IASET: Journal of General Medicine and Pharmacy (IASET: JGMP)
ISSN(P): Applied ISSN(E): Applied
Vol. 2, Issue 1, Jan - Jun 2016; 25-40

International Academy of Science, Engineering and Technology
Connecting Researchers; Nurturing Innovations

ONLINE EDUCATIONAL RESOURCES REGARDING THE PREVENTION OF OCCUPATIONAL DISEASES

ALDO TOMMASO MARROCCO

ABSTRACT

The article presents informative and educational resources that deal with the occupational diseases and their prevention. Such documents can be downloaded for free from the internet and consist of *text, images, quizzes, videos and educational stories in comic book format*. They may be of interest for the general reader, as well as for teachers that can use them with the method felt as most appropriate.

A few documents presented at the beginning of this article provide an overview on the *history of occupational medicine*.

The article presents documents that deal with stress, often consequent to the organization of the work, and related occupational diseases including in particular the *cardiovascular* ones.

Occupational exposure to chemicals is linked to higher risk of *cancer*. Documents quoted in this article discuss the exposure of workers and provide comments on the factors involved in the risk of cancer, thus helping to understand how it can be prevented in the workplace.

Several documents deal with *musculoskeletal disorders*, exposures that cause them, exercises and correct position of the body in the workplace that may help in their prevention. The documents also mention the importance of variations and rotations in repetitive tasks that cause musculoskeletal disorders.

Respiratory and skin diseases, and their prevention, are also analyzed in several documents presented in the article.

Particular situations, such as child labour and electrical and electronic waste recycling are also discussed.

The prevention of occupational diseases is less expensive and more effective than treatment and rehabilitation.

KEYWORDS: Occupational Diseases, Prevention, Educational Resources, Cardiovascular, Cancer, Musculoskeletal Disorders

INTRODUCTION

According to the International Labour Office (ILO), on a global scale, an estimated 160 million of non fatal work-related diseases occur every year while 2.02 million people die from occupational diseases. The global number reaches 2.34 million when the number of deaths from accidents is adding (2). Compared to the latter, occupational diseases remain largely invisible despite the magnitude of losses and sufferings that they cause (3).

The occupational diseases are considered hidden epidemics because of the long time lag between exposure and the onset of symptoms, and of their extensive under-reporting (2).

According to ILO estimates, on a global scale, occupational accidents and diseases result every year in a 4% loss in the gross domestic product (2). *Still, according to this document, the key to the problem is the prevention of occupational diseases and injuries, which is less expensive and more effective than treatment and rehabilitation*.

According to official data, the number of cases of occupational diseases is on the rise. This may depend on several factors, such as better systems of recording and notification, broadening the definition of occupational diseases and manifestation of long-latency diseases (2).

A website provides easy-to-read fact sheets that cover a wide range of workplace health and safety topics (4).

A paper (5) provides the ILO list of occupational diseases.

In the definition of an occupational disease, inter alia, we find that the occurrence of the disease among the exposed persons has a higher frequency than in the rest of the population. General criteria for identification and recognition of occupational diseases can be read on page 8 (5).

Aims of the Teaching Unit

This article presents informative and educational resources that deal with occupational diseases and their prevention.

The article, besides awakening the interest of the reader in the occupational diseases and providing related information, is also aimed at raising awareness of the student regarding the respect that we owe to our body.

MATERIALS AND METHODS

The aforementioned information and educational resources can be downloaded for free from the web and consist of text, images, educational stories in comic book format, quizzes and videos.

The content of the discussion is based exclusively on the documents quoted. Some general criteria and tools may help readers interested in searching for reliable documents in the net in order to acquire more information on this subject (1).

Teachers interested in teaching this subject may use such resources with the method felt as most appropriate.

History and Present Situation of Occupational Medicine

A document deals with the history of occupational medicine and in particular with the physician B. Ramazzini, acknowledged as the father of this discipline (6). He established a link between occupational conditions and disorders *by means of extensive investigations of workplaces, that included inspections to observe the environment and interviews with the workers*. Ramazzini anticipated this approach, now recognized as essential in the study of occupational medicine and yet unusual up to the 17th century (6). He also observed the link between the posture held by the worker and the associated hazards, thus pioneering the study of ergonomics.

"Informational Booklet on Industrial Hygiene" deals, among many other things, with the landmarks in the history of occupational medicine (7). During the classical period, the ancient Greeks and Romans recognized the hazards of chemicals involved in the production of metals, whereas, in the period 1500-1800, unsafe working environments and especially the mines were extensively studied (7).

Sir Percival Pott studied the deleterious effects of contact with soot for chimney sweeper's; his observations contributed to stimulating the British Parliament to pass the *Chimney Sweepers Act of 1788* (7).

The earliest English Factory Acts in the field of industrial safety were intended to provide compensation for the diseases consequent to unsafe or unhealthy workplaces, rather than preventing the disease itself. Later on, several European countries developed compensation acts and started adopting safety precautions and established medical services in industrial plants (7).

The US physician Alice Hamilton showed evidence of the relationships between exposure to toxins and disease, in addition, she proposed concrete solutions. This contributed to raising public awareness and the earliest compensation laws started to be passed. As a consequence of such laws, improvements to the environment in the workplace became cheaper than compensations (8).

Nowadays, though improved safety, better regulation and technological advances have lead to a decline in some traditional risks, the latter remain unacceptably high. At the same time, new professions and technologies may result in new, unidentified occupational hazards, and in the absence of control, prevention and protection measures (3).

Adequate surveillance, monitoring, recording and notification related to the working environment and occupational diseases would be necessary for the implementation of preventive strategies.

This is hampered by the increased number of workers in temporary, part-time and casual work, and by the intensification of migration flows. In fact, increased movement of workers to different jobs where exposures are different, combined with the presence of non-workplace factors, act as confounders in the study of the occupational diseases that have long latency periods.

As a consequence of such situations, it can be hard to determine the occupational origin of a disease (3).

Certain health events occur in an unusual concentration in a defined area or time period, this is what scientists refer to as clusters (9>Cancer>Cancer Clusters). A cancer cluster can result from a common cause or from the coincidence of unrelated causes. A document provides concepts related to the investigations of the possibility of an occupational origin of cancer, and explains what to look for when evaluating a cancer cluster (9>Cancer>Cancer Clusters).

Stress at Work

A booklet published by the World Health Organization (WHO) provides advice on how to deal with stress at work (10>Work organization and stress). *Stress may constitute a problem for both worker and organization; the best way to prevent it relies on good management and work organization.*

Stress at work may occur when the demands and pressures are not matched to the skill of the worker, or when knowledge and abilities are underutilised. The situation may even worsen as the worker feels he is not adequately supported by colleagues and supervisors, and perceives a low decision–making latitude.

Stress at work is mostly related to both how the job is designed and the organization is managed. The list of "Stress related hazards" in table 1 includes, inter alia, unpredictable working hours, lack of participation in decision making, job insecurity, unclear roles in the organization and lack of clarity of organizational objectives and structure (10>Work organization and stress).

The booklet, among many other things, describes the effects of stress on both the individuals and the organization. The worker may suffer poor physical and mental health and may engage, inter alia, in unhealthy activities, such as tobacco, alcohol and drug abuse. Besides, e.g. cardiovascular, digestive and musculoskeletal disorders, the immune system is also likely to be affected, with consequent impaired ability to fight infections.

When stress at work is involving a large number of workers, or the key staff, the performance of the entire organization is likely to be threatened. This can happen through, e.g. an increased absenteeism, a decreased commitment to work, increased unsafe working practices and accident rates. A table (10>Work organization and stress, page 16) describes what *a well designed work should include, e.g. training where necessary, effective supervision and guidance, clear communications, teamwork and a reasonable socializing* (10>Work organization and stress).

A WHO document (11), provides information and links on stress at workplace. According to this document, being offended, ridiculed or treated in unfair manner may affect health; conversely, being appreciated is beneficial (11).

Challenges in the job, perceived as acceptable by the worker, motivate him/her to do their best and when the efforts lead to success then the worker feels satisfied and relaxed. Differently, when the challenge is excessive or unmanageable, then exhaustion takes the place of relaxation, and the worker feels stressed instead of being satisfied (11 / 12>Stress at Work>Stress... At Work Booklet).

“Mental Health – Psychosocial Risk Factors in the Workplace” is a document whose content is summarised by its title (13).

A WHO document deals with physiological consequences of stress in the workplace concerning, e.g., adrenal hormones, central nervous system, *and cardiovascular responses* (14). It also deals with psychological and behavioural consequences; the latter includes, e.g. Absenteeism, excessive alcohol and tobacco consumption, lower involvement in family matters and having fewer friends. The paper also describes persistent health damage consequent to stress at work, such as a peptic or duodenal ulcer, increased susceptibility to infection (14).

Psychosocial hazards in the workplace can increase by two or three times the risk of mental disorders, such as anxiety, depression and substance abuse; furthermore, mental functions such as creativity and innovation are decreased (15).

Occupational Cardiovascular Diseases

According to many studies, but not all, job strain is linked to an increased cardiovascular risk. According to a prospective cohort study, the hazard ratio for recurrent coronary heart disease in patients exposed to a chronic job strain compared to unexposed ones, after adjustment for confounders, is 2.00 (16).

The association between job strain and risk of death from cardiovascular disease has been examined in another prospective cohort study, that involved 812 patients during a follow up that lasted on average 25.6 years (17). Workers exposed to high demands at work, combined with low job control, exhibited a cardiovascular mortality risk 2.2 times higher compared to colleagues with low strain in the workplace (17).

In another study, that involved 124.808 men and women, job strain has been linked to an increased risk of type 2 diabetes; the hazard ratio was 1.11 after adjustment for age, sex, socioeconomic status and lifestyle habits (18).

In fact, stress response results in increased secretion of cortisol, which in turn stimulates the production of liver glucose and counteracts the action of insulin (18).

Constant mobilization of free fatty acids, not subsequently metabolized by the skeletal musculature might contribute to an accumulation of cholesterol in the arteries; whereas adrenaline and noradrenaline, released in excessive amounts, may have an effect, e.g. upon the heart with an increased risk of electrolyte imbalance, arrhythmias, myocardial damage (14).

According to a study based on a large number of nurses, job strain is associated with weight gain, particularly in women that were already overweight at the beginning of the study (19).

"Why Stress Causes People to Overeat" is a document of the Harvard Medical School, whose content is summarised by the title (20). Notoriously, obesity, diabetes and high cholesterol in the blood are known risk factors for several disorders, and especially for cardiovascular disease.

Economic crisis and recession result in increased anxiety, depression and work-related stress that, if prolonged, may contribute to serious cardiovascular problems (3). The National Institute for Occupational Safety and Health wrote a booklet aimed at helping people to understand the causes of stress at work and mitigate the related threat (12>Stress at Work>Stress... At Work Booklet). This reading, through the story of two workers, describes the stress related to, e.g. heavy workload, hectic and routine tasks, lack of participation in decision-making, lack of support of coworkers, and organization that causes nobody to feel safe (12>Stress at Work>Stress... At Work Booklet).

Although a situation could prove stressful for a worker while not for another, and this depends on individual personality and coping style, it is scientifically evident that certain working conditions create problems for most people (12>Stress at Work>Stress... At Work Booklet / 14).

As a response to stress, the brain prepares the body for a defensive action; this is mediated by hormones and entails, e.g. increased heart rate, deeper respiration and tense muscles. This is not a problem, provided that such condition is occasional. On the contrary, a constant state of activation can accelerate the rate of wear and tear of the body and lead to health problems, especially cardiovascular disease, musculoskeletal and psychological disorders. In addition, stress at work may increase the risk of injury, and productivity is likely to be decreased (12>Stress at Work>Stress... At Work Booklet).

The document discusses two different approaches for dealing with stress in the workplace: one is based on stress management and the other on organizational change (12>Stress at Work>Stress... At Work Booklet).

Notoriously, our blood pressure is continually changing in response to several factors, including stress and forceful exertion, both common in the workplace.

In this respect, figures 1 and 2 (21) compare the different increase in blood pressure exhibited by students when giving a speech, in the presence of a supportive and a non-supportive audience. The increase in blood pressure is lower in the presence of a supportive audience; the experiment provides evidence of the potential health benefits of social support in attenuating stress reactions.

Interestingly, a paper deals with the blood pressure exhibited in body builders during heavy weight lifting exercises, with the mean value for the group as high as 320/250 mm Hg (22).

During the different exercises, the exhibited increase in blood pressure was also different, being higher during those where a bigger muscle mass was involved (22 figure 4).

When several repetitions of the same exercise are performed, a progressive elevation in systolic blood pressure is observed (22 figures 2 / 3).

Cancer as an Occupational Disease

"Occupation and cancer – follow-up of 15 million people in five Nordic countries" is the title of a Scandinavian study that lasted 45 years (23).

The paper also provides graphs on the standardized incidence ratios of many types of cancer for 54 occupational categories. *In addition, for each cancer type, a comment is provided that may help to understand the factors involved in the risk* (23).

Table 80 (23) shows the standardised incidence ratios for all malignant neoplasms among men; for instance, extreme values such as 0.83 for farmers and 1.20 for chimney sweepers can be observed.

The difference exhibited in the standardised incidence rates can be very high when a specific site of the body is considered. Table 35 (23) shows the standardised incidence ratios for female lung cancer; a broader range of rates can be observed, with values as low as 0.46 for farmers and 0.54 for gardeners, up to 2.33 for tobacco workers and 2.61 for engine operators. Some occupational exposures, combined with smoking, synergistically increase the risk for the lungs.

Table 4 (23) provides the standardised incidence ratios for lip cancers in men, with values ranging from 0.28 for physicians and 0.42 for teachers, to 1.57 for farmers and 2.27 for fishermen. High values for lip cancer observed in workers employed in outdoor occupations are attributed to the combination of smoking and sunlight.

A 600 page paper, published in 1977, deals with chemical, physical and biological hazards, carcinogens, pesticides, dermatoses, airway diseases, plant and wood hazards. Interestingly, the paper also deals with routes of entry and modes of action (24). The section dedicated to chemical hazards provides information for each substance, e.g. about potential occupational exposures, permissible exposure limits, harmful effects, medical surveillance, personal protective methods.

A monograph of the International Agency for Research on Cancer, entitled "Chemical agents and related occupations, a review of human carcinogens", deals with the evaluation of carcinogenic risk to humans (25).

According to an IARC (International Agency for Research on Cancer) document, chemical substances are divided into different groups according to the degree of evidence of carcinogenicity to humans (26>Classifications).

A paper analyses the increased risk of cancer consequent to *occupational exposure to specific substances*, for instance, formaldehyde. Occupational exposure to the latter, found in a wide variety of industries and occupations, may cause leukaemya and cancer of nasopharynx (26>Volume 100F). The paper also analyses the carcinogenity of *occupational exposure observed in certain activities*, e.g. in painting. Notoriously, thousands of chemical compounds are found in paints. People working with paints sufficient evidence has been shown for increased risk of mesothelioma, cancer of lung and urinary bladder. *This occupational exposure in women, both during pre-conception and pregnancy, has been associated with childhood leukaemya in the offspring* (26).

Again, with reference to formaldehyde, from page 188 (24) we may have much information, such as potential occupational exposures, permissible exposure limits, routes of entry, harmful effects etc; this paper studies a lot of chemical agents.

An IARC webpage, "Monographs on the Evaluation of Carcinogenic Risk to Humans" provides a list of agents that is found in the environments where people work (26>Volume 100F).

A guide to chemical Hazards provides information on general industrial hygiene practice, and assists the users in the recognition and the control of hazardous chemicals, including the carcinogenic ones (27).

Musculoskeletal System and Occupational Diseases

As much as a low physical activity level result in deterioration of muscles, tendons, cartilage, ligaments and bones, sudden overload as well as repetitive loading may damage the musculoskeletal system (28>The Body>Muskuloskeletal System).

Musculoskeletal disorders are among the most important occupational health problem. Problems are likely to occur with muscles and intervertebral discs of the lower back, neck, nerves and tendons of the upper limbs; in the lower limb osteoarthritis are an important pathology (28>The Body>Musculoskeletal System).

Repetition, static load, force and vibrations are among the work-related risk factors for muscles; sufficient recovery is necessary between working periods in order to allow the necessary physiological rest. Variations should be included in repetitive tasks, whereas force and intensity should be lowered in intensive works in order to optimize the exposure of the muscles.

When a force that results from the contraction of a muscle is applied to a tendon, the latter undergoes a deformation. This last is negligible if the recovery time allowed between successive exertions is long enough. Conversely, the tendon will be more and more stretched after each successive exertion if the recovery time is not sufficient.

Figure 6.4 (28>The Body>Musculoskeletal System) shows, in the wrist, the forces acting on the finger flexor tendons, also including the fictional ones caused by dynamic exertions of the worker. When the position of the wrist is such that the tendons are not perfectly straight, then the latter press against the adjacent anatomical surfaces. The thickening of the tendons, consequently irritated, may cause the median nerve to be compressed at the wrist; this is a possible cause of the carpal tunnel syndrome (29). A video shows a task that may be exposed to the carpal tunnel syndrome (30).

An easy-to-read document (31) explains what causes the carpal tunnel syndrome, what its occupational factors are and how it can be prevented. *Redesigning work station and tools, as shown respectively in figures 3 and 4, avoids awkward wrist positions; the job itself can be redesigned, including a rotation of the assignments that allows workers to move from a task to another.*

The readers who want to know more about musculoskeletal disorders may wish to read a publication that deals with injuries related to sports (32). Although generally beneficial for health, the practice of sports requires precautions if musculoskeletal injuries are to be prevented.

The intervertebral discs have an important mechanical function. Loading is a risk factor for the rupture of the discs; the load that they support is highly dependent on the posture.

Figure 6.8 shows the values of the intradiscal pressure, according to different postures.

As far as the supply of nutrients is concerned, the cells that constitute the intervertebral disc depend on the diffusion from blood vessels. Tobacco use and vibrations are associated to a reduced blood circulation, hence to a reduced supply of nutrients that, in turn, is linked to disc degeneration (28>The Body>Musculoskeletal System).

A booklet of the Kansas State University helps the readers to understand the causes of back pain; it also contains some quizzes on the subject. The booklet deals with safe work practices and stretching exercises that may help in the prevention of back injuries and in the relief of back pain (33).

A good fitness level and a lean body help in keeping the back healthy. Conversely, sedentary activities in inadequate positions as well as heavy lifting, pushing and pulling increase the risk, especially if they involve vibrations and twisting the spine (34). According to many studies, wearing supportive belts does not provide benefits because it may result in weakened back muscles from lack of use. A PDF is entitled “Back Belts May Not Prevent Injuries at Work” (35).

Speed walking, swimming, yoga and riding a stationary bike may prove beneficial in the prevention of back pain. In addition, when lifting something, it is recommended to keep close to the body the object to be lifted and at the same time to avoid twisting (34).

A video deals with “Disc Protrusion” (36).

According to a WHO document, 37% of the cases of low back pain are attributed to occupation, and they are estimated to cause 818,000 disability-adjusted life years lost annually (37).

Farmers constitute the category with higher risk. The content of “Preventing Low Back Pain in Agriculture” is summarized by the title (38).

In jobs involving a lot of kneeling or knee-bending, an increased risk of knee disorders has been observed (28>The Body>Musculoskeletal System).

Frequent kneeling is notoriously typical in floorlayers and carpet layers; in these latter the situation is aggravated by the additional stress of using knee kickers for stretching the carpets. In these categories, the rate of compensation claims for traumatic knee injury is about 50 - 100 times higher compared to the total workforce. The National Institute for Occupational Safety and Health recommends wearing protective knee pads when working on hard surfaces, and carpet layers are recommended to use a power stretcher instead of a knee kicker (39).

A paper entitled “Ergonomics - Solutions to Control Hazards” provides many links that deal with success stories, and ergonomic guidelines dedicated to many different workplaces: shipyards, nursing homes, apparel and footwear industries, agriculture and so on (40). Among these, “A Guide to Selecting Non-Powered Hand Tools” (41), and “Ergonomic Guidelines for Manual Material Handling” (42) might be of particular interest as a basic study.

Videos and infographic posters show safe work procedures for room attendants (43).

A PDF deals with reducing the risk of musculoskeletal injuries while prunes (44).

A guide helps to identify and solve occupational problems that may arise at the computer workstation, and provides tips for a correct posture such as improved lighting and improvement of job design (45). A checklist helps in the assessment of the working conditions; the guide also suggests exercises aimed at reducing muscle

tension and eye strain.

The document "Guidelines for Nursing Homes – Ergonomics for the prevention of musculoskeletal disorders" (46) is rich with images. By the way, this document supports the importance of discussing tasks with employees, which often helps in identifying the cause of the problems and in developing practical and effective solutions.

From a website (47) some links related to ergonomics can be opened. A document provides educational resources in comic book format that deal with musculoskeletal disorders and their prevention (48). Whereas a page allows the access too much information about health and safety in the workplace (49).

Occupational Respiratory Diseases

In most cases, occupational lung diseases result from the inhalation of dusts or chemicals in jobs such as mining, processing or manufacturing (50).

According to studies in developing countries, between 30% and 50% of the workers in primary industries and high-risk sectors may suffer from pneumoconiosis (3 page 5).

Clearly, different exposures lead to different diseases.

Airborne particles of crystalline silica, inhaled and subsequently deposited in the smallest bronchioles and in their neighboring alveoli may cause *silicosis* (50). Such particles are taken up by the macrophages that are consequently activated; the latter release oxidants and other inflammatory mediators. The macrophages may die and release the silica particles that will be taken up again by other macrophages; the process continues thus resulting in the destruction of cells and surrounding tissues (50).

When silicosis is diagnosed by a chest X-ray, the lung will not be normal again (51>Issue n° 12).

"Elimination of Silicosis: The importance of preventing occupational exposure to dust" and "Silicosis and its control in small scale silica mills in India" are published in the journal of occupational health of the World Health Organization (51>Issue n° 12).

A website provides much information about silica, including a video (52>Silica Exposure).

Inhaled fibers of asbestos are taken up by macrophages and transported to the pleural space; this results in an inflammation that can progress into fibrosis (50). Asbestos may cause several diseases, including *lung cancer* and *mesothelioma*.

People living next to asbestos mines and factories are also exposed, as well as families of workers that bring home their asbestos-covered clothing (50).

Malignant diseases related to asbestos have a long latency period, even as long as 40 years (53). In countries that have recently increased its use, such diseases are likely to not yet be evident (23).

A global ban of asbestos could eventually avoid the diseases associated with this material. Although in 2005 an international association of occupational and environmental scientists called for the ban, 125 million people are still exposed to asbestos in the workplace (50).

An ILO / WHO document is intended to help establish national programmes for the elimination of

asbestos-related diseases, both where this noxious material is still in use and where it is still in place as a consequence of its use in the past (53).

The aforementioned organizations also provide further assistance to individual countries, e.g. through information about safer materials that can substitute asbestos, overviews on best national practices etc.

A website provides videos and information about asbestos in demolition and its removal (54).

Inhaled coal dust is also taken by the macrophages; this generates inflammatory cytokines and noxious oxidants (50). Coal dust generates lesions that destroy the normal architecture of the lung and lead to disability (50).

US regulations have imposed, inter alia, the reduction of the respirable coal mine dust from 3 to 2 mg per cubic meter. As a result of the measures, the prevalence rate of *coal workers pneumoconiosis* fell from 20% in 1987 to 5% in 2002 (50).

A document deals with airborne dusts in the workplace, including the metallic, chemical, vegetable and biological ones (55).

Chapter 1 (55) deals with the human respiratory tract, the filtration of the air and the clearance of the particles, formerly inhaled; interestingly, this last process is likely to be impaired by smoking.

In chapter 2 we find a list of dusty occupations; the exposure is likely to be particularly harmful when involving radioactive or toxic substances (55). Table 2-ll provides some examples of health effects; from page 29 we can read some examples of prevalence of dust-related diseases in groups of overexposed workers (55).

Chapter 4 also analyses the mechanisms concerning both generation and circulation of dust in the workplace. Chapter 6 deals with the control of dust sources. If possible, dust-producing materials can be eliminated, or their amount reduced, or substituted with less hazardous ones (55).

As far as the substitution of materials is concerned, several examples are provided, pros and cons analyzed. Several materials can be used to substitute silica sands as blasting abrasive. They contain just a low percentage of quartz, or not at all, but in some cases, they may contain impurities such as arsenic or beryllium whose potential hazards should be investigated (55). Steel grit, used as an abrasive, has a high recyclability level, which entails a very low generation of waste (55).

A change in the physical form of a material, although not modifying its toxicological properties, may reduce the likelihood of its penetration into the human body. In some cases, for instance, potentially dusty materials can be used in a pelletized form or in a liquid suspension, thus reducing the exposure of workers to dust; the document provides several examples (55).

In other cases the equipment or the process can be modified, as shown in figures 6-1 and 6-2.

The document discusses the possibility of using damp materials, or wet methods, e.g. spraying water at the points where dust is generated, so as to prevent the dispersal of dry particles in the air (55).

Skin Diseases

"Occupational skin diseases and dermal exposure in the European Union: policy and practice overview" besides describing the structure of the skin, deals with harmful effects that are likely to be caused by chemical and biological

agents (56). Some agents, associated with solar radiation can trigger phototoxic reactions. Some physical agents, such as handling of vibrating machines, can also affect the skin (56).

Systemic effects can be caused by toxic substances that, absorbed through the skin, enter in the general circulation. Leukaemia is typically consequent to percutaneous absorption of benzene contained in gasoline, often misused by garage mechanics for hand cleaning (56).

Several factors may influence the absorption of substances through the skin, e.g. thickness of the latter, sunburn, dermatoses, high temperature and humidity, heavy sweating, age, use of certain cosmetics (56).

From page 58 we read about the prevention of skin diseases through measures designed to minimize or eliminate the exposure; appendix 1 provides specific examples on the subject (56).

As general or collective measures for the protection of the workers, toxic substances can be removed or substituted or, in some cases, transformed. For instance, most of the hexavalent chromium contained in cement can be reduced to the less toxic trivalent chromium through the addition of ferrous sulphate. In some cases, unwanted contacts can be avoided, for instance through plastic sheathing covering the handle of nickel-plated scissors (56).

The aforementioned collective measures of protection are generally more efficient than personal ones; the latter is also analyzed, they include use of protective clothing, gloves in particular, and protective creams (56).

Other documents also deal with occupational skin diseases (9 / 24 / 57).

Electrical and Electronic Waste Recycling: Related Occupational Diseases and Prevention

On a global scale, according to an ILO document, about 40 million tonnes of electrical and electronic waste are generated every year; their recycling rate is estimated to grow at an average rate of 18% a year (58).

E-waste is classified as hazardous for the high content of heavy metals; in addition, as a consequence of poor design, disassembly and separation of materials for reclamation is difficult. Hence, safe e-waste recycling requires intensive labour, and sophisticated and costly technologies (58).

Most of the e-waste collected in developed countries is shipped, often illegally, to developing countries to be recycled by hundreds of thousands of informal workers generally unaware of the risks for the environment and health (51). The document describes the exposure of such workers, often children, e.g. in manual disassembly, acid-leaching operations, open burning of plastic-coated electrical wires. In such workplaces, toxic substances are likely to be inhaled as dusts, or ingested during the meals in the poor hygienic conditions of the workplace (58).

According to an ILO document, among the environmental policies aimed toward a sustainable life cycle of e-waste, the role of the *Extended Producer Responsibility* is of paramount importance (58).

According to this environmental policy, the cost of waste management is internalized in the price of the product and the producer is financially responsible for the management of the end-of-life product. *This is aimed at providing an incentive toward the production of electronic equipment that is easy and cheap to recycle, thanks to ease of disassembly and a low content of toxic substances, whose legal disposal is notoriously costly* (58).

In many cases, the Extended Producer Responsibility has resulted, for instance, in a reduced use of mercury, lead and arsenic in electronic equipment.

The Extended Producer Responsibility also drives innovation, for instance, as far as the logistics of take-back is concerned (58). In fact, the Extended Producer Responsibility typically entails that the manufacturer is required to take back the end-of-life product that he formerly produced, for instance, through a deposit-refund system. This provides incentive to the consumer to return the end-of-life product to a designated collection point (59 page 3-4).

"Electronic Waste Recycling: Working Safely" is a fact sheet by the California Department of Public Health that deals with the protection of the workers from related occupational hazards (60).

Child Labor: Health and Safety

According to ILO estimates, 351.7 million children worldwide are economically active and, among them, *111 million aged 5 to 14 are involved in hazardous work*. Contrary to the general belief, even children working in a family setting are not always protected from hazardous exposures (61).

According to a study, workers aged 15 to 17 exhibits an occupational injury rate of 4.9, being 2.8 the rate for all workers; two graphs deal respectively, with fatalities and non-fatal occupational injuries (61 page 3 – 4).

A website contains an article that deals with a pilot education program on occupational health in secondary schools in Greece; another document deals with a project concerning eye safety in young workers, in Bangladesh (61).

An article describes the consequences on children of worksite exposures in different sectors (61). Personal protective equipments are not designed for children, in addition, difficulties exist in matching the size of the machines to the growing body of the young worker (61 / 62).

CONCLUSIONS

A website deals with the differences between children and adults, e.g. quick bone growth that exposes a young person to skeletal damage during heavy lifting, higher chemical absorption rates and developing ability in risk assessment. In addition, children have a greater need for rest that may translate into fatigue that, in turn, may contribute to an increase in disease and accidents (62).

"A safe student resource handbook" is an educational resource in comic book format (49).

Interestingly, a paper deals with life expectancy by education, income and occupation in Germany (63).

ACKNOWLEDGEMENTS

The author would like to thank Dr. Liu Lin for help kindly provided.

REFERENCES

1. Cornell University Library, (2012). Evaluating Web Sites: Criteria and Tools. http://olinuris.library.cornell.edu/ref/research/webeval.html
2. ILO, (2013). Questions and Answers about the prevention of occupational diseases. http://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---safework/documents/publication/wcms_211463.pdf
3. ILO, (2016). The Prevention of Occupational Diseases. http://www.ilo.org/safework/info/publications/WCMS_208226/lang--en/index.htm

4. Canadian Centre for Occupational Health and Safety. OSH Answers Fact Sheets, (2016). http://www.ccohs.ca/oshanswers/
5. ILO, (2010). List of Occupational Diseases. http://www.mhlw.go.jp/stf/shingi/2r98520000033ssx-att/2r98520000033sz1.pdf
6. G. Franco, (1999). Ramazzini and Workers' Health. http://155.185.2.46/immagini4/lancet354_99_858.pdf
7. United States Department of Labor, (1998). Informational Booklet on Industrial Hygiene. https://www.osha.gov/Publications/OSHA3143/OSHA3143.htm
8. G.D. Clayton. History of Industrial Hygiene. http://www.cdc.gov/niosh/pdfs/74-177-b.pdf
9. CDC, (2012). Diseases and Injuries. http://www.cdc.gov/niosh/topics/diseases.html
10. World Health Organisation, (2016). Psychosocial Risk Factors and Hazards. http://www.who.int/occupational_health/topics/risks_psychosocial/en/
11. World Health Organisation, (2016). Stress in the Workplace. http://www.who.int/occupational_health/topics/stressatwp/en/
12. The National Institute for Occupational Safety and Health, (1999). Stress.... At Work. http://www.cdc.gov/niosh/topics/heartdisease/
13. Canadian Centre for Occupational Health and Safety, (2012). Mental Health – Psychosocial Risk Factors in the Workplace https://www.ccohs.ca/oshanswers/psychosocial/mentalhealth_risk.html
14. World Health Organisation, (1984). Psychosocial Factors at Work: Recognition and Control. http://www.who.int/occupational_health/publications/ILO_WHO_1984_report_of_the_joint_committee.pdf
15. J. Burton, M Shain, (2006). Psychosocial Factors and Mental Health at Work: A Canadian Perspective. http://www.who.int/occupational_health/publications/newsletter/gohnet10e310806.pdf
16. C. Aboa-Eboulé et al. (2007). Job Strain and Risk of Acute Recurrent Coronary Hearth Disease Events. http://jama.jamanetwork.com/article.aspx?articleid=209121
17. M. Kivimaeki et al. (2002). Work Stress and Risk of Cardiovascular Mortality: Prospective Cohort Study of Industrial Employees. http://discovery.ucl.ac.uk/5284/1/5284.pdf
18. 18) S. T. Nyberg et al. (2014). Job Strain as a Risk Factor for Type 2 Diabetes: A Pooled Analysis of 124,808 Men and Women. http://care.diabetesjournals.org/content/37/8/2268.long
19. K. Fujishiro et al. (2015). Job Strain and Changes in the Body Mass Index Among Working Women: a Prospective Study. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4564350/#
20. Harvard Medical School, (2012). Why Stress Causes People to Overeat. http://www.health.harvard.edu/newsletter_article/why-stress-causes-people-to-overeat
21. Stephen, G.L., Mata, K.A. and Evans, G.V. (1993) Social Support Lowers Cardiovascular Reactivity to an Acute Stressor. Psychosomatic Medicine.http://astro.temple.edu/~slepore/Lepore_PM_1993

22. J.D. MacDougall et al. (1984). Arterial Blood Pressure Response to Heavy Resistance Exercise. http://www.luzimarteixeira.com.br/wp-content/uploads/2010/08/pressao-arterial-e-exercicio-resistido.pdf
23. E. Pukkala et al. (2009). Occupation and cancer – follow-up of 15 million people in five Nordic countries. http://www.tandfonline.com/doi/full/10.1080/02841860902913546
24. U.S. Department of Health, Education and Welfare, (1977). Occupational Diseases, A Guide to their Recognition. http://www.cdc.gov/niosh/docs/77-181/pdfs/77-181.pdf
25. IARC, (2016). IARC Monographs on the Evaluation of Carcinogenic Risk to Humans. http://monographs.iarc.fr/ENG/Monographs/PDFs/
26. IARC, (2012). Chemical agents and related occupations. http://monographs.iarc.fr/ENG/Monographs/vol100F/mono100F.pdf27) National Institute for Occupational Health and Safety, (2007).
27. NIOSH Pocket Guide to Chemical Hazards. http://www.cdc.gov/niosh/docs/2005-149/pdfs/2005-149.pdf
28. ILO Encyclopedia of Occupational Health and Safety. http://www.ilocis.org/en/contilo.html
29. NIH, (2016). Carpal Tunnel Syndrome Fact Sheet. http://www.ninds.nih.gov/disorders/carpal_tunnel/detail_carpal_tunnel.htm
30. Work Safe BC, (2016). Carpal Tunnel. https://www.worksafebc.com/en/resources/health-safety/videos/carpal-tunnel-syndrome?lang=en
31. Canadian Centre for Occupational Health and Safety, (2014). Carpal Tunnel Syndrome. https://www.ccohs.ca/oshanswers/diseases/carpal.html
32. National Institute of Arthritis and Musculoskeletal and Skin Injuries, (2016). Sport Injuries. http://www.niams.nih.gov/health_info/sports_injuries/
33. Kansas State University, (2007). Back Injury Prevention. https://www.osha.gov/dte/grant_materials/fy06/46g6-ht22/back_injury_prevention.pdf
34. National Institute of Neurological Disorders and Stroke, (2015). Low Back Pain Fact Sheet. http://www.ninds.nih.gov/disorders/backpain/detail_backpain.htm
35. WorkSafe BC, (2009). Ergonomic Commentary - Back Belts. https://www.worksafebc.com/en/resources/health-safety/books-guides/ergonomics-commentary-1-back-belts?lang=en
36. WorkSafe BC, (2016). Disc Protrusion. https://www.worksafebc.com/en/resources/health-safety/videos/disc-protrusion?lang=en
37. Punnett at al., (2005). Estimating the global burden of low back pain attributable to combined occupational exposures. http://www.who.int/quantifying_ehimpacts/global/5lowbackpain.pdf
38. Zhao Wei. Preventing Low Back Pain in Agriculture**.** http://nasdonline.org/1162/d000956/preventing-low-back-pain-in-agriculture.html

39. The National Institute for Occupational Safety and Health, (2014). Preventing Knee Injuries and Disorders in Carpet Layers. http://www.cdc.gov/niosh/docs/90-104/
40. Bhuwan Sharma & Hemant Mahajan, Assessment of Health Profile of Zari Workers with Special Reference to Musculoskeletal Disorders in an Urban Slum of Mumbai, India, International Journal of General Medicine and Pharmacy (IJGMP), Volume 2, Issue 2, April-May 2013, pp. 47-54
41. United States Department of Labor. Ergonomics – Solutions to control Hazards. https://www.osha.gov/SLTC/ergonomics/controlhazards.html
42. CDC, (2004). A Guide to Selecting Non-Powered Hand Tools. https://www.cdc.gov/niosh/docs/2004-164/pdfs/2004-164.pdf
43. NIOSH, (2014). Ergonomic Guidelines for Manual Material Handling. https://www.cdc.gov/niosh/docs/2007-131/
44. WorkSafe BC, (2015). Room Attendants. https://www.worksafebc.com/en/resources/health-safety/videos/room-attendants/full-video?lang=en
45. WorkSafe BC, (2012). Preventing Musculoskeletal Injuries in Vineyard Pruning. https://www.worksafebc.com/en/resources/health-safety/information-sheets/preventing-musculoskeletal-injuries-in-vineyard-pruning?lang=en
46. WorkSafe BC, (2009). How to Make Your Computer Workstation Fit You. https://www.worksafebc.com/en/resources/health-safety/books-guides/how-to-make-your-computer-workstation-fit-you
47. Occupational Safety and Health Administration, (2009). Ergonomics for the Prevention of Musculoskeletal Disorders. https://www.osha.gov/ergonomics/guidelines/nursinghome/final_nh_guidelines.pdf
48. National Institutes of Health. Ergonomics. https://www.ors.od.nih.gov/sr/dohs/HealthAndWellness/Ergonomics/Pages/ergonomics_home.aspx
49. Actsafe. Ergonomics/MSI. http://www.actsafe.ca/category/resources/library/ergonomics-msi/
50. WorkSafe BC, Forms and Resources. https://www.worksafebc.com/en/forms-resources#sort=relevancy&f:topic-facet=[Health%20%26%20Safety]&f:language-facet=[English]
51. American Thoracic Society. Occupational Lung Diseases. https://www.thoracic.org/patients/patient-resources/breathing-in-america/resources/chapter-13-occupational-lung-diseases.pdf
52. World Health Organisation, (2007). The Global Occupational Health Network. http://www.who.int/occupational_health/publications/newsletter/gohnetarchives/en/
53. WorkSafe BC. Silica. https://www.worksafebc.com/en/health-safety/hazards-exposures/silica
54. ILO/WHO, (2007). Outline for the Development of National Programmes for Elimination of Asbestos–Related Diseases. http://www.who.int/occupational_health/publications/elim_asbestos_doc_en.pdf
55. WorkSafe BC, (2014). How should I handle it? http://www.hiddenkiller.ca/handling.asp

56. World Health Organisation. Hazard Prevention and Control in the Work Environment: Airborne Dust. http://www.who.int/occupational_health/publications/en/oehairbornedust3.pdf

57. European Agency for Safety and Health at Work, (2008). Occupational skin diseases and dermal exposure in the European Union: policy and practice overview. https://osha.europa.eu/en/node/6875/file_view

58. S.E. Anderson, B.J. Meade, (2014). Potential Health Effects Associated with Dermal Exposure to Occupational Chemicals. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4270264/

59. ILO, (2012). The Global Impact of e-Waste Addressing the Change. http://www.ilo.org/wcmsp5/groups/public/@ed_dialogue/@sector/documents/publication/wcms_196105.pdf

60. C. Van Rossem, N.Tojo, T.Lindhqvist, (2006). Extended Producer Responsibility http://www.greenpeace.org/international/PageFiles/24472/epr.pdf

61. California Department of Public Health, (2012). Electronic Waste Recycling: Working Safely. https://www.cdph.ca.gov/programs/hesis/Documents/eWaste.pdf

62. World Health Organisation, (2005). Child Labor & Adolescent Workers. http://www.who.int/occupational_health/publications/newsletter/Gohnet9eng.pdf

63. University of Iowa. Child Labor and Health. https://www.continuetolearn.uiowa.edu/laborctr/child_labor/materials/documents/CLPEPhealthhandouts.pdf

64. M. Luy et al. (2015). Life Expectancy by Education, Income and Occupation in Germany: Extimations Using the Longitudinal Survival Method. http://www.comparativepopulationstudies.de/index.php/CPoS/article/view/203