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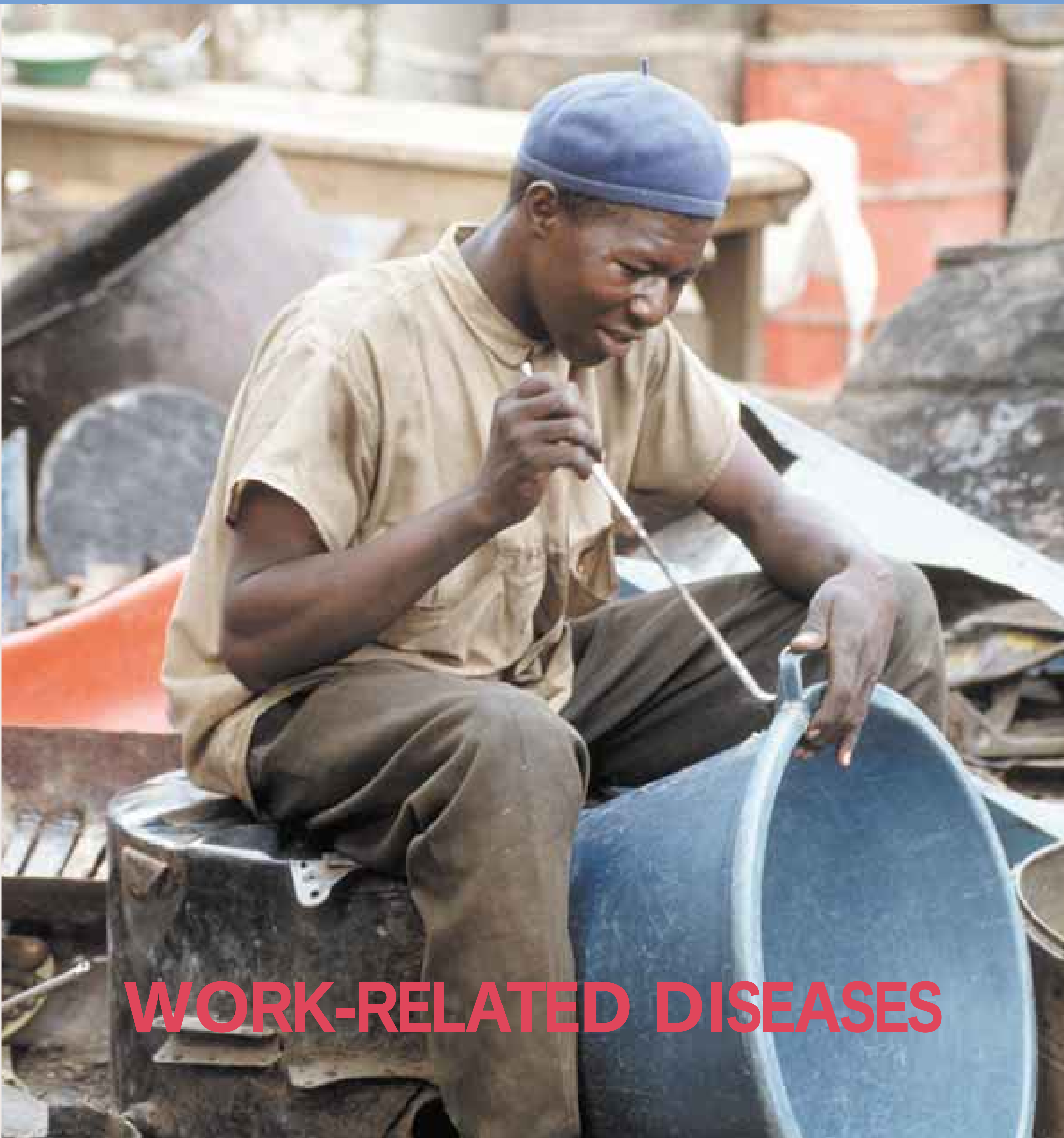

WORK-RELATED DISEASES

African Newsletter on Occupational Health and Safety

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Work-related diseases and their prevention

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Guest Editor in Chief
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Guest Linguistic Editor
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Layout of the cover page
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Contents

Work-related diseases and their prevention

At first thought it appears that there is nothing new that can be said about this topic. However, there is much new and much old and well established that can be reconceptualised in the light of changing global and local conditions.

Schilling and Andersson (1986) conceptualized four categories of work-relatedness viz. directly causal hazards (asbestos and mesothelioma), indirect contribution (TNT and myocardial ischaemia), aggravating hazards (solvents and psoriasis) and enhanced access to hazards (laboratory work and suicide).

Since then accelerated globalization and urbanization have led to very substantial changes in work, the workplace and the labour market, which in turn have given new meanings to work-relatedness. The old formal sector socio-economic class system of owner-manager/technical and professional staff/supervisory staff/skilled workers/semi- and unskilled workers, the majority of whom were permanently employed, has given way to a more flexible labour market characterized by top management on fixed term contracts, technical and professional staff on short-term consultancies, and the casualisation of semi- and unskilled workers. This has led to a radical reduction in the staff cohort of firms with job security, and swelling of the ranks of the unemployed, underemployed and self-employed in the informal sector of both industrialized and developing countries.

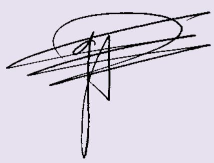
While still relatively small (around 10%) in the industrialized countries, the informal sector is by far and away the largest economic sector (more than 80% in some cases) in developing countries.

Is the difference between life in general and work disappearing? Given the increasingly fuzzy boundaries in time, physical and social space between life in general and work in both formal and informal sectors, a fifth category of work-relatedness suggests itself – the psychosocial burden of job insecurity. It cuts across the previous four categories of work-related hazards and to some extent is a modern version of the historical externalization of work-related diseases such as tuberculosis and pneumoconiosis from the mining industry (e.g. in Southern Africa). Paradoxically though, the globalized environmental perspective makes it increasingly difficult to externalize work-related health impacts as the system as a whole is conceptually and physically increasingly visible. While at the upper end of the employment hierarchy some may have experienced positive impacts, the majority of those in the new underclass of flexible and informal labour are subject to adverse health impacts which – given the new structure of work – are therefore work-related.

This gives rise to a fresh perspective on work-related diseases, most of which have multiple (including non-work-related) determinants. The entire spectrum of disease becomes once again of interest to occupational health practitioners. Special vigilance is required as it is now more challenging than ever to ascertain work-relatedness because of flexibilization and fuzzy boundaries. Many exciting avenues for reconceptualizing work-related diseases and their prevention present themselves to us in both industrialized and less-developed settings. Occupational stress related conditions jump to mind first. Job insecurity needs to be built into measures of occupational stress.

The traditional classification into primary, secondary and tertiary prevention is still valid. It is, however, clear that far too much emphasis has been placed mechanistically in the past on primary prevention (viz. occupational hygiene only) in occupational health. Exposure limits change over time usually becoming more stringent. Occupational hygiene techniques are often incorrectly or inappropriately applied underestimating or inadequately remediating hazards. In the developing world occupational hygiene expertise and analytical facilities are simply unavailable. This places a special duty on occupational health practitioners to actively engage in secondary prevention (health screening). Yet, this too is poorly practised especially in less developed settings. All too often this happens at the individual patient level, while no attention is paid to the group or population level. Group findings which are often subtle, early or subclinical in nature, are important in prevention and can be easily linked back to typical exposure conditions measured in a semi-quantitative low-tech manner. Typically though, occupational hygiene, safety and occupational health activities don't "talk" to each other. Integrating secondary and primary prevention presents a challenge for the further development of prevention. Tertiary prevention (rehabilitation and employment of the disabled) remains perennially important and is beginning to be included in legislation in many countries holding out the promise of retaining expertise and enhancing both productivity and equity at work.

In summary, there are exciting challenges to the occupational health and safety community to rethink the work-relatedness and its impacts, and especially to rethink prevention particularly at the population rather than just at the individual level.



Professor Jonny E. Myers
University of Cape Town
School of Public Health and Primary Health Care
Occupational and Environmental Health Unit
Anzio Road, Observatory 7925, South Africa

The ILO list of occupational diseases

S. Niu
ILO

Introduction

Despite the continued efforts in improving working conditions and the rapid development of safety and health technologies for the workplace, work-related hazards exist in almost all occupations. Diseases caused by work have to be discovered and their victims be properly compensated. The relationship between exposure and the severity of the impairment among workers and the number of workers exposed are important criteria for the determination of occupational diseases. Definition of occupational diseases is usually set out in legislation. It is mostly found in basic occupational safety and health laws. All definitions of occupational diseases specify causality as between the disease, the exposure factor (physical, chemical, biological and others) and the work. Identification of occupational diseases has an impact not only on provisions of the employment injury benefits, but also on national and enterprise level preventive programmes.

The International Labour Organization (ILO) has had a long history in identification of diseases as occupational in origin for the purpose of their prevention and compensation. Here are some examples:

In 1919, the year of the creation of the ILO, anthrax and lead poisoning were declared as occupational diseases at the first International Labour Conference.

In 1925, the Convention No. 18 on Workmen's Compensation established the first ILO list of occupational diseases. Three diseases were included in the list. They are poisoning by lead, its alloys or compounds and their sequelae, poisoning by mercury, its amalgams and compounds and their sequelae, and anthrax infection.

In 1934, Convention No. 18 was revised and a new Convention was adopted. The new list of occupational diseases included in the revised Workmen's Compensation Convention (No. 42) has 10 diseases: lead poisoning, mercury poisoning, anthrax, silicosis, phosphorus poisoning, arsenic poisoning, poisoning by benzene, poisoning by the halogen derivatives of hydrocarbons of the aliphatic series, diseases due to radiation, and skin cancer (primary epitheliomatous cancer of the skin).

In 1964, the International Labour Conference adopted the Employment Injury Benefits Convention (No. 121) and its accompanying Recommendation No. 121. Convention No. 121 is appended with a separate schedule which allows for amending the schedule without having to adopt a new Convention. This separate schedule contains a list of occupational diseases giving entitlement to benefit. The list of occupational diseases adopted in 1964 includes 15 diseases (five new diseases: they are diseases caused by exposure to beryllium, chrome, manganese, carbon bisuphide and radiation). Under article 8 of Convention No. 121, a ratifying state shall, as a minimum, recognise the occupational origin of all the diseases comprised in this list.

The ILO list plays a key role in the harmonization of the development of policy on occupational diseases and in promoting their prevention. It do not include all know occupational diseases. Diseases on the list should be common to a number of countries or populations. Rare disorders (or less frequent and very specific to a small target group) can be dealt with at the local level.

At the national level, the ILO list is important in promoting the inclusion of a range of internationally acknowledged occupational diseases in national lists. The list of Occupational diseases established by the ILO has always served as an example for countries establishing or revising their national lists. Adding to the list would imply the extension of preventive measures to control the use of harmful substances and would assist better health surveillance of workers. This effect can be expected both in countries that have ratified the Convention and those that have not.

Definition of occupational diseases

Paragraph 6(1) of the afore-mentioned Recommendation No. 121 defines occupational diseases as follows: "Each Member should, under prescribed conditions, regard diseases known to arise out of the exposure to substances and dangerous conditions in process, trades or occupations as occupational diseases". The Protocol of 2002 to the Occupational Safety and Health Convention, 1981 defines occupational disease as any disease contracted as a result of an exposure to risk factors arising from work activity.

Two main elements are present in the definition of occupational diseases:

- The exposure-effect relationship between a specific work environment and/or activity and a specific disease effect
- The fact that these diseases occur among the group of persons concerned with a frequency above the average morbidity of the rest of the population.

Paragraph 7 of Recommendation No. 121 further states: "Where national legislation contains a list establishing a presumption of occupational origin in respect of certain diseases, proof should be permitted of the occupational origin of diseases not so listed and of diseases listed when they manifest themselves under conditions different from those establishing a presumption of their occupational origin".

Amendment of the list of occupational diseases

Convention No. 121 includes expectations that the list would be updated periodically.

Article 31 of the Convention No. 121 provides for a special procedure for amending the list of occupational diseases contained in Schedule I: the Conference may, at any session at which the matter is included in its agenda, adopt amendments to schedule I to the Convention by a two-thirds majority. The list was accordingly updated in 1980 at the 66th Session of the International Labour Conference. The list in Schedule I as amended in 1980 contains 29 diseases.

There have been a lot of developments after the list was amended in 1980. New physical, chemical and biological factors which affect workers' health are being identified constantly thanks to the development of diagnostic technology and epidemiological studies. According to the WHO, at the workplace, workers are exposed to:

- Chemical risk factors: 100,000 (Carcinogens: 400)
- Biological agents: 200
- Physical factors: 50
- Adverse ergonomic conditions: 20
- Allergens: 3000

There has been a change in the pattern of employment in many countries, too. Traditional heavy industries have diminished in some and have been replaced by service industries; In others particularly in the developing countries, heavy industries are being developed and a large number of workers are being exposed to occupational risks that were previously unknown in those countries. The development of new chemicals, coupled with the considerable increase in international trade, is creating new risks in all countries.

The number of occupational diseases that are recognized and included in various national compensation schemes has seen a steady increase over the years even though the paces of such an increase vary greatly from country to country.

Another international development was the comprehensive recommendation of 22 May 1990 issued for the 12 countries of the European Communities, which includes all the diseases and substances in the list appended to Convention No. 121, and many others. The European schedule of occupational diseases (Annex I of the Commission Recommendation) concerns diseases which are occupational in origin. The Recommendation is also annexed with an additional list of diseases suspected of being occupational in origin which should subject to notification and which may be considered at a later stage for inclusion in Annex I of the European Schedule.

Against this background, a review of diseases, which may be included in the international list, and the practice and trends in diagnosis and evaluation of occupational diseases for compensation purposes was included in the ILO Programme and Budget 1990–91. It was planned to submit the results of this review to a meeting of experts in the biennium 1992–93.

To prepare for the meeting, the Office made an extensive review of the law and practice in the Member States, of occupational diseases in different national legislation and of practice in diagnosis, reporting and evaluation for compensation purposes. In addition, the office also prepared a list of occupational diseases taking account of the lists in force and national practice in 76 different states or countries which served as the basis for work of the consultation.

Due to unexpected changes of circumstances, the Director-General of the ILO approved the convening of a consultation instead of a meeting of experts regarding the revision of the list of occupational diseases. Accordingly, an informal consultation on the revision of the list of occupational diseases appended to Convention No. 121, took place on 9–13 December 1991, in Geneva.

The experts were invited taking into account the technical specialities to be covered according to the types of diseases and the general experience on the policy of occupational diseases in each of the participant's country. Some of the consultants were those associated with employers' organizations and trade unions.

Photo by M. Lintunen

Heavy loads, repetitive motions and wrong work postures can cause musculosckeletal diseases.

It was noted at the consultation that there was a significant gap between the 1980 amended list of 29 entries and the level of scientific knowledge at the time of the consultation. The experts agreed that there was no moral and ethical reason to recommend lower standards in one country than another. The purpose of the meeting was to narrow the gap between the scientific information available at the time of the meeting and the list amended in 1980.

It was clear during the 1991 consultation that a new format of the list would help clarify the need (or lack of need) to include specific substance as those included in the working documents. Efforts were made in the construction of the format to avoid ambiguity that would result from double entry of either agents or conditions. Where agents result in multiple organ system diseases, these should be included within the list of agents. The agents will be classified as noted with the indication that only non-cancer end points are considered. Carcinogens are listed separately for emphasis and because of their importance. The inclusion of the IARC category 1 list was noted to be a minimum inclusion with possibility of inclusion of the other substances within the carcinogen listing which are not on the IARC category 1 list.

A new format was adopted by the informal consultation, breaking down the list into following three categories: 1. Diseases caused by agents (chemical, physical, biological). 2. Diseases of target organ systems (respiratory, skin, musculoskeletal). 3. Occupational cancer. The new format provides for a definitive comprehensive structure of the list. The new nomenclature - general titles for each section is included, under which open lists could be added. This would permit in the future to avoid too frequent revisions of the list by having a continuous process of publishing new scientific, epidemiological and statistical information regarding any agent possibly responsible for occupational or work-related diseases.

From a taxonomic point of view, the ILO list of occupational diseases (amended 1980) is a mixture of specific diseases of proven occupational origin (pneumoconiosis caused by sclerogenic dust, bronchopulmonary diseases caused by hard metal dust, etc.) and diseases due to a variety of agents (toxins, carcinogens, allergens, radiation, vibration, noise, etc.) that exist in the workplace but may also be encountered elsewhere.

Sometimes, it is a general term (diseases caused by) with one specific chemical (cadmium, beryllium, arsenic, etc.) or a group of chemicals (toxic nitro-and amino-derivatives of benzenes, or alcohol, glycols, etc.), sometimes it is a specific disease (noise impairment) with a specific cause (noise). Where appropriate, categories of diseases in a general sense may be preferable to lists of specific causes, for example, occupational asthma is designated as occupational asthma caused by sensitizing agents or irritants inherent in the work process. This seems to be a sensible proposal since over 300 specific occupational sensitizers have now been identified. Would it be more helpful to list their names in detail? One could say that the prevention of a disease is a lot greater if causal agents are specifically identified, but a list has always a tendency to be restrictive while the present designation has the advantage of including future sensitizers as soon as they will be identified.

The question of further simplification is not easy to solve. For example, it would be possible to group all causes of pneumoconiosis by referring only to diseases caused by the inhalation of recognized slerogenic dusts. A number of toxic metals are named. Would it increase the practical utility of the list simply to refer to diseases caused by toxic metals? There are some situations where it may be convenient to group under disease titles and others where chemical or physical headings are more appropriate.

One disadvantage of such simplification reflects the status and historical importance of the “ILO List”. The ILO list is well known in all countries of the world and specifically identifies common and important individual diseases. It is a public statement that these diseases are, or can be occupational in origin and that they can and should be prevented. As a result, simplification of the list or rearrangement in strictly logical format may result in some losses of impact.

Criteria for the determination of new occupational diseases to be added on the ILO list of occupational diseases include the strength of exposure and effect relationship, the magnitude of the risk factors and the fact that a disease is recognized in many national lists. The importance of having an adequate scientific basis for discussion was noted. Nevertheless, it had not been possible to prepare comprehensive criteria before the consultation for the proposed additions to the list and the new additions represented the best scientific judgement of the expert consultants presented.

Updating the list of occupational diseases

Based on the work of the 1990 informal consultation, the International Labour Office submitted proposals to update the list of occupational diseases in Schedule I of the Convention No. 121 by the International Labour Conference. It was not possible for the proposals to be accepted due to competitive priorities until Nov. 2000 when the Governing Body of the ILO at its 279th Session decided to place an item on the recording and notification of occupational accidents and diseases, including the possible revision of the list of occupational diseases, Schedule I to the Employment Injury Benefits Convention, 1964 (No. 121), on the agenda of the 90th Session (2002) of the International Labour Conference, with a view to standard setting under the single-discussion procedure.

A report provides information concerning the law and practice in the different countries with respect to the recording and notification of occupational accidents and diseases, including the list of occupational diseases, was prepared and circulated to Member States for comments. The report was accompanied by a questionnaire drawn up with a view to, inter alias, the preparation of a list of occupational diseases to be included in an annex to a proposed Recommendation concerning the list of occupational diseases and the recording and notification of occupational accidents and diseases. Taking into account the answers and comments of the Member States, a final report had been prepared and submitted to the International Labour Conference in June 2002.

The delegates to the 2002 Conference agreed to adopt the 1990 list with minor editorial modifications with the expectation that the ILO would convene, as a matter of priority, a tripartite meeting of experts to re-examine the list of occupational diseases. This adopted List is, in fact, included in the annex of the Recommendation concerning the list of occupational diseases and the recording and notification of occupational diseases, 2002. This new list supplements Schedule I of the ILO’s Employment Injury Benefits Convention, which has not been revised since its last amendment in 1980. The Recommendation concerning the list of occupational diseases and the recording and notification of occupational diseases, 2002 provides for a mechanism which allows the list of occupational diseases to be regularly updated through tripartite meeting of experts convened by the Governing Body of the ILO. The full list of occupational diseases as annexed to the Recommendation concerning the list of occupational diseases and the recording and notification of occupational diseases, 2002 can be obtained from: http://www.ilo.org/public/english/standards/relm/ilc/ilc90/pdf/rec-194.pdf.

Dr Shengli NIU
Senior Specialist in Occup Health
Infocus Programme on Safety
and Health at Work
International Labour Office
4 route des Morillons
CH-1211 Geneva 22, Switzerland
www.ilo.org/safework
E-mail: niu@ilo.org

Work-related diseases

D. Negash
ZIMBABWE

Introduction

The definition of occupational disease includes diseases in which work is the main causal factor. These are diseases caused by a pathological adaptation of the patient to an adverse work environment.

Occupational health risks

The various agents or factors which adversely affect health may be classified as: biological, chemical, physical, mechanical and ergonomic and psychosocial.

Biological hazards

In non-industrialized countries where the availability of health services for the general public is limited, workers – like everybody else – contract ordinary infectious diseases at home or elsewhere and bring them to work. Diseases such as malaria, respiratory infections, venereal diseases, gastroenteritis and anaemia are not only very common but can also be prevented if recognized and treated early.

Infections

Workers at risk of infectious diseases are health care personnel, workers who come into contact with infected animals or with animal products, persons engaged in ground-breaking activities (miners, farmers), sex workers, and workers from non-endemic areas, e.g. military personnel, travellers.

Blood-borne infections

HIV/AIDS

HIV is a retrovirus which can remain as a dormant infection for 20 or more years. It may also progress within months to produce a clinical syndrome, AIDS, whose modes of transmission are now well known.

HIV/AIDS is depleting Africa of its skilled and able-bodied men and women, exacerbating its economic woes in the process. Although agriculture generates only 20% of Africa's income, it sustains up to 80% of the continent's population. In much of Sub-Saharan Africa, agricultural output and income are plummeting because of AIDS. Labour-intensive industries such as the South African mining concerns are seriously affected by concurrent epidemics of HIV/AIDS and tuberculosis. Because of AIDS in Namibia, the *Human Development Index*, which combines life-expectancy at birth, adult illiteracy rate and gross national product (GDP), is predicted to decrease by 10% by 2006; in South Africa, the index is predicted to decrease by 15% by 2010.

Hepatitis B

This viral infection, which can also be transmitted sexually and vertically from mother to child, is acquired in occupational settings through contact with infected blood and body fluids.

Zoonotic diseases

Man shares the environment not only with wild and domestic animals, but also with their diseases such as anthrax, tetanus and trypanosomiasis.

Anthrax is an acute spore-forming bacterial infection affecting the skin, intestine and lungs. Its modes of transmission include:

- direct skin contact with tissues of diseased animals (cattle, goats, pigs, sheep etc.), or with products of such animals (e.g. hair, wool, hides)
- contact with contaminated soil
- inhalation of spores in high-risk industrial processes such as tanning (and recently also in bioterrorism incidents)
- ingestion of contaminated undercooked meat.

Tetanus is another spore-forming bacterial infection and is usually introduced into the body through wounds contaminated by soil, street dust, or animal or human faeces.

Trypanosomiasis (African Sleeping Sickness)

This protozoan infection, which mainly affects the cardiovascular and central nervous systems, is transmitted by the bite of the tsetse fly. It is confined to Africa and is lethal in the case of humans and domestic cattle. Human infection occurs when people use large uninhabited woodland areas for recreational or occupational reasons.

Air-borne infections

Tuberculosis (TB)

Pulmonary tuberculosis is a bacterial infection caused by mycobacterium tuberculosis. Exposure to the bacilli occurs through air-borne droplet nuclei produced by patients with the active lung disease. The germs can stay alive in the environment for as long as two weeks. In approximately 90 to 95% of those infected, no disease appears. However, among those whose immunity is compromised by HIV co-infection, about 50% develop active tuberculosis. Using a short course of appropriate directly observed treatment (DOT), the disease can be effectively treated and its transmission interrupted.

Co-infection with HIV has resulted in a parallel epidemic of TB in urban Sub-Saharan African populations; the annual rates increased 5-10 fold during the latter half of the 1990s.

Sexually transmitted infections (STIs)

STIs, including HIV, are among the commonest communicable diseases world-wide. These diseases are extraordinarily common among sex workers and seasonal or migrant labourers. The prohibitive cost of medical care in the face of poorly-funded state-run health services also contributes to the spread of these potentially treatable diseases in Sub-Saharan Africa.

The complications arising from untreated STIs include blindness, chronic disorders of the cardiovascular and nervous system, infertility, cancer and death. Untreated ulcerative STI lesions also increase the risk of both contracting and transmitting HIV.

Water-borne infections

Schistosomiasis

This infection is acquired from parasitic flat worms whose free-swimming larval form can penetrate the skin and enter the blood stream when a person is wading or bathing. The types found in Africa are the intestinal and the urinary forms. Plantation workers and fishermen are at high risk of infection.

The most serious complications of these diseases are chronic liver disease, anaemia, kidney failure, bladder cancer, egg granuloma in the central nervous system.

Chemical hazards

Chemicals have become an integral aspect of modern life. The true impact of work-related chemical-associated diseases in both human and economic terms is unknown.

Substances that are considered harmful to biological systems are generally referred to as *toxins* or *toxicants*. Some substances that are harmful at high doses may in fact be essential to biological systems; this illustrates the *dose-response-relationship*.

Many toxic chemicals whether natural or man-made, acutely endanger life or lead to long-term diseases such as cancer, pneumoconiosis etc.

A substance is not necessarily *harmless* because it is *natural*, since naturally occurring minerals such as asbestos, lead, radioactive ores, mineral oil etc. are major causes of occupational diseases.

The main routes of chemical exposure are inhalation, skin contact and ingestion. Toxicity depends upon the nature of the chemical, its physical state, the route, the concentration and duration of exposure, and the disposition of the chemical, including any biotransformation, or upon the sensitivity of the organ or tissue exposed.

Although the targets for chemical injuries include the liver and systems such as the cardiovascular, genitourinary, reproductive, haematopoietic, and central and peripheral nervous systems, this article focuses on diseases of the ***skin*** and the ***respiratory tract***, as these two organs receive the brunt of most chemical assaults.

Occupational disorders of the respiratory system

The respiratory system begins at the breathing zone just outside the nose and mouth and extends through the conductive airways to the alveolar sacs, where gas exchange takes place between the alveoli and the capillary blood flowing around them.

With a ventilation rate of about 6 litres per minute at rest, the human lungs come into contact with a massive volume of air each day – along with the attendant suspended chemical and microbial load. Many hazardous substances in occupational settings are found as airborne particles. A dispersed suspension of solid or liquid particles in gases is known as an aerosol.

The pulmonary response to hazardous airborne particles at workplaces consists of acute inflammation, including broncho-constriction, respiratory sensitization (manifestations of asthma), pneumoconiosis, extrinsic allergic alveolitis, cancer and infection (e.g. TB).

Acute inflammation

This is caused by water-soluble gases and fumes which irritate the upper respiratory tract immediately on contact. Other irritant gases cause delayed pulmonary oedema and respiratory distress some 48 – 72 hours after exposure.

Respiratory sensitization

This is described as immediate if responses such as cough, shortness of breath and chest tightness appear within minutes of exposure, and non-immediate if they do so within 4 – 8 hours. Over 200 agents have been known to cause such responses, also referred to as occupational asthma **(OA).**

The inflammation of airways and broncho-constriction that lead to the aforementioned responses may be caused either by immunological response to sensitizing agents or by direct irritant effects of the chemical.

OA has the following features:

- The attack is dose-related
- For a potent sensitizing agent, a past history of allergy need not exist
- The level of exposure needed to sensitize is much higher than the dose required to provoke asthmatic attacks
- When exposure ceases, the sensitivity gradually decreases
- Immediate responses represents a small proportion of **OA** cases
- Accurate diagnosis, treatment and prevention are essential, given the seriousness of the disease.

Pneumoconiosis

Pneumoconiosis is defined as the accumulation of mineral dust in the lungs and the tissue reactions to its presence. From the pathological point of view, the disorder can be classified as:

- **Non-collagenous pneumoconiosis**; this is caused by non-fibrogenic dust (e.g. tin oxide) and is characterized by intact alveolar architecture; the dust reaction is potentially reversible.
- **Collagenous Pneumoconiosis**, which is the type caused by fibrogenic dust (e.g. silicon, asbestos). Its features are permanent alteration of the alveolar architecture and irreversible scarring of the lungs.

Asbestos fibres that reach the alveoli cause progressive fibrotic disease that may lead to premature death from either restrictive lung disease or from carcinoma.

Extrinsic allergic alveolitis

The inhalation of organic materials such as grain dust can produce alveolitis, which is characterized by the presence of cellular exudate in the alveoli followed by reduction of gas exchange across the blood-gas barrier. The clinical features are an acute or insidious onset of cough, wheezing, fever, sweating and breathlessness. Examples of extrinsic allergic alveolitis include the following two occupational lung diseases caused by fungal spores in grass and grain:

- farmer's lungs – from exposure to mouldy hay
- wheat weevil's lung – from exposure to mouldy grain.

Cancer of the respiratory tract

Established occupational respiratory carcinogens include asbestos, hexavalent chromium, uranium, coal-tars and soots, arsenic, cadmium and beryllium, and their compounds.

The following occupations increase the risk of cancer of this system:

- the mining of asbestos, uranium, arseniferous ores, tin
- processes such as aluminium smelting, chromate production
- construction, if asbestos is used.

Occupational skin diseases

Skin disorders induced by conditions of work are called ***occupational dermatoses***. A large number of chemicals encountered at work come into contact and react with the skin by:

- penetrating it to enter the blood stream and act systemically (e.g. solvents, parathion),
- reacting with its surface and causing primary skin irritation (e.g. acids, alkalies),
- penetrating it and causing allergic contact dermatitis (e.g. formalin, nickel).

Features of Occupational Dermatoses

The terms *dermatitis or eczema* refer to a particular type of inflammatory skin reaction which may be triggered by internal or external factors.

Occupational Contact Dermatitis – which accounts for over 90% of all cases of occupational dermatoses – is exogenous eczema caused by the interaction of the skin with chemical (mainly), biological or physical agents.

Features of the two types of contact dermatitis

Irritant contact dermatitis is caused by direct cytotoxic action of the offending substances. Most occupational contact dermatitis belongs to this type, and all human skin is vulnerable to this disorder if exposed to a sufficient dose.

Allergic contact dermatitis is a cell-mediated hypersensitivity reaction and is responsible for about 20% of all cases of contact dermatitis. Many allergens are irritants, but the threshold is much higher than that required for sensitization.

Occupational diseases due to physical agents such as noise, vibration, pressure and heat

Noise-induced hearing loss

Noise – unwanted sound – poses a serious hazard to hearing in today's increasingly noisy environment. The two types of noise-induced hearing loss are:

- ***Acute-noise induced conductive deafness*** refers to the immediate effects of exposure to high-intensity sound (e.g. that of an explosion) that causes rupture of the tympanic membrane (in the middle ear) and dislocation of the ossicles (inner ear). Generally, such a hearing deficit can be reversed surgically.
- ***Perceptive deafness*** is caused by exposure to high-intensity sound pressure over several years; this may damage the sensory hair cells in the inner ears permanently.
- ***Tinnitus*** is a common symptom accompanying noise-induced hearing loss; the sufferer perceives hearing unpleasant hissing, whistling or roaring sounds.

Vibration

Vibration is oscillatory motion about a point. Workers may be exposed to two types.

- ***Segmental or hand-arm vibration***
  Prolonged and recurrent exposure of the fingers or the hands to vibration can give rise to vascular and neurological disorders.
- *Vascular disorders* include vibration white finger (VWF). This is characterized by intermittent blanching of the fingers due to arterial vasospasm, which is often precipitated by exposure to cold weather or objects.
- *Neurological effects* of segmental vibration include numbness, tingling, and an elevated sensory threshold to touch, temperature and pain.
- Whole-body Vibration
  This occurs when the body is supported on a surface which is vibrating.
  Vibration of the human frame can produce adverse effects such as increased dynamic load on the musculoskeletal tissue (back and shoulder pain), motion sickness, reduction in visual acuity and interference with intracellular activity. These effects may compromise safety as well as productivity.

Decompression sickness

Under normal circumstances humans are exposed to atmospheric pressure, which at sea level is 1 bar or 1 atmosphere. Rapid changes in pressure causes a wide range of *decompression sicknesses*. The main occupations in which changes in density altitudes are experienced are those of deep-sea divers (marine biologists, underwater archeologists), tunnel workers and high-flying air crew. In the first two groups, pressure is increased; in the last it is decreased.

The effects depend on the *rate* and *degree* of decompression, which can range from minor discomfort to instant death. Such diseases include barotrauma (rupture of the alveolar sacs or the tympanic membrane) and dysbaric osteonecrosis.

The coastal waters of Southern Africa are increasingly attracting deep-sea divers and thus exposure to decompression sickness. When deep-sea divers descend at high pressure and return to the surface at low pressure, nitrogen gas is released. If the bubble made by this gas is large enough to impede the blood flow to the bones, this can lead to the breakdown of healthy bony tissues (dysbaric osteonecrosis).

Heat exposure

The metabolic heat produced by metabolic activities is lost to the environment by peripheral vasodilation and sweating to maintain the body temperature at 37°C. The heat which affects workers particularly in the tropics can be due to ***exogenous and endogenous factors.***

The ***exogenous*** factors are air temperature and speed, relative humidity, mean radiant temperature, duration of exposure, and clothing. The ***endogenous*** thermal load depends on basal metabolism and physical activity.

The heat load generated by endogenous or exogenous sources can lead to heat stress, which is characterized by problems including diminished vigilance, heat stroke, heat-related cramps, rashes and collapse, and exhaustion caused by water and salt depletion.

Disorders caused by ergonomic hazards

Departures from sound ergonomic practices can cause injurious mechanical stresses. These stresses can be *external*, as in the case of a chain saw, which causes vibration of the hand and fingers, or *internal,* as when strenuous lifting causes compression of the spinal discs, resulting in severe backache. Work-related musculoskeletal disorders (also called *cumulative strain disorder)* often result from biomechanical stress.

These stress disorders of the muscular skeletal system frequently affect the

Photo by D. Negash

Photo 1 and 2. Occupational prepatellar bursitis before and after surgical excision.

lower back, neck, shoulders, knees and feet. The range of problems includes sprains, stress, strains, fractures, tendonitis, carpal tunnel syndrome and bursitis. ***Occupational prepatellar bursitis***, which is a common and debilitating occupational knee injury among rural African women, will be discussed in detail.

Risk factors in ergonomic disorders include awkward posture (e.g. bending), sudden load or forceful exertion (e.g. lifting and handling heavy objects), localized mechanical contact stresses (e.g. kneeling), and repetitive or prolonged static postures or vibration.

Prepatellar Bursitis (PPB)

In rural Africa, where most of the population live, a girl child is introduced to various domestic chores that require prolonged kneeling. These include working with a grinding stone, threshing grain, cassava etc., smearing floors of dwellings with cow dung for aesthetic and insect repellent purposes, spreading grain for sun-drying, using a blowpipe to start a fire, or milking, often while kneeling on one knee.

For the rest of her working life, the rural woman assumes kneeling posture for hours every day. Years of exposure to the traumatic and prolonged mechanical stress imposed by activities involving kneeling underlies the onset of the painfully incapacitating PPB that many elderly women suffer in silence.

In a cross-sectional study based on rigid clinical parameters conducted by this author, the prevalence of occupational PPB among middle-aged West Kenyan women exposed to years of kneeling activities without the use of a knee cushion was 21%. Not surprisingly, the condition was absent among women who consistently used a means of dissipating the kinetic energy, such as knee pads, rags etc.

Photos 1 and 2 show a case of incapacitating PPB in the study group before and after the massive bursa was surgically removed.

Psychosocial Hazards

Occupational stress in the context of the majority of workers in Africa means the strain imposed on the worker by the pressure both of urbanization and of new work methods and environments. The plight of child and migrant labourers, who often live and work under squalid and unsafe conditions, is much worse than that of workers in the mainstream labour market.

Urbanization

Most workers in Africa are drawn from unskilled rural populations whose daily rhythms used to be dictated by natural events such as sunrise and sunset. In the new urban setting, these rhythms of work and rest are disrupted.. The crowded urban living conditions, sedentary lifestyle, noise, frequently unhealthy diet, loneliness and disruption of the traditional life of the extended family life are simply at odds with their relatively serene rural past. In an effort to cope, many workers resort to the abuse of drugs such as tobacco and alcohol, as well as indulging in irresponsible sex.

The work environment

Stress at work may be caused by many factors:

a) physical environment: noise, extreme temperature, unsound ergonomic conditions
b) job content: work overload, time pressure (e.g. assembly line work)
c) work organization: shift work, long work hours
d) interpersonal relationships: authoritarian attitudes of superiors, harassment, verbal and physical abuse, discrimination, etc.
e) career structure: threat of redundancy, perception of underpayment
f) the home-work interface: childcare responsibilities.

The symptoms of stress can be *physical* (e.g. headache, gastro-intestinal and cardiovascular disorders), *psychological* (anxiety and depression), or *behavioural* (the worker becomes aggressive, accident-prone etc.).

Prevention of occupational diseases

The prevention of work-related diseases depends mainly on the control of the underlying adverse biological, chemical, physical, ergonomic and psychosocial agents encountered at work through the employment of various strategies. These include interventions in the areas of engineering, administration, education, legislation, ergonomics, hygiene, public health, social matters and medicine. The use of large numbers of strategies aimed at protecting and promoting health and safety and at preventing diseases and injuries at work should take place within the wider context of human rights.

Compliance with the Conventions and Recommendations or labour standards established by the International Labour Organization in order to improve conditions of life and work must constitute the ultimate path towards this goal. Finally, since a healthy workforce is a priceless asset for a nation, any investment aimed at protecting and promoting it will result in an enormous dividend.

Bibliography

1. Encylopaedia of Occupational Health and Safety 4th edition. ILO, Geneva, 1998.
2. Harrington JM, Gill FS, AW TC, Gardner K. Occupational Health 4th ed., 1998.
3. Hathaway GJ, Proctor NH, Hughes J. Chemical Hazards of the Workplace. 4th ed., John Wiley and Sons, 1996.
4. Howard JK, Tyrer FH. (Editors) Textbook of Occupational Medicine, Churchill Livingstone, 1987.
5. Jeyaratnam J. (Editor) Occupational Health in Developing Countries. Oxford University Press, 1992.
6. Levy BS, Wedman DH. (Editors). Occupational Health. Recognizing and Preventing Work-related Disease and Injury. 4th ed., Lippincott Williams and Wilkins, 2000.
7. Negash D. Prevalence of Occupational Prepatellar Bursitis in Middle-aged West Kenyan Women. Thesis in partial fulfilment of the degree of Master of Medicine in Occupational Health. University of Birmingham, U.K. 1990.
8 . Stacey NH. (Editor) Occupational Toxicology. Taylor and Francis, 1993.
9. Stop TB Partnership. The Global plan to stop Tuberculosis WHO, Geneva, 2002.
10. Waldron HA, Edling C. (Editors) Occupational Health Practice. 4th ed., Arnold, a member of Hodder Headline Group, 2001.
12. Zenz C. Occupational Medicine. Principles and Practical Applications 2nd ed., Year Book Medical Publishers, 1988.

Dr Debru Negash
Specialist in Occupational Health and Tropical Medicine
Department of Community Medicine
College of Medicine
University of Zimbabwe
P O Box A178
Avondale, Harare
Zimbabwe
E-mail: debrumia@zol.co.zw

Why the poor response in South Africa to the ILO/WHO Global Programme to Eliminate Silicosis?

D. Rees
SOUTH AFRICA

Among the many existing reasons, there are two overriding reasons why South Africa should have enthusiastically embraced the Global Strategy to Eliminate Silicosis: we have a serious silicosis problem; and the Strategy presents a good opportunity for our fragmented occupational safety and health structures to work together in a common cause, providing a platform for more integrated approaches to other issues.

Yet our response has been desultory, even uninterested in some respects. The reasons are worth thinking about because they may provide insights into the lack of improvement in occupational safety and health in the country. There has been no investigation into the matter, so I present here some preliminary ideas. Others, particularly people from countries with successful strategies, will have to add a good deal.

Silica and disease in South Africa

A reasonable explanation for our poor response contends that silica dust is controlled and silica-related diseases are unimportant. But this response is untenable, because what data we have show the opposite. We can conclude from recent investigations that:

- Dust control is inadequate in both the mining and non-mining sectors (1,2,3). (The development of small mines throughout the region is likely to expose more workers to more silica dust.)
- There is a large burden of undetected lung disease in former silica-exposed miners now living in labour-sending areas (4,5).
- Silicosis is common among industrial workers (2,3) and gold miners, and the attendant tuberculosis risk is high (6,7,8).
- Recent research has found that silica dust increases the risk of tuberculosis (9) as well as that of silicosis, and that this risk is compounded in HIV-infected workers (10).

Inadequate dust control is widespread in the region. For example, only 24% of South African foundries responding to a postal questionnaire actually measured dust, and an uncontrolled dust hazard was evident in all foundries surveyed by the National Centre for Occupational Health, South Africa, between 1983 and 1992 (2). In the late 1990s, only 8 out of 48 gold mines (11) had all estimated quartz concentrations below the widely used reference level of 0.1 mg/m^3.

Silicosis rates among former gold miners now living in labour-sending areas illustrate the importance of silicosis in the region. Steen and co-workers (4) found a silicosis prevalence of 26 to 31% among former miners living in Thamanga, Botswana, and Trapido et al. reported a corresponding prevalence of 22–37% in Libode, Eastern Cape, South Africa (5). Generalizing these rates to an estimated two million former miners living in Southern Africa produces an astonishing 480,000 cases of pneumoconiosis (12).

If silicosis were an innocuous disease these high rates would not be of great concern, but the strong association between silicosis and tuberculosis in Southern Africa combined with the HIV epidemic, makes the situation alarming. Cowie found an increasing incidence of tuberculosis with increasing severity of silicosis among South African gold miners: 1% per annum among men without silicosis; 2.2% among men with mild silicosis; 2.9% with moderate silicosis; and 6.3% with advanced silicosis[8]. Cowie suggested that one quarter of his subjects with silicosis would have developed tuberculosis by 60 years of age (8). This was before the surge in the HIV epidemic.

Recent studies have found that it is not only silicosis but silica dust itself that confers an increased risk of tuberculosis, and that this risk persists even after silica dust exposure ends, probably for life; a finding with profound implications for public health policy, including surveillance of workers and workers' compensation.

Combined with significant levels of migrant labour and the highest HIV infection rates in the world, the interactions between inadequate silica dust control, high rates of silicosis, HIV infection and tuberculosis, including the multi-drug resistant forms, present major challenges for occupational and general public health services in the region.

The Global Elimination of Silicosis Programme in South Africa

If the evidence is strong that serious silica-related diseases are common, then what can explain our weak participation in the Global Programme?

One explanation is that awareness, particularly of the interaction between silica, silicosis and tuberculosis, has not penetrated deeply. There is anecdotal evidence for this assumption: South African foundry managers interviewed about silicosis did not consider the disease a serious matter. (Unpublished data, Engela Venter, National Centre for Occupational Health.)

But there is a lack of urgency even among those aware of the extent of silica exposure and its associated risks. Some likely explanations are:

Competing needs make silica diseases relatively unimportant. Government departments, trade unions and businesses face enormous demands in a country in social and economic transition confronted by poverty, unemployment, HIV and globalization. Occupational injury is a more visible and immediate concern.

Vertical, issue-specific programmes – such as those aimed at the elimination of a disease – use resources inefficiently.

The economic and business case for mobilizing resources is underdeveloped. It is a tenet of occupational health that reduced occupational disease and injury and improved working conditions will promote development, but convincing evidence from poorer countries is hard to find. At the enterprise level, increased competition from inside and outside the country is the theme of an oft-heard lament. (I cannot afford to spend money on improving working conditions if my competitors do not.)

A fragmented national occupational health and safety system has resulted in a lack of leadership and accountability.

The Global Programme is perceived to be of limited value. Firstly, because South Africa has a long history of campaigns, programmes and government commissions to reduce dust and diseases, what will the new programme bring? A second reason is that the solutions are seen to be complex, for example in deep level mining, and confidence that a programme will provide solutions is low.

It may be that these are not the most important explanations, or, more probably, that some or all of them have contributed to our lacklustre response. Assuming the latter, what might be done?

“Raising awareness” has become a mantra aimed at solving any number of social ills; nevertheless, it remains a prerequisite for action. The interactions between silica, silicosis, tuberculosis and HIV, and the benefits of participation in the Strategy are key elements.

Competing needs and “issue-fatigue” probably mean that additional resources, including dedicated personnel, are needed. In particular, it is probably unrealistic to expect organized labour to contribute meaningfully without support. The proposed Sida/SADC Programme on Occupational Safety and Health, supported by the Swedish National Institutes of Working Life and Public Health, includes a programme of action on silica, and is an example of how this support can be achieved.

Although a strategy to eliminate silicosis may be seen as too issue-specific, skills and systems developed to control dust and find cases of silicosis are likely to enhance occupational health services and capacity generally, and will contribute to tuberculosis control. If there is evidence for these advantages, it will support the Programme.

Research or case studies that demonstrate the developmental role of better occupational health in poorer countries need to be more widely available, and industry-wide activities would assuage fears about “unfair competition” arising from uneven implementation.

The potential bonding of sectors of the occupational health system through joint silicosis projects, potentially smoothing future integration, should be stressed. The lack of leadership and accountability could be addressed by identifying an individual from the leading government department, currently that of Labour, to formulate a strategy with the social partners and other departments and agencies. This will take time, and current initiatives, in the mining sector and academic institutions, for example, should not be inhibited.

Publicising any achievements of the Programme in other countries would develop confidence that the effort would be rewarding, particularly if practicable and cost-efficient solutions were emphasized.

In conclusion, a sustained effort on the part of a very large number of people in many settings is needed to eliminate silica-related diseases. The effort is unlikely to be made unless the evidence is available to make the case for it. Although we have the primary responsibility in our own countries, international agencies (the ILO and WHO seem obvious candidates as promoters of the Global Elimination of Silicosis) could contribute substantially by providing information for an evidence-based approach.

References

1. Commission of Inquiry into Safety and Health. Leon RN, Chairperson. Pretoria: Department of Mineral and Energy Affairs, 1995.
2. Rees D, Weiner R. Dust and pneumoconiosis in the South African foundry industry. S Afr Med J 1994;84:851–5.
3. Rees D, Kielkowski D. Dust and pneumoconiosis in the South African ceramic industry. S Afr J Science 1991;87:493–5.
4. Steen TW, Gyi KM, White NW, et al. Prevalence of occupational lung disease among Botswana men formerly employed in the South African mining industry. Occup Environ Med 1997;54:19–26.
5. Trapido AS, Mqoqi NP, Williams BG, et al. Prevalence of occupational lung disease in a random sample of former mineworkers, Libode district, Eastern Cape Province, South Africa. Amer J Ind Med 1998;34:305–13.
6. Hnizdo H, Sluis-Cremer GK. Risk of silicosis in a cohort of white South African gold miners. Am J Ind Med 1993;24:447–57.
7. Murray J, Kielkowski D, Reid P. Occupational disease trends in black South African gold miners. Am J Respir Crit Care Med 1996;153:706–10.
8. Cowie RL. The epidemiology of tuberculosis in gold miners with silicosis. Am J Respir Crit Care Med 1994;150:1460–2.
9. Hnizdo E, Murray J. Risk of pulmonary tuberculosis relative to silicosis and exposure to silica dust in South African gold miners. Occup Environ Med 1998;55:496–502.
10. Churchyard GJ, Corbett EL. Tuberculosis and Associated Diseases In: SIMRAC Handbook of Occupational Health Practice in the South African Mining Industry. Guild R, Ehrlich RI, Johnson JR, Ross MH (Eds). The Safety in Mines Research Advisory Committee, Johannesburg, 2001.
11. Rees D, Kielkowski D, Lowe R, et al. A Report on Occupational Health Indicators for South Africa. National Centre for Occupational Health, Johannesburg, 1999.
12. Trapido A, Goode R, White NW. Costs of occupational lung disease in South African gold mining. J Mineral Policy 1998;13:26–33.

David Rees
Professor of Occupational Health, University of Witwatersrand
Director of National Centre for Occupational Health NCOH
P.O. Box 4788
Johannesburg 2000
South Africa
Fax + 27 11 712 6458
Tel + 27 11 720 0525
E-mail reesd@health.gov.za

Low back pain among rural and urban populations in Southwest Nigeria

F. O. Omokhodion
NIGERIA

Introduction

Low back pain is a work-related disorder which is well recognised in several occupations. It is the most common musculoskeletal disorder in the workplace. Low back pain has been reported among factory workers (1, 2), in health care (3, 4) and in the informal sector (5). Several occupational factors – such as poor work postures, bending, lifting and heavy physical work – are associated with low back pain (6).

Reports from industrialized countries have indicated prevalence rates among the general population ranging from 21% in Hong Kong (7) and 39% in Bradford, UK (8) to 69% in Denmark (9). Reports from less industrialized countries are few but it is generally believed that the prevalence is much lower. Such deductions have been made on the basis of reports on general health surveys carried out in less industrialized countries. It has been suggested that the reason for the low prevalence in these countries is that low back pain pales into insignificance in the face of major health problems resulting from communicable diseases and poverty, and that low back pain as such may not be reported in health surveys conducted among populations. Specific enquiry into the occurrence of low back pain should elucidate the extent of this problem among the population. Four surveys were carried out in rural and urban parts of Southwest Nigeria to enquire about low back pain among the population.

Method

Hospital workers in a rural hospital in Igboora, Oyo State (n=74) and the general population in Igboora (n=900) constituted the two study groups in the rural setting while civil servants (office workers) in Ibadan (n=840) and the general population in the Idikan area of Ibadan (n=474) constituted the study groups in the urban area.

A structured questionnaire was administered to the four study groups. The questionnaire sought information on sociodemographic variables such as age, sex, job history, smoking status and educational status. Respondents were requested to provide information about the occurrence of low back pain in the 12 months preceding the survey and at the time of the survey. Their knowledge of causes and prevention of low back pain was also recorded. Questionnaires were coded and analysed separately for the four study groups.

Prevalence of low back pain

Among health care workers, the 12-month prevalence of low back pain was 46%. Back pain was more prevalent among females (64%) than males (37%). The prevalence increased with age. The highest prevalence was reported among nurses (69%) followed by secretaries and administrative staff (55%) (Table 1.)

Among the general population in Igboora, the 12-month prevalence of low back pain was 40% while the point prevalence was 33%. The prevalence was higher among males (44%) than females (36%). The residents in that rural population were predominantly petty traders, farmers and artisans. The prevalence of low back pain was highest among farmers (46%) and lowest among petty traders (34%). Artisans reported a prevalence of 40%. In this study the prevalence was not related to age. Farming as an occupation and the male sex were

Table 1. Prevalence of low back pain among hospital workers in rural settings.

Occupation	No. of men	No. (%) with back pain	No. of women	No. (%) with back pain	Overall prevalence (%)
Doctors	1	1 (100)	-	-	100
Nurses	2	1 (50)	14	10 (71)	69
Technicians/Technologists	17	4 (25)	2	1 (50)	26
Secretaries/ Admin. staff	9	4 (66)	-	-	55
Cleaners/aids	10	5 (50)	7	3 (43)	47
Drivers	5	1 (20)	-	-	20
Others	5	2 (40)	2	2 (100)	57
Total	**49**	**18**	**25**	**16**	**46**

Table 2. Low back pain (LBP) among occupational groups in an urban population.

Occupation	N	n LBP	(% with LBP)
Housewives	19	6	32%
Traders	189	64	44%
Artisans	111	52	47%
Farmers	27	23	85%
Office/Formal sector employees	52	18	35%
Other	68	24	35%
No response	8	1	13%
Total	474	208	44%

significantly associated with low back pain.

In the urban setting, the 12-month prevalence of low back pain among office workers was 38% while the point prevalence was 20%. The prevalence was higher (40%) among males than females (34%). Low back pain was more prevalent among workers in the senior staff grade (42%) in comparison with those in the junior staff grade (28%). The prevalence of low back pain was associated with smoking and was highest among current smokers 57% as compared against 36% among those who had never smoked.

The general population in the urban setting reported a 12-month prevalence of 44% and a point prevalence of 39%. The prevalence was higher among males (49%) than females (39%). The prevalence of low back pain increased with age. The prevalence of low back pain was highest among farmers (85%) and lowest among housewives (32%). Statistical analysis showed that back pain among this population was associated with farming as an occupation and a history of trauma. About 80% of those with low back pain associated their back pain with the work they do. Causes of back pain mentioned included heavy physical work, bending, lifting and walking long distances.

Treatment for low back pain was mainly by analgesics and rest. Consultation with health practitioners for low back pain was higher among the urban population (77%), than among the rural population (42%) and was related to the severity of back pain. The number of days taken off work in the last year was 3 among the general population in the urban area, 4.7 among office workers, 5 among workers in the rural hospital and 13 among the general population in the rural setting.

These surveys show that the prevalence of low back pain in the rural and urban populations studied are about the same and are comparable with those reported in industrialized countries.

Risk factors for low back pain

Low back pain is generally accepted to be associated with increasing age (8, 10, 11). However, published reports have not shown a consistent association between low back pain and sex. While some reports have shown a female preponderance (9, 12), others showed no gender differences (13). The association between low back pain and smoking is a subject of controversy. Nevertheless, several studies report that low back pain is associated with smoking (1, 9). The biological mechanism is poorly understood, but it is thought that smoking may lead to reduced perfusion and malnutrition of tissues in and around the spine, thereby causing these tissues to respond inefficiently to stress (14). Low back pain is also associated with a history of trauma.

With regard to occupational factors, the surveys in Nigeria highlight the association between low back pain and farming. A similar finding has also been reported in Lesotho (15). This is not surprising, as activities in that occupation require bending, lifting and heavy physical work. Workers in small-scale industries in the informal sector, such as mechanics and other artisans, have a risk of low back pain for the same reasons. In the formal sector, nurses, secretaries and senior office workers are also at risk. Low back pain among nurses is due to lifting and prolonged standing while office workers and secretaries can attribute their low back pain to prolonged sitting, usually in poorly designed chairs.

Prevention of low back pain

Workplace education on the prevention of low back pain may help to reduce the prevalence of this problem. The need for workplace education in the informal sector continues to be a challenge to occupational health practitioners in developing countries. However, trade unions and labour groups can be utilized for the dissemination of information among workers.

The use of correct postures for various work activities will limit physical strain on the musculoskeletal system. As material handling equipment is usually not available in developing countries and re-designing of jobs may not be feasible, lifting techniques should be taught to nurses and workers in trades where manual handling of heavy objects is practised. Prolonged static positions, e.g. sitting and standing for long hours at work, should be avoided. Executive chairs in the office setting are usually poorly designed and should be avoided if found ergonomically unsuitable.

Treatment of low back pain remains unsatisfactory. Acute back pain may be relieved with bed rest (16), while some studies have demonstrated the positive effects of exercise (17, 18) and continuous activity (19). Many low back pain sufferers will not present to the physician except the symptoms are severe. This visit provides the opportunity to rule out non work-related causes of low back pain.

References

1. Toroptsova NV, Benevolenskaya LI, Karyakin AN, Sergeer IL, Erdesz S. Cross sectional study of low back pain among workers at an industrial enterprise in Russia. Spine 1995;20:328–32.
2. Rotgoltz J, Derazne E, Froom P, Grushecky E, Ribak J. Prevalence of low back pain in employees of a pharmaceutical company. Israel J Med Sci 1992;28:615–8.
3. Hignett S. Work-related back pain in nurses. J Adv Nursing 1996;23:1238–46.
4. Mierzejewski M, Kumar S. Prevalence of low back pain among physical therapists in Edmonton, Canada. Disab Rehab 1997;19:309–17.
5. Omokhodion FO, Osungbade OO. Health Problems of automobile mechanics in Nigeria. Tropical Doctor 1996;26:102–4.
6. Xu Y, Bach E, Orhede E. Work environment and low back pain: the influence of occupational activities Occup Environ Med 1997;54:741–5.
7. Lau EM, Egger P, Coggon D, Copper C, Valenti I, O'Connell D. Low back pain in Hong Kong: prevalence and characteristics compared with Britain. J Epid Comm Health 1995:49:492–4.
8. Hillman M, Wright A, Rajaratnam G, Tennant A, Chamberlain MA. Prevalence of low back pain in the community: implication for service provision in Bradford, U.K. J Epid Comm Health 1996;50:347–52.
9. Harreby M, Kjer J, Hesselsoe G, Neergaard K. Epidemiological aspects and risk factors for low back pain in 38-year old men and women: 25 year prospective cohort study of 640 school children. Eur Spine J 1996;5:312–8.
10. Waxman R, Tennant A, Helliwell P. A prospective study of back pain in the commu-

nity. Spine 2000;25(16):2085–90.
11. Matsui H, Maeda A, Tsuji H, Naruse Y. Risk of low back pain among workers in Japan. Association of familial and physical factors with low back pain. Spine 1997;2:1242–7.
12. Thorbjornsson CO, et al. Psychological and physical risk factors associated with low back pain: A 24-year follow-up among women and men in a broad range of occupations. Occup Environ Med 1998;55:84–90.
13. Smedley J, Egger P, Copper C, Coggon D. Manual handling activities and risk of low back pain in nurses. Occup Environ Med 1995;52:160–3.
14. Eriksen W, Natvig B, Bruusgaard D. Smoking, heavy physical work and low back pain, a four year prospective study. Occp Med 1999;49(3):155–60.
15. Worku Z. Prevalence of low back pain in Lesotho mothers. J Manipulative and physiological therapeutics 2000;23(3):147–54.
16. Waddell G, Feder G, Lewis M. Systematic reviews of bed rest and advice to stay active for acute for low back pain. Br J Gen Practice 1997;47:647–52.
17. Gundewall B, Liljeqvist M, Hansson T. Primary prevention of back symptoms and absence from work. A prospective randomised study among hospital employees. Spine 1993;18:587–94.
18. Ljunggren AE, Weber H, Kogstad O, Thom E, Kirkesola G. Effect of exercise on sick leave due to low back pain. A randomised, comparative long term study. Spine 1997;22:1610–6.
19. Malmivaara A, Hakkinen U, Aro T, et al. The treatment of acute low back pain bed rest, exercises or ordinary activity. New Engl J Med 1995;332:351–5.

Dr Folashade O. Omokhodion
Consultant Occupational Physician
Department of Community Medicine
University College Hospital
Ibadan
Nigeria

Occupational allergy and asthma among food-processing workers in South Africa

M. F. Jeebhay
SOUTH AFRICA

Occupational allergies and asthma – a global health problem

Occupational food allergies and asthma are diseases resulting from a hypersensitivity of the immune system to food substances encountered in the work environment (1). As the proportion of the total number of occupational diseases, occupational allergies constitute 15% of all diseases (2). The proportion of adult cases of asthma attributable to occupational exposure is estimated to be 10–15% (3). Worldwide, the most commonly reported causes of asthma in the workplace are agents of biological origin such as cereal flours, enzymes, natural rubber latex, laboratory animals and some low molecular weight agents (isocyanates and acid anhydrides) (4). In South Africa, the food-processing industry (grain milling, bakery) is one of the top three industries reporting an increasing number of workers with occupational allergies and asthma to the Compensation Commissioner and to the voluntary surveillance system, SORDSA (Surveillance of Work-Related and Occupational Respiratory Diseases in South Africa) (5,6,7). SORDSA data also point to an increasing incidence of occupational asthma in the highly industrialized provinces of South Africa. Occupational allergies and asthma are clearly becoming an increasingly important health problem affecting workers.

Food manufacturing and processing industries in South Africa

The food manufacturing and processing industry in South Africa employs over 180,000 workers (March 2002) involved in a broad spectrum of occupations. These include work with: meat, fish, fruit, vegetables, oils and fats; dairy products; grain mill products, starches, starch products (e.g. sweets, chocolates, confectionery); prepared animal feeds; and other food products and beverages (personal communication, Fil Van Niekerk, Statistics South Africa). Materials processed include both naturally occurring biological raw products (plant/vegetable, animal or microbial origin) as well as chemicals used for the preservation of foods for human (e.g. sulphites) or animal (e.g. formaldehyde) consumption. Additional chemical exposure also occurs in the packaging of food (e.g. plastics, glues, inks) (Photo 1, see next page). Certain techniques in food processing (e.g. thermal denaturation, acidification and fermentation) generate new allergens, while others (e.g. slaughtering, cooking, gutting, grinding, milling, drying, centrifuging, lyophilizing) generate high-risk aerosol exposures to food products that are capable of causing allergic health outcomes among exposed workers (Photo 2 on page 61) (8,9). Workers considered to be at increased risk include farmers who grow and harvest crops; factory workers involved in food processing, manufacturing and storage; and workers involved in food preparation (chefs and waiters) (10).

Allergenic constituents of food products associated with adverse reactions

Common constituents of food products

causing occupational allergies and asthma include proteinaceous material (e.g. pollen, spices, grain and coffee dust, animal hair and secretions, storage mites, insect pests), micro-organisms (e.g. *Aspergillus*), parasites (e.g. *Anisakis sp*., *Hoya sp*.), toxins (e.g. histamine, endotoxin, mycotoxin), synthetic enzymes such as papain and (1->3)-B-D-glucans (e.g. fungal alpha-amylase) (9,11,12). These constituents enter the body either through inhalation or dermal contact, causing adverse reactions of an irritant or allergic nature. Proteins, both naturally occurring and synthetically derived, with a high molecular weight (>2kDa) commonly cause IgE-mediated allergic reactions among food-processing workers. These are commonly manifested as *allergic rhino-conjunctivitis, asthma, urticaria and protein contact dermatitis*. The reactions can occur in workers as a result of exposure to food allergens in the occupational context or among workers with a known food ingestion-related allergy as a result of cross-reactivity of antibodies to allergens having structural similarities. Important factors influencing the manifestation of occupational allergies and asthma include allergen characteristics (e.g. physical and chemical properties, sensitizing potential), circumstances surrounding exposure (e.g. dose, duration and route of exposure) and host-associated factors (e.g. atopy, smoking status, HLA type) (13).

Photo by M.F. Jeebhay

Photo 1. The heating of plastic wrapping during the packaging of fish products generates pyrolysis products that can cause asthma.

Recent epidemiological studies

In recent years, there have been an increasing number of studies in South Africa reporting the disease burden attributable to occupational allergies and asthma among food processing workers (14). Cross-sectional studies among grain mill workers in Cape Town indicate that between 17% and 37% of workers have occupational asthma due to cereal grains (wheat, rye), storage mites (*Lepidoglyphus sp., Tyrophagus sp.*) and/or grain weevil (*Sitophilus granarius)* (15). Studies in poultry farms and processing plants in Gauteng province demonstrate that between 11% and 13% of workers have symptoms consistent with asthma associated with sensitization to poultry-specific allergens present in chicken feed, serum, feathers and faeces (16). In our postal surveys of seafood- processing plants along the west coast of the Western Cape province, 50% of employers reported at least one worker with occupational allergies, including asthma, annually (17). More detailed studies among fish-processing workers demonstrated that 16% of workers complained of work-related asthma symptoms, with 3% having occupational asthma due to allergens in bony-fish (pilchard and anchovy) and 4% with occupational asthma due to the fish parasite *Anisakis sp*. An unexpected finding was the high prevalence of latex sensitization (9%) among fish-processing workers using non-powdered latex gloves in their work (18). Current studies among table-grape farm workers in the Hex River Valley of the Western Cape indicate that 26% have work-related asthma symptoms, and 7% of all workers are classified with asthma due to the spider-mite, *Tetranychus urticae* (data in press). This microscopic mite (commonly known as red spider) is found in colonies on the surface of leaves, parasitizing fruit trees, herbaceous plants and greenhouse crops worldwide. It is a known cause of occupational asthma among fruit farmers making widespread use of pesticides for pest control (19). The findings of this study demonstrate that certain outdoor mites associated with work exposure on food-cultivating farms can also result in allergy and asthma similar to the commonly known indoor house dust mites and storage mites.

Preventing occupational allergies and asthma

Regulatory exposure standards and economic incentives

While occupational allergies and asthma can in principle be prevented, there is very limited evidence that it occurs in practice (20,21). This is due to the variable nature and ineffective use of legally enforceable standards and economic incentives currently in various countries (22). Legal regulatory imperatives are usually aimed at large industries and/or where there is one dominant putative agent. They can take the form of banning the agent, substitution of the agent or defining a specific exposure standard for compliance. Economic incentives are commonly used for multiple agents and/or small industries. They mainly take the form of taxation, risk-based insurance premiums, fines or pressure from labour and consumer unions. In the South African context, the greatest reliance is placed on legal regulatory frameworks, since they are uniform, cost little and are implementable fairly expeditiously. The problem, however, is that the sanctions (e.g. fines) are low and poorly enforced, leading to ineffectual prevention.

There are various laws that deal with or have a bearing on hazardous agents causing occupational allergies and asthma among food-processing workers in South Africa (23). The primary preventive law, the Occupational Health and Safety Act (OHSA), makes it obligatory for medical practitioners to report all cases of suspected occupational disease to the Department of Labour. The Any incident also requires investigation and prompt action by the employer in order to solicit the expertise of an occupational hygienist so as to identify sources of high-risk exposure and provide recommendations for controlling the hazards. The Hazardous Chemical Substances (HCS) Regulations under this law deal somewhat scantily with substances of foodstuff origin. It does not, however, provide appropriate guidelines for evaluating exposure to specific allergens causing allergic and inflammatory effects (24,25). Furthermore, the exposure standards stipulated for grain dust, for example, are not sufficiently protective in preventing sensitization to specific allergens. The recently promulgated Regulations for Hazardous Biological Agents (HBA) deal specifically with eliminating, controlling or minimizing exposure to HBA in the food industry among others. These Regulations are based on the comprehensive European Directive No. 2000/54/EC on the protection of workers from risks related to exposure to biological agents at work (26). However, it would appear that the emphasis of these regulations is primarily directed at microbes causing infection. There is therefore a need for legislation dealing specifically with the prevention of occupational asthma due to allergenic and irritant exposures.

Other preventive legislation having a bearing on food products relates to the various legislative requirements for food hygiene and safety are enforced unevenly by a multitude of different government departments (27). These laws are geared primarily towards fulfilling consumer needs, while none deal explicitly with the occupational health concerns of workers exposed to these foods.

The social and economic impact on workers affected by allergic reactions caused by agents at the workplace should not be underestimated. At an individual level they are frequently severe enough to cause workplace absence, change of job, loss of pay, disability and eventual work cessation and job loss. For this reason, occupational asthma is scheduled as a compensable disease under the Compensation for Occupational Injuries and Diseases Act (COIDA), thereby granting some important medical aid and social security benefits to affected workers (23). Recent studies show, however, that affected workers still experience difficulties due to inefficient administration of the current system of dispensing compensation in South Africa (5).

Workplace interventions

Environmental control of allergens is still the mainstay of preventing the development of allergic diseases, including asthma, in the workplace. Improvements in the work environment can contribute significantly to decreasing the risk of sensitization in the case of further, as yet unaffected, workers. It will also reduce the risk of precipitating an asthmatic attack among already sensitized workers. Workplace strategies for controlling allergen exposure generally use a combination of approaches that include substitution of the product, engineering controls (e.g. process isolation, process modification, exhaust ventilation), personal protective equipment (respirators, gloves) and administrative controls (e.g. improved work practices) (28,29). Education and training programmes that inform and educate workers about the allergic health effects associated with food handling are equally important. Material safety data sheets, if adequately compiled, can be a useful adjunct to these programmes, enabling workers to take the necessary precautions when working with these agents (14,30).

In South Africa, the common practice of employers is to opt for personal protective equipment or getting the person to leave the job, rather than dealing with allergen exposure at source. Despite the overwhelming evidence that workplace exposure to flour dust, for example, should be controlled, prevention strategies in bakeries and grain mills have not been very satisfactory (28). Process automation and enclosure as well as other simple strategies such as using vacuum cleaners rather than sweeping grain dust have been introduced in some grain mills. Work with bakeries has been less successful due to the predominance of small-sized bakeries that are not keen to embark on expensive engineering controls. A large-scale intervention study is currently under way to develop indigenous intervention strategies for this sector. Control measures to reduce the emission of bioaerosols containing aeroallergens produced in fish-processing plants include process separation or enclosure as well as the use of local extraction ventilation systems for equipment (gutting machine, fishmeal bagging) (Photo 2). Where there is skin contact with the hazardous agent (fish sorting, spice mixing), appropriate gloves (cotton-lined) and plastic sleeves can be worn, thereby preventing sensitization through non-intact skin (Photo 2). When preventive measures are being instituted, special care should be taken to ensure that one hazard is not replaced by another; an example is the introduction of powdered or high protein latex gloves, which may inadvertently cause latex allergy.

Surveillance

Conventionally, occupational hygiene surveillance programmes employ either direct subjective observation of work processes; total dust levels or protein levels as a proxy for exposure; or direct sampling and environmental quantification of specific occupational aeroallergens. Studies have shown, however, that total dust levels correlate poorly with specific allergen levels, and the third method is thus the preferred one, provided that standardized analytical procedures are utilized (31). The most widely used methods for the medical surveillance of occupational allergic respiratory diseases are questionnaires, spirometry and immunological tests such as skin prick tests or allergen-specific serum IgE levels. The aim is to detect immunological sensitization or occupational asthma early on, before it becomes severe or irreversible (32). The results of occupational hygiene and medical surveillance programmes can be used to assess the effectiveness of recently introduced control measures.

Photo by M.F. Jeebhay

Photo 2. The fish canning process produces bioaerosols as well as fish juice, both potential sources of allergic sensitization through inhalation and skin contact.

Studies in South Africa indicate that only 11–18% of workplaces (mainly large companies) provide some form of occupational health services, mainly concentrated in the urban areas of highly industrialized provinces (7). Recent research into the seafood- processing industry confirmed that – as with most other food industries – the surveillance programmes and preventive strategies for workers in this industry are inadequate. Small and medium-scale workplaces (employing less than 200 workers) were found to be less likely to provide an occupational health service, to conduct medical surveillance programmes, or to identify at least one worker per workplace with work-related allergic symptoms (17). None of the workplaces had occupational hygiene programmes specifically geared towards evaluating bioaerosols in general or aeroallergens in particular.

The future

As new foods are developed, it is possible that new occupational reactions may occur during the processing of these. Of special interest is the recent introduction of genetically modified crops in South Africa. These crops may contain novel proteins, not previously known, which may be capable of causing allergic reactions in the occupational setting well before the products are made available to the consumer market (10). It is therefore crucial that epidemiological surveillance programmes involving sentinel groups such as workers in food-processing plants should be initiated in order to detect the emergence of new allergies and health risks at a very early stage (33). Manufacturer responsibility for product stewardship should include, among other things, product labelling and the provision of material safety data sheets containing detailed information on the allergenicity of these products to workers and consumers handling these foods so as to ensure overall public health and safety (30).

References

1. Jeebhay M. Occupational Allergy: a focus on biological agents (editorial). Current Allergy and Clinical Immunology 2000;13(3):2–3.
2. Reijula K. Patterson R. Occupational allergies in Finland in 1981–91. Allergy Proc 1994;15(3)163–8.
3. Blanc PD, Toren K. How much adult asthma can be attributed to occupational factors? Am J Med 1999;107(6):580–7.
4. van Kampen V, Merget R, Baur X. Occupational airway sensitizers: an overview on the respective literature. Am J Ind Med 2000;38(2):164–218.
5. Jeebhay MF, Omar F, Kisting S, Edwards D, Adams S. Outcome of worker's compensation claims submitted by the Workers' Clinic in Cape Town. Occupational Health Southern Africa 2002;8(1):4–7.
6. Esterhuizen TM, Hnizdo E, Rees D. Occurrence and causes of occupational asthma in South Africa – results from SORDSA's Occupational Asthma Registry, 1997-1999. S Afr Med J 2001;91(6):509–13.
7. Jeebhay M, Jacobs B. Occupational health services in South Africa. In Crisp N and Ntuli A, eds. South African Health Review, 5th edition. Durban, South Africa: Health Systems Trust, 1999;19:257–76. (http://www.hst.org.za/sahr/99/chap19.htm)
8. Malagie M, Jensen G, Graham JC, DL Smith. Food industry processes. In: Stellman JM, ed. Encyclopedia of Occupational Health and Safety, 4th edition. Geneva, International Labour Office,1998;67:2–7.
9. Jeebhay MF, Robins TG, Lehrer SB, Lopata AL. Occupational Seafood Allergy - A Review. Occupational and Environmental Medicine 2001;58(9):553–62.
10. Aresery M, Lehrer SB. Occupational reactions to foods. Curr Allergy Asthma Rep 2002;2(1):78–86.
11. Jeebhay MF. An approach to hazardous biological agents in the workplace – legal provisions and practical considerations. Occupational Health Southern Africa 2002;8(2):8–13.
12. Lopata A, Fenemore B, Majova Z, Bali N, Jeebhay M. Insect and storage pests causing occupational allergy. Current Allergy and Clinical Immunology 2000;13(3):16–9.
13. Lehrer SB, O'Neil CE. Occupational reactions in the food industry. Food Technology 1992; May:153–6.
14. Jeebhay MF, Ehrlich R. Occupational asthma in South Africa. In; Paul Potter and Steve Lee, eds. The Allergy Society of South Africa (ALLSA) Handbook of Practical Allergy, 2nd edition. Cape Town, South Africa, Ince Press, 2001;142–59.
15. Jeebhay MF, Stark J, Fourie A, Robins T, Ehrlich R. Grain dust allergy and asthma among grain mill workers in Cape Town. Current Allergy and Clinical Immunology 2000;13(3):23–5.
16. Rees D, Nelson G, Kielkowski D, Wasserfall C, da Costa A. Respiratory health and immunological profile of poultry workers. S Afr Med J 1998;88(9):1110–7.
17. Jeebhay MF, Lopata AL, Robins TG. Seafood processing in South Africa – A study of working practices, occupational health services and allergic health problems in the industry. Occupational Medicine (London) 2000;50:406–13.
18. Jeebhay MF, Robins TG, Lopata A, Lehrer S, Malo JL, Bateman E, Rees G, Miller M, Molekwa J, et al. Occupational seafood allergy and asthma in South Africa. (abstract 083). La Medicina del Lavaro 2002:93(5):426.
19. Kim YK, Kim YY. Spider-mite allergy and asthma in fruit growers. Curr Opin Allergy Clin Immunol 2002;2(2):103–7.
20. Taylor AN. Can occupational asthma be prevented (abstract 096). La Medicina del Lavaro 2002;93(5):456.
21. Toren K. Prevention of occupational diseases: regulations, economic incentives, or both? (abstract 092). La Medicina del Lavaro 2002;93(5):454.
22. Topping MD, Williams CR, Devine JM. Industry's perception and use of occupational exposure limits. Ann Occup Hyg 1998;42(6):357–66.
23. Jeebhay MF. Health and safety legislation and worker's compensation for allergic diseases of occupational aetiology. Current Allergy and Clinical Immunology 2000;13(3):4–8.
24. Bernstein IL, Chan-Yeung M, Malo JL and Bernstein DI, ed. Asthma in the Workplace, 2nd edition. New York, U.S.A.: Marcel Decker Inc., 1999.
25. van Kampen V, Merget R, Baur X. Occupational airway sensitizers: an overview on the respective literature. Am J Ind Med 2000;38(2):164–218.
26. http://www.allriskmgmt.co.uk/directives/00-054.htm
27. Smith FCA. Contradictions in legislation in the food industry. Occupational Health Southern Africa 1999;5(1):14–6.
28. Verma DK, Purdham JT, Roels HA. Translating evidence about occupational conditions into strategies for prevention. Occup Environ Med 2002;59:205–14.
29. Mbuli S. Evaluating and controlling exposure to bioaerosols causing allergy in the workplace. Current Allergy and Clinical Immunology 2000;13(3):26–7.
30. Bernstein JA. Material safety data sheets: Are they reliable in identifying human hazards? J Allergy Clin Immunol 2002;110:35–8.
31. Houba R, Doekes G, and Heederik D. Occupational Respiratory Allergy in Bakery Workers: A review of the literature. Am J Ind Med 1998:34:529–46.
32. Tarlo SM, Liss GM. Can medical surveillance measures improve the outcome of occupational asthma? J Allergy Clin Immunology 2001;107:583–5.
33. Lack G, Chapman M, Kalsheker N, King V, Robinson C, Venables K – BSACI working party. Report on the potential allergenicity of genetically modified organisms and their products. Clin Exp Allergy 2002;32(8):1131–43.

Dr Mohamed F Jeebhay
Senior Research Fellow
Occupational and Environmental Health Research Unit
School of Public Health and Primary Health Care
University of Cape Town
Room 4.44, Fourth Level, Falmouth Building
Anzio Road, Observatory 7925
South Africa
Tel:27-21-4066309/6300
Fax:27-21-4066163
e-mail:
mjeebhay@cormack.uct.ac.za

Tuberculosis among health care workers in Malawi

A. D. Harries
MALAWI

Introduction

Before the advent of anti-tuberculosis treatment, the risk of tuberculosis (TB) among health care workers (HCWs), particularly those who worked in TB sanatoriums, was high. After 1950, this risk declined substantially in industrialized countries because of the decreasing incidence of the disease and the availability of effective anti-tuberculosis chemotherapy. With the upsurge of TB worldwide since 1993, there have been a number of reported outbreaks of nosocomial (hospital-based) TB, especially in the United States of America, and the disease is now recognized once again as a serious occupational hazard for HCWs.

Sub-Saharan Africa

At the end of 2001, it was estimated that there were 40 million people living with HIV and AIDS worldwide. Of this total, 28 million (70%) lived in sub-Saharan Africa. Up to 15 million people are dually infected with HIV and with the tuberculosis bacterium, *Mycobacterium tuberculosis*, and nearly 70% of these dually infected people live in sub-Saharan Africa. People with dual infection are at considerable risk of a reactivation of the disease and of again developing active TB**.** People with HIV infection are also at high risk of contracting an *M.tuberculosis* infection from a patient with infectious TB and of then developing the active disease. It is not surprising, then, that sub-Saharan Africa has the highest TB notification rates in the world; and this phenomenon is strongly associated with HIV. As many as a third or more of patients with HIV develop TB during their lifetime, and in some countries over 70% of TB patients are HIV-seropositive.

Given the high prevalence of HIV and TB in sub-Saharan Africa, the risk of nosocomial TB transmission is probably substantial. The few published studies from the region have confirmed that nosocomial transmission does occur (1), and that tuberculosis infection among HCWs is related to the level of exposure to TB patients (2).

The incidence of TB among HCWs is high, and over the last ten years it has been increasing – mainly as a result of the co-incident HIV epidemic (3,4).

Malawi

Malawi is a poor, land-locked country in central Africa. It is currently experiencing a serious epidemic of TB and HIV. In 2001, there were almost 28,000 registered TB cases, i.e. an annual case notification rate of 240/100,000 per year. It is estimated that over 1 million people are living with HIV and AIDS out of a total population of about 11 million. The HIV-seroprevalence rate among pregnant women attending antenatal clinics in 1999 was 26–27% in urban and semi-urban areas, and 12% in rural areas. A country-wide survey conducted in 2000 among new patients with TB found an HIV-seroprevalence rate of 77% (5).

Malawi: TB among health care workers

As a result of clinical observations suggesting that HCWs are at high risk of TB, a study was conducted between 1993 and 1994 among nurses working in a large urban hospital in Blantyre, one of the main cities in the country (6). Of 310 qualified nurses working in the hospital, 12 (4%) were diagnosed as having TB and were treated for the disease during this two-year period. The proportion of nurses who developed TB over this two-year period in the medical and TB wards (13%) was significantly higher than the proportion who developed TB in other hospital departments (3%). The rate of TB per 100 person-years amongst nurses working in medical and TB wards was 6.6, as compared to a rate of 1.3 among nurses from other hospital departments. During this same two-year period, there were 578 patients diagnosed as having smear-positive pulmonary tuberculosis (PTB) in the hospital wards. The medical wards accounted for 544 (94%) of these diagnoses. In these wards, there were long delays between time of admission and diagnosis of TB: more than 5 days in the case of 65% of patients, more than 10 days in 25% of cases and more than 15 days in 8%. Although it was not possible to establish a direct causal association, it is highly likely that long delays in the diagnosis of infectious (smear-positive) tuberculosis resulted in a high risk of nosocomial TB transmission to nurses.

The study prompted a country-wide survey of all 40 district and mission hospitals that diagnose, register and treat tuberculosis. The hospitals were all visited, and information was obtained on the number of hospital-based HCWs and their incidence of TB during 1996 (7). During this year, 108 (3.6%) of 3042 HCWs from these 40 hospitals were registered and treated for TB. The overall case fatality rate was 24%. Compared with the adult general population aged 15 years or above, the relative risk of TB among HCWs was 11.9 (95% confidence interval, 9.8 – 14.4) . The relative risk of TB was high in all categories of HCWs, especially in the case of clinical officers, who have the highest degree of contact with patients.

Protecting health care workers from TB in industrialized countries

In industrialized countries much attention is now focused on the need to control TB transmission in hospitals. TB control measures such as improved ventilation systems, protective high efficiency particulate air (HEPA) face masks and other individual protective measures have been introduced into European and American hospitals, successfully protecting HCWs from contracting TB in the workplace.

Protecting health care workers from TB in sub-Saharan Africa

The recommendations for controlling nosocomial TB transmission in industrialized countries are not, in general, applicable to low-income countries in Africa, because of the high costs of implementation, the difficulties involved in maintaining the delivery of services requiring high technology, and the inappropriateness of some of the measures for the epidemiological situation. As a result, practical and affordable measures aimed at protecting HCWs from TB in low-income countries have been developed (8, 9). These focus on three main areas: a) diagnosis and treatment of infectious TB cases, i.e. those with smear-positive PTB; b) environmental control; and c) individual protection of the HCW.

Diagnosis and treatment of infectious TB cases

The most cost-effective way of interrupting the chain of TB transmission is the diagnosis of infectious TB outside hospital wards as frequently as possible, and rapid diagnosis and treatment for people who are being examined as in-patients (Table 1).

Environmental control

One of the most effective ways to reduce TB transmission is proper ventilation. TB wards and general medical wards should have plenty of sunlight, many windows that open to the outside and doors to other parts of the hospital that are kept closed for most of the time. Laboratories should also follow guidelines (see references 8, 9) for safe testing of sputum specimens.

Protecting the health care worker

The most useful measures are: a) ensuring that staff know their HIV-serostatus and that those who are HIV-infected avoid working with suspected TB cases, TB patients and TB specimens; b) providing isoniazid preventive therapy for staff who are HIV-seropositive, as this reduces the risk of TB; and c) educating patients on good hygiene in the case of coughing. While HEPA masks are useful in protecting HCWs, ordinary surgical face masks have no proven protective value, and HCWs should therefore be discouraged from using them. However, a surgical face masks worn by an infectious patient who is coughing may help to reduce the spread of infectious droplet nuclei. Repeat vaccination with BCG has no proven value, and in HIV-infected persons this measure may even be harmful.

Protecting health care workers from TB in Malawi

Following the country-wide survey on TB incidence among HCWs, the Malawi National TB Control Programme responded to the problem in mid-1998 by producing written guidelines on hospital TB infection control. These were disseminated to all hospitals in the country, and in the same year a seminar for hospital-based HCWs on ways of preventing TB transmission was conducted in each hospital . The written guidelines were produced after consultation with stakeholders, and were based on what could realistically be achieved in a resource-poor setting. The guidelines focused on: i) rapid diagnosis of patients with smear-positive PTB; ii) administrative measures aimed at isolating infectious patients in general medical wards; and iii) education of patients on cough hygiene. Hospitals were also requested to consider offering confidential counselling and HIV-testing (VCT) to their staff, and to advise those who were HIV-seropositive against working on general wards or TB wards.

Another country-wide visit to the same 40 district and mission hospitals was carried out in order to ascertain whether there was any improvement in infection control (unpublished observations). TB control guidelines had been implemented to varying extents, and only one hospital had introduced voluntary counselling and HIV testing of its staff. Most hospitals stated that they used rapid systems to diagnose smear-positive PTB, but objective measurements showed that there were no differences in the time between hospital admission and diagnosis. A limiting factor was the inability of many hospital laboratories to provide a daily smear-microscopy service, because of shortage of trained staff. The TB case notification rate among HCWs in 1999 was 3.2%, a non-significant decrease if the figure is compared to that for 1996.

Further efforts are obviously required to improve the safety of the health care service. Each hospital should probably appoint an individual or infection control committee to be responsible and accountable for infection control procedures. More attention should be paid to increasing laboratory staff numbers, and to finding ways for hospital laboratories to perform sputum smear examinations on a daily basis. Hospitals should consider setting up occupational health and safety services, which should include confidential voluntary counselling and a package of care for those who test HIV-seropositive. As a minimum safety measure, HIV-positive HCWs should not work in the general wards or TB wards, but rather in safer hospital areas. HCWs are a skilled and valuable resource in sub-Saharan Africa, and every effort must be made to keep this workforce healthy.

References

1. Wilkinson D, Crump J, Pillay M, Sturm AW. Nosocomial transmission of tuberculosis in Africa documented by restriction fragment length polymorphism. Trans Roy Soc Trop Med Hyg 1997;91:318.
2. Kassim S, Zuber P, Wiktor SZ et al. Tuberculin skin testing to assess the occupational risk of Mycobacterium tuberculosis infection among health care workers in Abidjan, Cote d'Ivoire. Int J Tuberc Lung Dis 2000;4:321–6.
3. Wilkinson D, Gilks CF. Increasing frequency of tuberculosis among staff in a South African district hospital: impact of the HIV epidemic on the supply side of health care.

Table 1. Diagnosis and treatment of infectious TB patients

- Adhering to established criteria for investigating patients with suspected TB
- Investigating suspected TB cases as outpatients wherever possible
- Decreasing delays in sputum collection in hospital wards
- Decreasing delays in delivery of sputum smear results to hospital wards
- Decreasing delays in laboratory smear microscopy
- Improving safety of sputum smear microscopy for laboratory workers
- Isolation of infectious TB patients
- Use of rifampicin-based anti-tuberculosis treatment for smear-positive PTB

Trans Roy Soc Trop Med Hyg 1998;92:500–2.
4. Eyob G, Gebeyhu M, Goshu S, Girma M, Lemma E, Fontanet A. Increase in tuberculosis incidence among staff working at the TB Demonstration and Training Center (TBTDC) in Addis Ababa, Ethiopia: a retrospective cohort study (1989–1998). Int J Tuberc lung Dis 2002;6:85–8.
5. Kwanjana JH, Harries AD, Gausi F, Nyangulu DS, Salaniponi FML. TB-HIV seroprevalence in patients with tuberculosis in Malawi. Malawi Medical Journal 2001;13:7–10.
6. Harries AD, Kamenya A, Namarika D et al. Delays in the diagnosis and treatment of smear-positive tuberculosis and incidence of tuberculosis in hospital nurses, Blantyre, Malawi. Trans Roy Soc Trop Med Hyg; 1997;91:15–7.
7. Harries AD, Nyirenda TE, Banerjee A, Boeree MJ, Salaniponi FML. Tuberculosis in health care workers in Malawi. Trans Roy Soc Trop Med Hyg 1999;93:32–5.
8. Harries AD, Maher D, Nunn P. Practical and affordable measures for the protection of health care workers from tuberculosis in low-income countries. Bull World Health Organization 1997;75:477–89.
9. Granich R, Binkin NJ, Jarvis WR et al. Guidelines for the prevention of tuberculosis in health care facilities in resource-limited settings. World Health Organization 1999. WHO/CDS/TB.99.269.

Anthony D Harries
National TB Control Programme
Community Health Science Unit
Private Bag 65
Lilongwe, Malawi
Email: adharries@malawi.net
Fax: 265 1 772 657
Phone: 265 1 754936

Hearing impairment among workers in gold mining in Ghana

G.K. Amedofu
GHANA

Summary

A study to determine the impact of hazardous noise on workers was conducted in a surface gold mining company in Ghana from May to June 2002. The methods used included noise survey, case history, otoscopy and conventional pure-tone audiometry. Five main areas were surveyed for hazardous noise; namely, the pit, processing, the analytical laboratory, the borehole and the mess areas. The results showed that noise levels above 85 dBA occurred in all the above areas except the mess. A total of 252 workers were seen, and out of this number, 59 (23%) had the classical noise-induced hearing loss (NIHL). In addition, NIHL increased as a function of age at 4 kHz and as the duration of exposure increased. It was also noted that out of 81 workers with a pre-employment history of noise exposure, 41 (51%) had NIHL. NIHL varied with regard to job location. 14 (6%) of workers had hearing loss greater than 25 dB at the frequencies of speech. Thus, factors not under the control of the company may affect the hearing of an employee.

Introduction

Occupational noise exposure is the most common cause of noise-induced hearing loss (NIHL) in both developed and industrialized countries. Although excessive noise exposure has been recognised as harmful to the ears, very little attention has been paid to reducing noise at the source or to preventing its transmission from the source to the worker. It is important for the employer in an industrial setting to obtain baseline audiograms so as to determine the amount of hearing loss for which he will be responsible.

The generally acceptable standard regulation in most countries, including Ghana, is that a noise level of 85 dB A for an 8-hour daily exposure is potentially damaging (1). In several developed countries, awareness that noise-induced hearing loss constitutes an occupational hazard has increased. As a result, there is a gradual change in focus from recognising and treating hearing loss to preventing it through effective proactive hearing conservation programmes (2). In developed countries, employers in factories and mining companies are required by law to develop hearing conservation programmes to protect workers against exposure to hazardous noise (3). Ghana has a law which protects workers from hazardous noise exposure, but there is no law which specifically protects workers exposed to hazardous noise in mining companies even though the potential danger of NIHL in this industrial setting has been recognised (4).

No study on occupational hearing loss among workers in surface mining companies has been conducted in Ghana, even though a study was done on workers in a large underground mining company. An investigation in surface mining companies in Ghana was therefore needed in order to determine the potential risk to workers in this work setting.

Materials and Methods

Instrumentation and noise survey

The decision on instrumentation depends on the goal of the measurements made. In our particular situation, we wanted to know whether the noise in the areas to be surveyed is such that it can lead to permanent hearing damage and, if so, whether the source of the noise

Table 1. Noise levels at survey sites in the mines.

Site	Average Noise Level (dBA)
Pit (drilling machines)	98
Processing area	95
Analytical laboratories	88
Bore hole area	86
Mess area	82

Table 2. Age distribution among workers with occupational noise-induced hearing loss (NIHL)

Worker's age	No. tested	No. with NIHL	Percent
20 – 29	70	4	6
20 – 39	116	25	22
40 – 49	57	23	40
50+	9	7	78
All ages	**252**	**59**	**23**

Table 3. Relationship between duration of noise exposure and noise-induced hearing loss (NIHL) (>25dB HL)

Duration of exposure (years)	No. tested	No. with NIHL	Percent
1 – 5	161	29	18
6 – 10	54	17	31
11 – 15	27	9	33
16 – 20	10	4	40
All ages	**252**	**59**	**23**

should be controlled or workers in the noisy environment should be protected. Because it is versatile and simple to use, the Quest Sound 01/11/2002 Level Meter, Type 2 Model 2700, was used to measure average sound values. Since facilities for calibration are not locally available, calibration of the sound level meter (SLM) was done by an engineer from Intra-Acoustics, a company in Denmark, in December 1998. The desired response of the SLM was set at slow position in the processing, pit, borehole, mess, and analytical laboratory areas in the mines. When measurements were made, the microphone was located in such a way as not to be in the acoustic shadow of any obstacle or in appreciable field of reflected waves.

Audiometry

A total of 252 workers from 20 to 50 years of age were seen on site in a large surface gold-mining company. The procedure adopted included a detailed case history, otoscopic examination and audiometry. The audiometric tests were conducted in a test booth with an ambient noise of 30 dBA (re: ANSI standard S3.6–1969) located near the hospital at the mines. The tests were conducted at frequencies from 500 Hz through 8000 Hz in octaves using a Kamplex Audiometer (Model 27) calibrated previously to the ANSI standard (S 3.6–1969). Audiograms were considered normal if no threshold between 500 Hz through 800 Hz exceeded 25 dB (5). Audiograms depicting the classical sign of NIHL with the characteristic notch at 4 kHz were analysed. The degree and type of hearing loss were also determined according to Goodman (6) and Cahart (7), respectively, as follows:

Degree of hearing loss:
10 to 25 dB HTL (Hearing Treshold Level) normal hearing
26 to 40 dB HTL mild hearing loss
41 to 55 dB HTL moderate hearing loss
56 to 70 dB HTL moderate to severe hearing loss
71 to 90 dB HTL severe hearing loss
91 profound hearing loss.

Type of hearing loss: conductive, sensorineural and mixed hearing loss.

Results

Table 1 (above) displays average noise levels, in dBA, for some selected sites in the mines. As can be seen, the average noise level in the pit, processing, borehole and analytical laboratory areas exceed 85 dBA. The highest levels of noise recorded in the various areas were as follows: processing area machines: Ball Mill 100 dBA, Sag Mill 99 dBA and Crusher Top dBA; Pit area: Tam Rock 120 dBA, Geo Drill 105 dBA, Excavator-11 105 dBA and Cat Dz 11, 95 dBA; and analytical laboratory area machines: Keegor Mill, 100 dBA, Jew Crusher, 100 dBA and Lead Extractor, 88 dBA. It is noted that even though machines in the pit area produce higher noise levels than those in the other areas, owing to the nature of the work in the area, fewer workers are exposed to such high levels of noise.

Table 2 (above) shows the age distribution for workers with NIHL. As can be observed, hearing loss at 4kHz had a tendency to increase as a function of age. For instance, in the age range of 20–29 years, 6% of workers had hearing loss greater than 25 dB at 4 kHz. On the other hand, at the age of 50 years and above, 78% of workers had NIHL.

Table 3 (above) indicates the relationship between the duration of exposure to noise and the development of hearing loss at 4 kHz. It can be observed that there is a direct relationship between NIHL and the duration of exposure. The relationships were: at 1–5 years of exposure, 29 (18%) workers out of 161 had the characteristic notch at 4 kHz; at 6–10 years of exposure the corresponding ratio was 17 (31%) out of 54 workers, at 11–15 years of exposure it was 9 (33%) out of 27 workers and at 16–20 years of exposure, 4 (40%) out of 10 workers.

Table 4 (on next page) depicts the number of workers with a history of pre-employment exposure to hazardous noise and the development of NIHL. Note that out of 47 workers with a history of noise exposure longer than 5 years, 20 (43%) had NIHL. In turn, out of 24 workers with a pre-employment exposure of 5–10 years, 13 (54%) had NIHL; and finally, 8 (80%) out of 10 workers with a pre-employment exposure longer than 10 years had NIHL. As to be expected, the number of workers with hearing impairment rose as the duration of pre-employment exposure increased.

Table 5 (on next page) shows the distribution of hearing loss at 4 kHz among workers in various work settings. For instance, out of the total of 252 workers studied, 57 of them work in the processing area, and out of this number 23 (40%) had NIHL. In turn, 53 individuals work at the Pit area, and out of this number 9 (27%) had the characteristic notch at 4 kHz and so on.

Table 6 (on next page) displays the speech range classification of hearing loss among workers. It is noted that 14 (6%) of the workers tested had a hearing loss greater than 25 dB at the speech frequencies (500 Hz, 1000 Hz and 2000 Hz). Eight of them had a mild hearing loss, while the remaining six workers had a moderate to profound hearing loss. The hearing loss was bilateral in five cases and unilateral in one case. There were three cases of conductive hearing loss, two cases of mixed hearing loss and nine cases of sensorineural hearing loss.

Discussion

This study was done to determine the noise levels in a surface gold mining company and also to find out whether the noise level have any effect on the hearing capabilities of workers in the company. Our data has shown that the pit and processing areas produced the highest levels of noise in the mines. On the average, the noise level in the Pit area was 98 dBA, while that in the processing area was 95 dBA. The noise levels for the others were: analytical laboratory, 86 dBA and mess, 82 dBA.

The generally accepted standard regulation in most countries is that a noise level of more than 85 dBA for an 8-hour daily exposure is potentially damaging (1). In Ghana, there is no law governing workers' exposure to hazardous noise levels in mining companies. However, the mine's inspectorate uses a noise level of greater than 85 dBA for an 8-hour daily exposure as the standard when advising mining companies on the importance of hearing conservation (4). Thus, according to the standard adopted in Ghana, the noise levels in the processing, pit, analytical laboratories and borehole areas are hazardous, while those in the mess are not.

The standard used by the mines inspectorate in Ghana (>85 dBA) was deduced from the ISO standard of Europe and the ANSI standard of the USA. This standard is based on the equal energy principle (EEP), which assumes that for any noise exposure, the degree of hearing loss is proportional to the total amount of energy exposure (Energy = power dB x duration). The EEP is attractive because it provides a single number for estimating the noise hazard and it is a simple quantity to measure and apply (8).

It is noted that workers 59 seen (23%) had the characteristic notch at 4 kHz. By convention, the 4000 Hz audiometric dip has traditionally been regarded as the classical finding in NIHL but an identical audiometric threshold has also been described in other populations, owing to many endogenous and exogenous agents. For example, while NIHL has been adduced as the cause of 4 kHz dips found in routine audiometric testing of schoolchildren (9), others have considered genetic influence to be the more likely etiological factor, at least if there is no history of significant noise exposure (10). Since no pre-exposure audiograms are available for the workers seen in this study, no conclusion can unfortunately be made as to the possible contribution of endogenous and exogenous factors to the threshold elevations recorded in the 59 workers at 4 kHz. The 23% NIHL reported in this study is slightly higher than the 20% figure reported by Amedofu et al. (12) in the underground mine survey.

It was also found that hearing loss increased as a function of age. For instance, 116 workers between the ages of 30–39 years were tested and out of this number, 25 (22%) had NIHL. On the other hand, nine workers above the age of 50 years were seen and out of this, seven (78%) has NIHL. Gallow and Glorig (11) noted that the permanent threshold shift (PTS) found among noise-exposed people results from the combined effects of chronic noise exposure and ageing. The same finding was reported by Amedofu et al (12). Studies by Mass (13) indicated that the growth in the noise-induced permanent threshold shift (NIPTS) at 4 kHz is most rapid during the first 10 to 15 years of exposure, after which the loss seems to slow down and plateau. In another vein, other studies (14–17) have shown that the effects of chronic noise exposure are more evident in young subjects (about 30 years) where they cannot separate the hearing loss due to ageing. Beyond the age 50 years, the PTS does not grow appreciably, but age-related hearing loss continues. Thus, the increase in hearing loss later in life is related to ageing and not to noise per se.

Another question raised was whether workers who were exposed to hazardous noise prior to their entry into their present employment had NIHL. Here again, it was found that there is a direct relationship between the duration of exposure in previous employment and the development of NIHL Seen thus, it is imperative for gold-mining companies to obtain base-line audiograms for each new employee, in order to determine hearing status so as to avoid payment of compensation for NIHL for which the company is not responsible (18).

Another finding was that hearing loss at 4 kHz was a function of occupation, with workers in the pit area being the most at risk. In fact, the pit area had the highest noise level (98 dBA) followed by the processing area (95 dBA). The differential effect of type of occupation on the level of NIHL was also reported by Amedofu et al (12) in Ghana and by

Table 4. Pre-employment exposure and noise-induced hearing loss (NIHL)

Year	No. seen	NIHL	Percent
< 5	47	20	43
5 – 10	24	13	54
>10	10	4	40
Totals	**81**	**41**	**51**

Table 5. Noise-induced hearing loss (NIHL) among workers in various work settings

Work setting	No. seen	No. with NIHL	U/Bilateral	Percent
Processing	57	23	5,18	40
Pit/Survey/Field	26	7	3, 4	27
Mining	13	1	1	8
Security	35	13	8, 5	37
Workshop	19	7	3, 4	37
Administration	62	14	9, 5	23
Geology	14	1	1	1
Utility	17	3	1, 2	18
Loss control	8	-	- -	-
Machine operation	17	3	7 10	18

Table 6. Speech range classification (PTA) for workers tested in the mines. (in the worse ear only)

Degree	No. tested	U/Bilateral	Percent
Normal	238	-	94
Mild	8	8, 3	3
Mild to moderate	-	-	-
Moderate	2	1, 1	1
Moderate to severe	2	1, 1	1
Profound	2	2	1
Totals	**252**	**9.5 (14)**	**100**

Wahab and Zaidi (19) in Pakistan. In the former study (12), it was reported that miners who work underground were the most at risk of NIHL. This suggests that the spread of the effect of NIHL among workers in mining companies would depend on the type of company (surface or underground mining).

Out of the 252 workers seen, 94% had normal hearing, while 14 (6%) had a hearing loss ranging from mild to profound. Five had bilateral hearing loss while nine had unilateral hearing loss. In two of the five cases with bilateral hearing loss, an asymmetrical sensorineural hearing loss was found. Although a high right-left correlation has been reported in guinea pigs (20), asymmetry is not uncommon among those with industrial NIHL (21), especially among those exposed to lateralized noise sources (22). There is another argument that the effect of noise and ageing alone might not account for the NIHL seen at the workplace. Fundamental to this notion is the report that the effect of noise at the workplace can be exacerbated by temperatures, vibration and chemicals (23,24). Therefore, a greater understanding of the effects of combined exposures on hearing is needed so that more effective strategies can be developed for the prevention of hearing loss.

Conclusion

Occupational NIHL is known to be a problem for industrial workers, miners police, fire-fighters and the military. Our study done at a surface mine in Ghana has shown that there are some areas in the mines, namely, processing, pit, analytical laboratories and borehole areas where workers are exposed to hazardous noise (>85 dBA). It was noted that 59 (23%) of workers in the mining company had the characteristic notch at 4000 Hz. This is slightly higher than the 20% figure reported for an underground mining company in Ghana. This point should, however not be stretched too far, since populations for the study have not been randomly sampled.

Ghana has general guidelines for safety standards in mining companies, but to date, there are no laws which protect workers exposed to hazardous noise. Again, our study has shown that there is a direct relationship between NIHL, on one hand, and age and duration of exposure, on the other hand. There are observations that the basic similarities and differences between PTS and age-related hearing loss are not well understood. Out of the 252 workers seen, 14 (6%) had various types and degrees of hearing loss. Thus, it is very important for mining companies to develop hearing conservation programmes to protect their workers against hazardous noise. Indeed, hearing conservation must begin by providing each individual with information. NIHL is insidious, permanent and irreversible, causing communication interference that can substantially affect the quality of life.

As such, it is in the interest of companies to evaluate each employee in terms of his or her medical history and non-workplace noise. Significantly, the history should stress pre-employment exposure, since it was revealed that 51% of workers with pre-employment exposure to hazardous noise had NIHL. The hearing loss varied with the duration of exposure. Factors not under the control of the company may affect the hearing of an employee. As such, employees who engage in noisy hobbies or who hold noisy second jobs should be encouraged to use effective hearing protection devices during their noise exposure. Company sponsored education programmes should stress the importance of good hearing conservation practices on and off the job, and should also inform employees about other diseases that may affect their hearing.

References

1. Consensus statement. NIH Consensus development conference. January 23rd -24th 1990;3(1):1–21.
2. Suiter TC, Franks JR, Dunn JR. A practical guide to effective hearing conservation programs in the work place. *National Institute for Occupational Safety and Health.* 1990;90–122
3. Factories, Shops and Offices Act in Ghana, 1970,1–3.
4. Health and Safety in mining companies. *Report on workshop, Ministry of mines and energy.* 1999;2–15.
5. Feldman AS, Grimes FC. *An overview of noise exposure and hearing conservation in industry*. William and Wilkins, Baltimore. USA. 1985;1–81.
6. Goodman A. Reference New Levels for pure-tone Audiometers. *American Speech and Hearing Association (ASHA).* 1965;7:262–3
7. Cahart R. Classifying Audiograms: An approved method of classifying Audiograms. Laryngoscope. 1945;55,13
8. Henderson D, Henderson RP. A parametric evaluation of equal energy hypothesis. In: Salvi RG., Hamermic RP and Colleti V. eds. *Basic and applied aspects of Noise Induced Hearing Loss*. NY Plenum Press; 1986;369–77.
9. Ritzer B, Rytzer C. School children and noise: the kHz dip-tone screening in 1,491 school children. *Scandinavian Audiology.* 1981;10:213–6.
10. Klockhoff I, Lythes I. Hearing defects of noise trauma type with lack of noise exposure. *Scandinavian Audiology.* 1982;11:257–50.
11. Gallo E, Glorig A. Permanent threshold shift changes produced by noise exposure and ageing. *American Industrial Hygiene Association.* 1964;2:705–24.
12. Amedofu GK, Brobby GW, Ocansey G. Occupational hearing loss among workers of a large gold-mining company in Ghana. *Paper presented at the 34th Annual Conference of the West African College of Surgeons.* January 22nd – 30th 1994; Accra Ghana.
13. Mass, JB Industrial noise and hearing conservation. In: Katz J. ed. *Handbook of clinical Audiology.* Baltimore William and Wilkins 1972;61–76.
14. Roster G. Progression of hearing loss caused by occupational noise. *Scandinavian Audiology.* 1994;23:13–37.
15. Kryter KD. Impairment of hearing from exposure to noise. *Journal of Acoustical Society of America.* 1973;53:1211–26.
16. Taylor W, Pearson J, Main A, Burns W. Study on noise and hearing loss in Jute weaving. Journal Acoustical Society of America. 1965;32:135–7.
17. Quanta A, Portalatin P, Henderson D. Temporary and permanent threshold shift. An overview. *Scandinavia Audiology.* 1998;27(Supp 48):75–86.
18. Amedofu GK. Perspectives of noise-induced hearing loss in Africa. *African J. of Health Sciences.* 1996;3(3):77–9.
19. Wahab U, Zaidi HS. Noise-induced hearing loss in Pakistan. *Pakistan Journal of Otorhino-laringology.* 1997;75–7.
20. Grenner J, Nilsson P, Kathbamna B. Right-left correlation in Guinea pigs after noise exposure. *Acta Otlarying.(Stockholm).* 1990;109:41–8.
21. Chung DY, Wilson GN, Gannon RP. Lateral differences in susceptibility to noise damage. *Audiology.* 1983;22:199–205.
22. Mann A, Naggan L, Bergman G. Classification of acoustic trauma based on pure-tone Audiometry. *Acta. Otolaryngl. (Stockholm).* 1981;92:25–31.
23. Ward WD. Endogenous factors related to susceptibility to damage from noise. *Occupational medicine: State of the art, Review.* 1995;10(3):561–77.
24. Morata TC, Franks JR, Dunn DE. Unmet needs in occupational hearing conservation. *Lancet.* 1994;344:479.

Dr Geoffrey Kwabla Amedofu
Department of Eye, Ear, Nose and Throat; School of Medical Sciences, Kwame Nkrumah, University of Science and Technology
Kumasi, Ashanti Region
Ghana
Tel. (office): 233-051-23298
Mobile: 024-25306
E-mail: amedofugk@yaboo.com

Knowledge, attitudes and practices among barbers in south-western Ethiopia

T. Zewudie, W. Legesse, G. Kurkura
ETHIOPIA

Introduction

Human immunodeficiency viruses (HIV) can be transmitted from one person to another through the use of non-sterile needles, syringes and other skin piercing equipment such as blades and scissors. Proper sterilisation of all such instruments is therefore important in order to prevent HIV transmission. HIV is very sensitive to standard methods of sterilisation and a high level of disinfection, and methods designed to inactivate other viruses such as hepatitis B virus also inactivate HIV as well (1, 2).

The barber's shop is a place where there is frequent use of the same blade, trimmers and scissors, often without proper sterilisation or disinfection. The use of these sharp instruments may represent an HIV hazard, since the skin of a client's face and skull can be scratched and broken during shaving, and even while his hair is being shaped. In Ethiopia, the shared use of blades and trimmers in barber's shops is a common practice, and accidental scratching due to sharp equipment provides an opportunity for micro-organisms, mainly HIV and other blood-borne pathogens, to enter the body easily and cause serious health problems for the clients (3). Because of possibilities of skin piercing and accidental injuries, barber's shops may therefore be one of the routes of exposure to the HIV infection leading to the deadly AIDS disease currently afflicting developing countries such as Ethiopia.

In Ethiopia, HIV/ AIDS started spreading rapidly in the 1980s after the notification of the first case in 1986. The prevalence of HIV infection in the country rapidly increased from 3.2% in 1993 to 10.3% in 2001 (4). The total number of adults and children infected in 1997 was estimated to be 2–3 million, and of all infected cases it was estimated that 20% were in the age group of 15–24 years (4).

The statistics cited above may not be an ideal means of laying bare the severity of the problem, but this becomes obvious when one recognises that there are always people behind these figures. As a cure for AIDS is not yet available, an ever growing AIDS epidemic may be inevitable unless action is scaled up drastically; and the damage already done seems minor compared with what lies ahead. It is hard to play down the effects of AIDS, which stands to kill more than half of the young adults in developing countries (5).

The AIDS epidemic has the greatest impact on these countries, disproportionately affecting the age groups in the most productive years, and the spread of the disease has devastating consequences at the household, community and family levels, with significant negative consequences for the national economy as a whole (5).

The government of Ethiopia launched a national policy on HIV/AIDS in 1998.

Photo by White Block Barber

A barber's shop in Jimma town.

The policy has been designed to guide the implementation of successful programmes to prevent the spread of HIV and AIDS, to care for people with AIDS, and to reduce the adverse socioeconomic consequences of the epidemic. One goal of the policy is to ensure the safe use of sharp equipment, and one method is prevention (6, 7).

Though many studies related to knowledge, attitudes and practices and their effect on HIV transmission are being conducted among various sectors of society, little attention is being paid to the profession of hair cutting and the use of sharp equipment in this profession. Hence the present study was carried out to assess the knowledge, attitudes and practices of barbers regarding the sterilisation of sharp equipment and its effect on HIV transmission.

Study objectives

A cross-sectional survey using a predesigned questionnaire and observational checklist was conducted from 22 January to 30 January, 2002, in order to assess the knowledge, attitudes and practices of barbers in the town of Jimma in relation to the sterilisation or disinfection of sharp equipment so as to reduce the risk of HIV transmission. The questions were put to the respondents by means of an interview, and the interviewer recorded the responses. The survey questions were designed to:

1. assess the extent of proper sterilisation/disinfection in the barbers' work pattern
2. evaluate the knowledge of barbers about sterilisation and HIV transmission
3. determine attitudes and practices as regards the sterilisation/disinfection of sharp equipment
4. compare the importance of sterilisation for public health with barbers' knowledge, attitudes and practices in this regard.

Study area

Jimma town is located 335 km southwest of Addis Ababa. The town has an estimated area of 4482 square m and is located at an altitude of 1740 m above sea level. Its average annual rainfall is about 1465.7 mm, which makes it one of the wettest places in the nation. The town is divided into three *Kefitegna* and 21 *Kebeles* containing 22,831 housing units with an average family size of 5.5 persons. According to the 1994 national census, it was estimated that the population would be 125,569 by the year 2001. Health services are provided for the entire town and its surroundings, with one health centre, three health stations, and one University Hospital (8). There are 41 barber shops with 102 barbers that are legally entitled to serve the town's population, and all of them were included in the study.

Results

All 102 barbers working in the 41 barber shops in the town were included in the study and observed using an observational checklist. The mean age of the barbers interviewed was 28 (S.D. $\pm$9.8). Thus, with reference to the questionnaire, young adults between 20–25 years of age predominated. With regard to sex, 98% of the barbers were male. The educational status ranged from Grades 9 to 12.

When the knowledge of the barbers was assessed, it was found that about 99% of respondents had correctly responded to the items concerning the use of sterilisation, the importance of inspection of their work environment by health personnel and the possibility of disease transmission through unsterile sharp equipment. However, only 51% of the respondents knew of the possible transmission of HIV through such equipment. The number of respondents who really knew the correct meaning of sterilisation, methods of sterilisation and the difference between disinfection and sterilisation was found to be less than 43%.

Of all the barbers interviewed, 94% supported the provision of sterilisation in their work pattern as a necessity, and 88% knew that unsterile blades can transmit diseases. However, about 63% of the respondents believed that disinfection is enough to prevent the transmission of diseases, including HIV/AIDS.

The observational checklist and the practice questionnaire of this study showed that not all barber shops had been using sterilisation but that all had been using disinfection to remove disease causing micro-organisms including HIV from their commonly used sharp equipment between serving one client and the next. However, the ingredients of disinfectants, the concentration and expiry date of the methylated spirit that the barbers used were not indicated by labels in all barber shops. Furthermore, the contact time between alcohol and blades was inadequate – usually less than one minute. Moreover, about 76% of the barber shops used bottles other than the original ones, with no labelling or other pertinent information, for their methylated spirit. The study found that 51% of barber shops buy the methylated spirit from a pharmacy, 34% from other shops and 15% from a supermarket. All of the barbers try to clean and sterilise blades and trimmers by brushing their surface with cotton that has been soaked in methylated spirit.

Discussion

The transmission of HIV through blood transfusions, sexual contacts and the sharing of skin-piercing instruments such as blades and needles has been widely reported in the literature. HIV is susceptible to heat and sunlight, and the period of survival outside the body is known to be in general measurable in seconds, although occasionally it may be as long as 10 to 15 minutes (9).

Barber shops can act as potential channels for the transmission of HIV from one customer to another. This can occur when the same blades and trimmers are used by different customers – a common practice in Ethiopia. Moreover, during rush hours, the reduction in time between serving two clients, coupled with an increased likelihood of skin scratching and skin piercing may dramatically increase the chance of a successful transmission of HIV. Thus barber's knowledge, attitudes and practices regarding the sterilisation and disinfection of commonly used sharp equipment can have a great influence on the chain of HIV transmission.

The results of the present study reveal that some respondents have good knowledge with regard to some of the 'knowledge' questions, but that the great majority does not. Of the respondents, a large proportion (70%) was ignorant about the knowledge questions on sterilisation in relation to HIV transmission, particularly through the sharp equipment (blades) used in their occupation. This may be due to a lack of understanding of the difference between disinfection and sterilisation, and to a lack of health education about HIV transmission through the unsterile sharp equipment that they commonly use. A similar finding has been reported from a study carried out in India (9).

The assessment of barbers' attitudes towards the sterilisation of shaping equipment in relation to HIV transmission showed that the proportion of barbers with a favourable attitude is greater than the proportion of barbers with good knowledge and good practices. Hence the attitude of barbers in this study is generally favourable, which may be due to their having access to some information about sterilisation and disease transmission caused by unsterile sharp equipment.

This study demonstrates that no barber shops in the study area were practising total sterilisation but that they *were* trying to practise disinfection. The authors of the study did not in general regard the disinfection practised as high-level disinfection, at least not as it was observed in the study period. Firstly, the majority (75%) of barber shops used bottles other than the original ones, and hence disinfection was carried out using disinfectants with no labelled concentration and with unknown ingredients and an unknown expiry date. Secondly, the contact time between the disinfectant and the equipment was not enough to bring about proper disinfection. Thirdly, nearly 50% of the shops obtain disinfectants from inappropriate sources, and around 75% were considered not totally inspected by health personnel. The above figures highlight the fact that if corrective measures are not taken, the inappropriate sterilisation and disinfection practices observed in the barber shops may only give customers a false sense of security, while rendering the effort spent on sterilisation ineffective. The reason for the absence of total sterilisation in all barber shops and for the incorrect practice of disinfection in their work pattern may be partly attributed to insufficient knowledge about sterilisation and the possible risk of HIV transmission. The lack of strict control measures and monitoring by responsible bodies in order to break the chain of HIV transmission through places of work may be another factor contributing to the improper disinfection procedures observed in all barber shops. This finding is similar to previous reports (9), and control measures need to be instituted to rectify the problem.

Conclusions

Ethiopia is one of the poorest countries of the world with a dependency ratio of 0.87 and an adult HIV prevalence of over 10% (5, 8, 10). As the productive force of the society is the main victim of the epidemic, the impact of HIV/AIDS on the nation's economy may be enormous. The results of this study revealed that the knowledge, attitudes and practices of barbers regarding the sterilisation of sharp equipment are generally poor in the workplaces of the study area. Thus any attempt to change the behaviour of the barbers should be viewed as one potential way of breaking the chain of HIV transmission in the country.

Recommendations

At present, a cure for HIV/AIDS is a distant dream, and the only tool we have at hand is prevention. Based on the findings of this study, the following recommendations were made.

1. The government, in conjunction with other relevant bodies, should give proper attention to the problem of sterilisation in barber shops in such a way that people get proper information pertaining to the public health importance of sterilisation.
2. There should be rules and regulations regarding the sterilisation of sharp equipment in barber shops, and these rules should be strictly applied at local, regional and national levels.
3. Awareness of the potential risk of HIV transmission through sharp equipment should be promoted among the communities. The profession of barber seems to be one occupation where there is scope for educational intervention.

References

1. Marcus R et al. Transmission of HIV in health care sitting world wide; Bulletin of WHO; 1989;67(5):577.
2. WHO. Guideline on sterilisation and high-level disinfection methods effective against HIV; AIDS action WHO report: Global program on AIDS. 1988.
3. Cheebruooh M. Laboratory practice in tropical countries (part-II); Cambridge University press; 2000:49–50.
4. MOH. AIDS in Ethiopia: Back ground projects, impact and intervention; MOH epidemiology and AISD department. 1998.
5. UNAIDS. Alban A, Guinness L. Socio-Economic Impact of HIV/AIDS in Africa; from economic and AIDS in Africa; Switzerland [CD-ROM acrobat reading]. 2000.
6. Orc Macro et al. Ethiopia Demographic and Health Service; 2000:159–63.
7. Policy on HIV/AIDS of the Federal Democratic Republic of Ethiopia.
8. Central statistics authority of Ethiopia; the 1994 population and housing census of Ethiopia; statistical abstract. 2000.
9. Khadait DW, Abadekar NN, Vasudeo ND. Knowledge and practice about HIV transmission among barbers of Nagpur city; Indian Journal of Medical Science; 1999;53(4):167–71.
10. Mengstu B. International conference on public management, policy and development proceeding governance and substantial development: Promotive collaborative partnership; Addis Ababa, Ethiopia; 2001.

Gebi Kurkura,
Worku Legesse and
Tesfaye Zewudie
Jimma University
P.O. Box 378
Jimma
Ethiopia

A.V.F. Ngowi, TANZANIA
T. Partanen, COSTA RICA

Introduction

A wide range of pesticides is used for pest and vector control in agricultural areas in Tanzania, but with poorly equipped health care facilities and health care workers not familiar with pesticides, the whole system of care and treatment of the poisoning cases becomes ineffective, not to speak of the prevention of pesticide poisoning. The statistics on pesticide poisoning generated by such a deficient health care system also become unreliable. The World Health Organization estimates that three million cases of acute pesticide poisoning (two million suicide attempts, one million accidental poisonings) resulting in 220,000 deaths, occur worldwide every year (1); this figure is based on hospital registries. The burden of pesticide-related illness and injury is difficult to determine, since pesticide poisoning is commonly undiagnosed and/or unreported all over the world (2, 3). Tanzanian medical records indicate that 736 poisoning cases per year are due to pesticides (4).

Pesticides are the most popular means of pest, plant disease and vector control, and their effect on target organisms is easy to appreciate, despite the adverse health effects on non-target organisms – humans included. Pesticide promotion and inducements by the industry and suppliers further encourage villagers to use products that are harmful to their health in the absence of sufficient knowledge concerning the effects of these compounds.

A study was undertaken to investigate whether Tanzanian health care workers have sufficient knowledge and means to manage adverse health effects of pesticides.

Methods

The present study was conducted in 1991–1993 in the coffee and cotton growing areas of Tanzania, where intensive farming is conducted and a substantial number of pesticide poisonings were reported (5). The study was part of a multi-country (Kenya, Tanzania, Uganda) initiative to assess exposure to pesticides and subsequent health effects,

Treatment of pesticide poisoning: A problem for health care workers in Tanzania

with the overall objective of developing strategies for the reduction of exposure and pesticide-related illnesses. Detailed methods of data collection and analysis are described in Ngowi et al. (6). In brief, the target population included 104 physicians, clinical officers and nurses at every health care facility (N=48), both governmental and private, in the coffee (N=16) and cotton (N=32) growing areas of Tanzania. The groups chosen for the survey were selected on the grounds that they had the opportunity to handle poisoning cases occurring in their service areas. Face-to-face interviews were conducted, and the characteristics and distribution of health care workers as well as their responses to knowledge and practice questions were analysed and published.

Results

Fifty six percent of the health care workers interviewed came from the coffee growing areas (Table 1 on page beside). The mean age was 33 years, with respondents in cotton growing areas being on average 2 years older than those in coffee areas. Respondents from the coffee growing areas were mostly nursing aids, while in cotton growing areas they were predominantly medical assistants and clinical officers. There was a conspicuous shortage of physicians in both areas. The majority of respondents in both areas were employed at dispensaries. The duration of their employment in health care averaged 12 years, with an average of 5 years in agricultural areas. The proportions of female respondents in coffee and cotton growing areas were 57% and 35% respectively.

The survey showed that respondents were able to name several pesticides (Table 2), with endosulfan named most frequently in both areas but predominantly in cotton growing areas. Blue copper (copper sulphate) was most frequently mentioned in coffee growing areas. Captafol and parathion were named, even though they have been banned from use in the country for several years; this raises the question of whether these compounds are still actually used. Only 1% of respondents were able to distinguish between organophosphorus and organochlorine groups of pesticides. The only pesticides known by group were diazinon (as an organophosphate) and endosulfan (as an organochlorine). The respondents regarded a number of pesticides as responsible for poisoning. Endosulfan (19%) and chlorpyrifos (15%) were the most frequently named compounds. All respondents reported a need for information or training on health aspects of pesticides.

Eighty five percent of the respondents in the coffee growing areas answered "yes" to the question "Do you treat pesticide poisoning?", while the "yes" rate

Table 1. Distribution of interviewed health care workers in coffee and cotton growing areas by background variable

	Coffee N (%)	Cotton N(%)	All N(%)
Age (y)			
21–29	14 (25.5)	20 (40.8)	34 (32.7)
30–39	23 (41.8)	20 (40.8)	43 (41.3)
40–49	15 (27.3)	8 (16.3)	23 (22.1)
50–57	3 (5.5)	1 (2.0)	4 (3.8)
Median (y)	34.0	35.0	33.2
Occupation			
Physician	1 (1.7)	3 (6.5)	4 (3.8)
Medical assistant			
or clinical officer	12 (20.7)	17 (37.0)	29 (27.9)
Public health nurse	1 (1.7)	2 (4.3)	3 (2.9)
Registered nurse	9 (15.5)	1 (2.2)	10 (9.6)
Enrolled nurse/midwife	1 (1.7)	1 (2.2)	2 (1.9)
Nursing aid	14 (24.1)	3 (6.5)	17 (16.3)
Other	20 (34.5)	19 (41.3)	39 (37.5)
Type of facility			
Hospital	17 (29.3)	5 (10.9)	22 (21.2)
Health centre	5 (8.6)	9 (19.6)	14 (13.5)
Dispensary		24 (41.4)	20 (43.5)
44 (42.3)			
Sub-dispensary	10 (17.2)	8 (17.4)	18 (17.3)
Village health post	1 (1.7)	-	1 (1.0)
Other	1 (1.7)	4 (8.7)	5 (4.8)
Duration (y) of service in health care			
< 1	2 (3.4)	1(2.2)	3 (2.9)
1 – 1.9	7 (12.1)	2 (4.3)	9(8.7)
2 – 4.9	7 (12.1)	7 (15.2)	14 (13.5)
5 – 9.9	7 (12.1)	11 (23.9)	18 (17.3)
10 – 19	24 (41.4)	18 (39.1)	42 (40.4)
20+	11 (18.9)	7 (15.2)	14 (12.5)
Median (y)	5.0	5.0	11.7
Duration (y) of service in agricultural area			
< 1	5 (8.6)	7 (15.2)	12 (11.5)
1 – 1.9	6 (10.3)	8 (17.4)	14 (13.5)
2 – 4.9	20 (34.5)	13 (28.3)	33 (31.7)
5 – 9.9	17 (29.3)	11 (23.9)	28 (26.9)
10 – 19	9 (20.0)	6 (13.0)	15 (14.4)
20 +	1 (1.7)	1 (2.2)	2 (1.9)
Median (y)	3.0	3.0	5.0
Gender			
Female	33 (56.9)	16 (34.8)	49 (47.1)
Male	25 (43.1)	30 (65.2)	55 (52.9)

Table 2. Pesticides reported by health care workers as known by names but not chemical groups in the coffee and cotton growing areas in Tanzania.

	Frequency of naming per area		
Pesticides listed as known (chemical group)	***Coffee*** **N=235(%)**	***Cotton*** **N=89(%)**	**Total N=324(%)**
Actellic Super Dust (OP)	-	3 (3.4)	3 (0.9)
Blue copper (FU)	36 (15.3)	-	36 (11.1)
Campheclor (OC)	-	1 (1.1)	1 (0.3)
Carbicron	-	1 (1.1)	1 (0.3)
Chlorothalonil (FU)	20 (8.5)	-	20 (6.2)
Chlorpyrifos (OP)	34 (14.5)	2 (2.2)	36 (11.1)
Copper hydroxide (FU)	9 (3.8)	-	9 (2.8)
Cyhalothrin (PY)	1 (0.4)	4 (4.5)	5 (1.5)
Cypermethrin (PY)	-	11 (12.4)	11 (3.4)
DDT (OC)	11 (4.7)	11 (12.4)	22 (6.8)
Deltamethrin (PY)	-	1 (1.1)	1 (0.3)
Diazinon (OP)	1 (0.4)	7 (7.9)	8 (2.5)
Dieldrin (OC)	11 (4.7)	-	11 (3.4)
Difolatan (FU)	2 (0.9)	-	2 (0.6)
Dimethoate	-	1 (1.1)	1 (0.3)
Endosulfan (OC)	18 (7.7)	26 (29.2)	44 (13.6)
Fenitrothion (OP)	13 (5.5)	2 (2.2)	15 (4.6)
Fenvalerate (PY)	-	3 (3.4)	3(0.9)
Fluometuron (HE)	-	2 (2.2)	2(0.6)
Gesaprim (HE)	2 (0.9)	2 (2.2)	4(1.2)
Glyphosate(HE)	6 (2.6)	-	6(1.9)
Hostathion (OP)	-	1 (1.1)	1(0.3)
Malathion (OP)	-	3 (3.4)	3(0.9)
Paraquat (HE)	16 (6.8)	-	16(4.9)
Parathion (OP)	-	1 (1.1)	1(0.3)
Pirimiphos-methyl (OP)	-	1 (1.1)	1(0.3)
Profenofos (OP)	21 (8.9)	-	21(6.5)
Pyrethrum (natural PY)	-	2 (2.2)	2(0.6)
Red copper (FU)	28 (11.9)	-	28(8.6)
Tilt	3 (1.3)	-	3(0.9)
Triadimefon (FU)	3 (1.3)	-	3(0.9)
U-combi (Mixture OP, OC)	-	4 (4.5)	4(1.2)

was 62% in cotton producing areas. The responses to "How do you or would you treat pesticide poisoning?" are presented in Table 3. There was a tendency for the respondents to describe general rather than specific treatment. The major concern was to remove the pesticide inside the victim by either washing out (gastric lavage, induced vomiting) or inducing excretion. Neutralization using milk was reported in most cases; few reported the use of atropine as an antidote. Symptomatic treatment was also reported frequently, especially if all else failed.

A high proportion of the respondents in coffee (70%) and cotton (77%) growing areas reported a lack of means for the treatment of pesticide poisonings. While many admitted not knowing what was required for the treatment of pesticide poisoning, and needed advice, some expressed the need for drugs and/or equipment. The required inputs included drugs such as atropine, injection drugs for preventing poison (e.g. hydrocortisone, phenergan, adrenaline, piriton), oral drugs for diluting toxins, antibiotics (e.g. christapen, penicillium), diuretics (lasix), analgesics, antihistamines, infusion fluids (sodium chloride, dextrose), and equipment such as infusion sets, blood pressure instruments, tubes to induce vomiting, suction equipment, large plastic syringes for sucking out poison, gastric and nasal tubes, monitoring equipment, resuscitation materials, ventilators, spatulas, soaps, skin brushes, oxygen, gloves, aprons, vehicles to transport serious cases to hospital, milk, and charcoal tablets.

Discussion

This study showed that health care workers in coffee and cotton growing areas could name pesticides used in their work areas but that only 1% could tell to which chemical group the pesticides belonged. A higher proportion of health care workers in the coffee growing areas treated pesticide poisoning than was the case in the cotton growing areas, although cotton growing areas had workers with a higher level of qualification (medical assistants and clinical officers) as compared to those in coffee areas (nursing aides). About three quarters of health care workers reported a lack of equipment for the treatment of pesticide poisoning, and a majority reported that they were unfamiliar with appropriate means for the treatment of pesticide poisoning. Although the survey was conducted in the early 1990s, inquiries made by the senior author show that the situation has remained unchanged.

The inability of health care workers to classify pesticides into chemical groups (organophosphates, organochlorines, etc.) reflects their lack of understanding of fundamental principles in the diagnosis and treatment of pesticide poisoning. This in turn leads to a poor prognosis for the victims of poisoning

Photo by E. Kähkönen

Health care facilities are often poorly equipped and health care workers are not familiar with pesticides.

Table 3. Treatment for pesticide poisoning, as reported by health care workers in coffee and cotton growing areas in Tanzania.

Pesticide	Treatment	Remarks from respondents
All pesticides	- gastric lavage, induce vomiting	- to remove pesticides from the stomach
	- intravenous* infusion, drips	- to speed excretion, support circulation
	- milk or antacids	- to neutralize the poison or reduce corrosiveness
	- treat symptomatically	
	- induce excessive urination using diuretics (lasix)	- to remove pesticide from blood
	- antidotes e.g. atropine	
	- aspiration	
	- sustain vital signs**	
	- antibiotics***	- to prevent damage or infections in the lungs (pneumonia)
	- kerosine	
Diazinon (OP)	- atropine	
Dursban (OP)	- warm salted water	- to induce vomiting
	- milk	
	- intravenous* infusions	
	- atropine	
	- magnesium	
DDT (OC)	- induce vomiting, referral	
Endosulfan (OC)	- analgesics e.g. paracetamol	
	- atropine	
	- milk	
	- magnesium milk	
	- intravenous* drips	
	- antibiotics	
	- charcoal	
	- salt	
Fenitrothion (OP)	- induce vomiting	
	- magnesium solution	
	- antibiotics	
Gramoxone	- intravenous* infusion	- there is no cure patients always die
	- antibiotics	
	- pain killers	
Karate (PY)	- salted water	
	- milk	
Selecron (OP)	- warm salted water	
	- milk	
	- belladonna	
	- intravenous* infusions	

* Examples given were normal saline, Ringer's lactate, Hatman solution, dextrose
** Vital signs included blood pressure, pulse rate, respiration rate, etc.
*** Antibiotics included penicillin (PPF) and ampicillin

and hence to an ill-health burden for the communities. The treatment that they provide seems to be based on traditional ways of handling poisoning cases in general. Although a number of respondents indicated a need for drugs and equipment, it is unlikely that they actually knew what they needed for the treatment of pesticide poisoning.

The management of pesticide poisoning in Tanzania is constrained by deficient knowledge among health care workers and by poor resources for diagnosis and treatment. The study demonstrated an urgent need for improved proficiency in the diagnosis and treatment of poisoning in the case of the compounds that cause poisonings most frequently, as well in that of the compounds that cause the most severe poisonings (i.e. those classified by the World Health Organization as highly and extremely toxic), no matter how frequent or infrequent the poisonings are. Pesticides such as ethoprophos, phosphamidon, chlorfenvinphos, dichlorvos, dicrotophos, carbofuran and methomyl were found in the areas surveyed and are known to be extremely hazardous (7). Training health care workers on health aspects of pesticides and on how to recognize, diagnose and treat pesticide poisoning cases, and supplying the rural health care establishments with suitable diagnostic and treatment facilities throughout Tanzania have been shown to be urgently needed aspects as well.

References

1. World Health Organization and United Nations Environment Programme. *Public Health Impact of Pesticide Used in Agriculture*. Geneva, WHO/UNEP. 1999.
2. Reigart RJ, Roberts JR. *Recognition and management of pesticide poisonings*. United States Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances, EPA 735-R-98-003. 1999.
3. Ballard TJ, Calvert GM. *Surveillance of acute occupational pesticide-related illness and injury: the US experience.* Ann Ist Super Sanita 2001;37:175–9.
4. Mbakaya CFL, Ohayo-Mitoko GJA, Ngowi AVF, Mbabazi R, Simwa JM, Maeda DN, Stephens J, Hakuza H. *The status of pesticide usage in East Africa*. Afr J Health Sci 1994;1:37–41.
5. Ngowi AVF, Maeda DN, Kissio H. *Impact of pesticides on human health. A case study of the coffee growing regions of Tanzania*. Afr Newslett Occup Health and Safety 1992;2:80–3.
6. Ngowi AVF, Maeda DN, Partanen TJ. *Assessment of the ability of health care providers to treat and prevent adverse health effects of pesticides in agricultural areas of Tanzania*. Int J Occup Med Environ Health 2001;4:347–54.
7. Ngowi AVF. *Health Impact of Exposure to Pesticides in Agriculture in Tanzania*. PhD thesis, Acta Universitatis Tamperensis (In press). 2002.

AVF Ngowi
Tropical Pesticide Research Institute
P.O Box 3024
Arusha, Tanzania
Timo Partanen
Central American Center for Studies of Toxic Substances
Universidad Nacional
Heredia, Costa Rica

Occupational diseases related to wet and cold conditions in Kenya

M.D.Nderitu
KENYA

Introduction

The horticulture and floriculture industry has become a common economic activity in Kenya over the past two decades. This industry provides a basis for the development of other sectors in the Kenyan economy, since the flowers and vegetables grown in this industry are mainly for export to the European markets, and are thus one of the main foreign exchange earners. Thanks to their high quality, Kenyan horticultural and floricultural products have won a high level of acceptance on international markets. The industry has thus grown considerably in the recent past.

The growing area has expanded to cover the Rift Valley province (main area), the areas around the outskirts of Nairobi, and the central parts of Kenya.

The industry involves a variety of activities, which include growing, harvesting and primary processing. These activities involve the use of machinery and/or implements, or manual work. Floriculture and horticulture have thus become an area of concern to all stakeholders, because of problems related to the environment, sanitation, inadequate medical services, chemical hazards, and low incomes. All of these constitute occupational health and safety matters.

Problems involved

The principal risks to the health of workers stem from the following causes: environmental aspects; the nature of the work, tools and machines; and human factors. Within the horticultural and floricultural industry in Kenya, the use of cold store facilities has exposed the workers to hazards related to cold, wet conditions, plus, of course, hazards related to the materials used in the refrigerant systems of storage facilities.

Exposure to cold, chilly and wet conditions has become an increasing occupational hazard, thus affecting large groups or smaller familial clusters. Harvested flowers and vegetables are usually stored in cold-rooms and chillers before being exported by air transport. Some of the processes involved include packaging and sorting done at processing lines inside cold-rooms, and the prolonged exposure of specific workers to cold, wet and chilly conditions may result in injuries such as frostbite, common cold, pneumonia, immersion foot, etc. The above phenomena are common among workers deployed to work in cold-rooms and chillers.

A study conducted in a few selected workplaces shows that the most common injuries suffered are frostbite on fingers and prolonged common colds. Besides the cold and chilling effects, there are also hazards related to compounds used as coolants. These are freons, ammonia, chlorodifloromethane ($CHCLF_2$), dichlorodifluoromethane (CCL_2F_2) etc. When these refrigerants leak from the piping, they constitute severe occupational hazards for the workers. A case was reported in which chlorodifluromethane leaked out of the pipe, threatening to affect workers. These refrigerants are known to cause frostbite and irritation to the skin and eyes.

Control and prevention of these occupational hazards and illnesses

It may be impossible to eliminate hazards related to a cold, wet and chilling environment, but precautionary measures can be taken to minimise such hazards and to avoid the associated illnesses. Below is a list of precautionary measures:

(i) Protective clothing, e.g. warm boots, heavy jackets, warm gloves and head covers should be used.
(ii) There should be medical surveillance of all suspected cases of work-related illness.
(iii) Workers should be trained on the dangers involved in their type of work.
(iv) The hours of exposure of workers to these conditions should be minimised.
(v) The systems should be fitted with emergency cut-out switches, and piping corrosion should be avoided by installing adequate insulation.
(vi) Sharp instruments should never be used to remove ice from pipes or refrigeration equipment. Cold metal is prone to be brittle, and fragile components may be encased inside the ice. Defrosting should be done by means of heated gas or warm water.
(vii) Precautions should be taken during routine maintenance to protect the eyes and other vulnerable organs from fumes and splashes.

Muchemi David Nderitu
Occupational Health and Safety Officer
Homegrown (K) Limited,
P. O. Box 10222 - 00400
Nairobi – Kenya
Tel: 254+02+2721168;
254+0722+204831/2#
E- mail:
j.gema@homegrown.co.ke

Contact persons/country editors

Chief Inspector of Factories
Commissioner of Labour and
Social Security
Department of Labour and
Social Security
Private Bag 0072
Gaborone
BOTSWANA

Samir Ragab Seliem
Egyptian Trade Union Federation
Occupational Health and
Safety Secretary
90 Elgalaa Street
Cairo
EGYPT

Z. Gezahegne
Head/workers' Working Conditions
Research and Education Division
Ministry of Labour and
Social Affairs
P.O.Box 2056
Addis Ababa
ETHIOPIA

Commissioner of Labour
Ministry of Trade Industry and
Employment
Central Bank Building
Banjul
GAMBIA

Franklin K. Muchiri
Directorate of Occupational
Health and Safety Services
P.O.Box 34120
Nairobi
KENYA

Noel J. Mkhumba
Information and Documentation
Centre
P/B 344
Capital City Lilongwe 3
MALAWI

Assistant Director of Factories
Federal Ministry of Employment,
Labour and Productivity
Private Mail Bag 12576
147, Broad Street
Lagos
NIGERIA

Peter H. Mavuso
Head of CIS National Centre
P.O.Box 198
Mbabane
SWAZILAND

Ministry of Labour and
Youth Development
Factories Inspectorate
P.O.Box 9014
Dar es Salaam
TANZANIA

Paul Obua
Occupational Health and
Hygiene Department
Ministry of Labour
P.O.Box 4637
Kampala
UGANDA

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