational asthma: Prevention, identification & management: Systematic review & recommendations. London: British Occupational Health Research Foundation; 2010.
110. Fishwick D. 2007.
111. Mackie. 2008.
112. Kopferschmitt-Kubler MC, Romier-Borgnat S, Popin E, Port-Wasser C, Bessot JC, Pauli G. Les systèmes de surveillance de l'asthme professionnel à travers le monde. Revue Francaise d'Allergologie et d'Immunologie Clinique. 2000;40(3):374-80.
113. Tarlo S, Liss G, Yeung K. Changes in rates and severity of compensation claims for asthma due to diisocyanates: a possible effect of medical surveillance measures. Occupational and Environmental Medicine. 2002;59:58-62.
114. Fishwick D, Sen D, Barker P, Codling A, Fox D, Naylor S. Health surveillance for occupational asthma in the UK. Occupational Medicine. 2016;66:365-70.
115. Luong Thanh B, Laopaiboon M, Koh D, Sakunkoo P, Moe H. Behavioural interventions to promote workers' use of respiratory protective equipment. Cochrane Database of Systematic Reviews 2016, Issue 12.
116. Robson L, Stephenson C, Schulte P, Amick B, Chan S, Bielecky A, et al. A systematic review of the effectiveness of training & education for the protection of workers. Toronto, ON: Institute for Work & Health. Cincinnati, OH: National Institute for Occupational Safety and Health; 2010.
117. Neitzel R, Meischke H, Daniell W, Trabeau M, Somers S, Seixas N. Development and pilot test of hearing conservation training for construction workers. American Journal Of Industrial Medicine. 2008;51:120–9
118. Seixas N, Neitzel R, Stover B, Sheppard L, Daniell B, Edelson J, et al. A multi component intervention to promote hearing protector use among construction workers. International Journal of Audiology. 2011;50:sup1:S46-S56.
119. Gates D, Jones M. A pilot study to prevent hearing loss in farmers. Public Health Nursing. 2007;24(6):547–53.
120. Marlenga B, Linneman J, Pickett W, Wood D, Kirkhorn S, Broste S, et al. Randomized trial of a hearing conservation intervention for rural students long-term outcomes. Pediatrics 2011;128(5):e1139-e46.
121. Lusk S, Saeng Hong O, Ronis D, Eakin B, Kerr M, Early M. Effectiveness of an Intervention to Increase Construction Workers' Use of Hearing Protection. Human Factors. 1999;41(3):487–94.
122. Stephenson M, Shaw P, Stephenson C, Graydon P. Hearing loss prevention for carpenters Part 2 - Demonstration projects using individualized and group training. Noise and Health 1351. 2011:122.

123. Stephenson C, Stephenson M. Hearing loss prevention for carpenters: Part 1 - Using health communication and health promotion models to develop training that works. Noise and Health 1351 2011:113.
124. Lusk S, Ronis D, Kazanis A, Eakin B, Hong O, Raymond D. Effectiveness of a tailored intervention to increase factory workers' use of hearing protection. Nursing Research. 2005;52(5):289-95.
125. Hong O, Ronis D, Lusk S, Kee G-S. Efficacy of a computer-based hearing test and tailored hearing protection intervention. International Journal of Behavioral Medicine. 2006;13(4):304–14.
126. Hong O, Eakin B, Chin D, Feld J, Vogel S. An Internet-based tailored hearing protection intervention for firefighters. Health Promotion Practice. 2013;14(4):572–9.
127. El Dib R, Atallah A, Andriolo R, Garcia de Oliveira Soares B, Verbeek J. A systematic review of the interventions to promote the wearing of hearing protection. Sao Paulo Med J. 2007;125(6):362-9.
128. Clemmensen KK, Randboll I, Ryborg MF, Ebbehoj NE, Agner T. Evidence-based training as primary prevention of hand eczema in a population of hospital cleaning workers. Contact dermatitis. 2015;72(1):47-54.
129. Clemmensen KKB, Randboll I, Ryborg MF, Ebbehoj NE, Agner T. Prevention of hand eczema in hospital cleaning workers. Contact Dermatitis. 2014;70:57.
130. Held E, Mygind K, Wolff C, Gyntelberg F, Agner T. Prevention of work related skin problems: an intervention study in wet work employees. Occup Environ Med. 2002.
131. Steengaard SS, Bregnhoj A, Johansen JD. Hand eczema among hairdressing apprentices in Denmark following a nationwide prospective intervention programme: 6-year follow-up. Contact Dermatitis. 2016.
132. Bregnhoj A, Menne T, Johansen JD, Sosted H. Prevention of hand eczema among Danish hairdressing apprentices: an intervention study. Occup Environ Med. 2012;69(5):310-6.
133. Maxfield AM, Lewis MJ, Tisdale JA, Lachenmayr S, Lum M. Effects of a preventive message in the organizational context: occupational latex allergy in hospitals. Am J Ind Med. 1999;Suppl 1:125-7.
134. Radulescu M, Bock M, Bruckner T, Ellsasser G, Fels H, Diepgen TL. Health education about occupational allergies and dermatoses for adolescents. Journal der Deutschen Dermatologischen Gesellschaft = Journal of the German Society of Dermatology : JDDG. 2007;5(7):576-81.
135. Bauer A, Kelterer D, Bartsch R, Pearson J, Stadeler M, Kleesz P, et al. Skin protection in bakers' apprentices. Contact Dermatitis. 2002;46(2):81-5.
136. Bauer A, Kelterer D, Bartsch R, Schlegel A, Pearson J, Stadeler M, et al. Prevention of hand dermatitis in bakers' apprentices: different efficacy of skin protection measures and UVB hardening. Int Arch Occup Environ Health. 2002;75(7):491-9.
137. Dulon M, Pohrt U, Skudlik C, Nienhaus A. Prevention of occupational skin disease: a workplace intervention study in geriatric nurses. Br J Dermatol. 2009;161(2):337-44.
138. Held E, Wolff C, Gyntelberg F, Agner T. Prevention of work-related skin problems in student auxiliary nurses: an intervention study. Contact Dermatitis. 2001;44(5):297-303.
139. Lee A, Nixon R, Frowen K. Reduction of use of latex gloves in food handlers: an intervention study. Contact Dermatitis. 2001;44(2):75-9.
140. Arbogast JW, Fendler EJ, Hammond BS, Cartner TJ, Dolan MD, Ali Y, et al. Effectiveness of a hand care regimen with moisturizer in manufacturing facilities where workers are prone to occupational irritant dermatitis. Dermatitis. 2004;15(1):10-7.
141. Loffler H, Bruckner T, Diepgen T, Effendy I. Primary prevention in health care employees: a prospective intervention study with a 3-year training period. Contact dermatitis. 2006;54(4):202-9.

142. Schwanitz HJ, Riehl U, Schlesinger T, Bock M, Skudlik C, Wulfhorst B. Skin care management: educational aspects. Int Arch Occup Environ Health. 2003;76(5):374-81.
143. Flyvholm MA, Mygind K, Sell L, Jensen A, Jepsen KF. A randomised controlled intervention study on prevention of work related skin problems among gut cleaners in swine slaughterhouses. Occup Environ Med. 2005;62(9):642-9.
144. Heron RJ. Worker education in the primary prevention of occupational dermatoses. Occupational medicine (Oxford, England). 1997;47(7):407-10.
145. van Gils RF, Boot CR, van Gils PF, Bruynzeel D, Coenraads PJ, van Mechelen W, et al. Effectiveness of prevention programmes for hand dermatitis: a systematic review of the literature. Contact Dermatitis. 2011;64(2):63-72.
146. Richter K, Acker J, Kamcev N, Bajraktarov S, Piehl A, Niklewski G. Recommendations for the prevention of breast cancer in shift workers. EPMA Journal. 2011;2(4):351-6.
147. Kerin A, Aguirre A. Improving health, safety, and profits in extended hours operations (shiftwork). Ind Health. 2005;43(1):201-8.
148. Lerman SE, Eskin E, Flower DJ, George EC, Gerson B, Hartenbaum N, et al. Fatigue risk management in the workplace. Journal of Occupational and Environmental Medicine. 2012;54(2):231-58.
149. Hickey J, Saunders J, Davern P. The extent and influence of Asbestos Safety Awareness training among managers who had previously commissioned an asbestos survey in their workplace buildings. Ind Health. 2015;53(5):398-409.
150. Weidman J, Dickerson DE, Koebel CT. Effective Intervention Strategy to Improve Worker Readiness to Adopt Ventilated Tools. Journal of Construction Engineering and Management. 2016;10.
151. Kim J, Arrandale V, Kudla I, Mardell K, Lougheed D, Holness D. Educational intervention among farmers in a community health care setting. Occupational Medicine. 2012;62:158-61.
152. Ghajar-Khosravi S, Tarlo S, Liss G, Chignell M, Ribeiro M, Levinson A, et al. Development of a web-based, work-related asthma educational tool for patients with asthma. Can Respir J 2013;20(6):417-23.
153. Lipszyc J, Gotzev S, Scarborough J, Liss G, Gupta S, Tarlo S. Evaluation of the efficacy of a web-based work-related asthma educational tool. Journal of Asthma. 2016;53(10).
154. Fontaine G, Brahimi C, Fortier M. Occupational Health Competency Framework for Public Health in Québec. Québec: Government of Québec; August 2013.
155. O'Brien I, Driscoll T, Ackermann B. Description and Evaluation of a Hearing Conservation Program in Use in a Professional Symphony Orchestra. Ann Occup Hyg. 2015;59(3):265–76.
156. Berg R, Pickett W, Fitz-Randolph M, Broste S, Knobloch M, Wood D, et al. Hearing conservation program for agricultural students: short-term outcomes from a cluster-randomized trial with planned long-term follow-up. Preventive Medicine. 2009;49:546–52.
157. Knobloch M, Broste S. A hearing conservation program for Wisconsin youth working in agriculture. J Sch Health. 1998;68(8):313-8.
158. Brown TP, Rushton L, Williams HC, English JS. Intervention implementation research: an exploratory study of reduction strategies for occupational contact dermatitis in the printing industry. Contact Dermatitis. 2007;56(1):16-20.
159. Sell L, Flyvholm MA, Lindhard G, Mygind K. Implementation of an occupational skin disease prevention programme in Danish cheese dairies. Contact dermatitis. 2005;53(3):155-61.
160. van der Meer EW, Boot CR, Twisk JW, Coenraads PJ, Jungbauer FH, van der Gulden JW, et al. Hands4U: the effectiveness of a multifaceted implementation strategy on behaviour related to the prevention of hand eczema-a randomised controlled trial among healthcare workers. Occup Environ Med. 2014;71(7):492-9.
161. van der Meer EW, Boot CR, van der Gulden JW, Knol DL, Jungbauer FH, Coenraads PJ, et al. Hands4U: the effects of a multifaceted implementation strategy on hand eczema

prevalence in a healthcare setting. Results of a randomized controlled trial. Contact dermatitis. 2015;72(5):312-24.
162. Huuskonen MS, Rantanen J. Finnish Institute of Occupational Health (FIOH): prevention and detection of asbestos-related diseases, 1987-2005. Am J Ind Med. 2006;49(3):215-20.
163. Corley EA, Dehart-Davis L, Lindner J, Rodgers MO. Inspection/maintenance program evaluation: replicating the Denver Step Method for an Atlanta fleet. Environ Sci Technol. 2003;37(12):2801-6.
164. Yan F, Bond TC, Streets DG. Effectiveness of mitigation measures in reducing future primary particulate matter emissions from on-road vehicle exhaust. Environ Sci Technol. 2014;48(24):14455-63.
165. Haas EJ, Cecala AB, Hoebbel CL. Using Dust Assessment Technology to Leverage Mine Site Manager-Worker Communication and Health Behavior: A Longitudinal Case Study. J Progress Res Soc Sci. 2016;3(1):154-67.
166. Horrocks N, Pounder R. Working the night shift: preparation, survival and recovery--a guide for junior doctors. Clin Med (Lond). 2006;6(1):61-7.
167. Kogi K. Healthy shiftwork, healthy shiftworks. J Hum Ergol (Tokyo). 2001;30(1-2):3-8.
168. Van Reeth O. Sleep and circadian disturbances in shift work: strategies for their management. Horm Res. 1998;49(3-4):158-62.
169. Peate I. Strategies for coping with shift work. Nurs Stand. 2007;22(4):42-5.
170. Knauth P, Hornberger S. Preventive and compensatory measures for shift workers. Occup Med (Lond). 2003;53(2):109-16.
171. Ogeil R, Barger L, Lockley S, O'Brien C, Sullivan J, Qadri S, et al. Use of sleep and wake promoting drugs in North American police officers: associations with mental health, performance and safety. 30th Annual Meeting of the Associated Professional Sleep Societies; Denver, CO United States: Associated Professional Sleep Societies,LLC; 2016.
172. Neil-Sztramko SE, Pahwa M, Demers PA, Gotay CC. Health-related interventions among night shift workers: a critical review of the literature. Scand J Work Environ Health. 2014;40(6):543-56.
173. Liss G, Tarlo S, Labrecque M, Malo J-L. Prevention and surveillance. In: Malo J-L, Chan-Yeung M, Bernstein D, editors. Asthma in the Workplace, Fourth Edition: CRC Press. Taylor & Francis Group; 2013.
174. Meijster T, van Duuren B, Heederik D, Houba R, Koningsveld E, Warren N, et al. Cost-benefit analysis in occupational health: a comparison of intervention scenarios for occupational asthma and rhinitis among bakery workers. Occupational and environmental medicine. 2011;68(10):739 – 45.
175. Miedinger D, Rast HP, Stöhr S, Jost M. Asthme professionnel: identification, diagnostic et gestion. Prev Med Switzerland - Occupational Medicine Division - SUVA. 2012.
176. Lussier F, Séguin P, Haouara F, Hiller S, Lavoie M, Phénix P. Réseau de référence pour l'asthme professionnel - Révision du modèle (Provincial) Montreal, QC: Quebec Agency for Health and Social Services; 2013.
177. Piney M, Llewellyn D, O'Hara R, Saunders J, Cocker J, Jones K, et al. Reducing isocyanate exposure and asthma risk in motor vehicle repair. International Journal of Workplace Health Management. 2015;8(4):272-83.
178. Gannon P. Pre-employment assessment and health surveillance for employees exposed to occupational asthmagens: overview. Occupational Medicine. 2005;55:586-7.
179. Fisher R, Saunders W, Murray S, Stave G. Prevention of Laboratory Allergy. Journal of occupational and environmental medicine. 1998;40(7):609 – 13.
180. Gordon S, Preece R. Prevention of laboratory allergy. 53. 2003:371 – 7.