COLLEGE OF FAMILY PHYSICIANS SINGAPORE

# The SINGAPORE FAMILY PHYSICIAN

## OCCUPATIONAL HEALTH

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- Skin Problems
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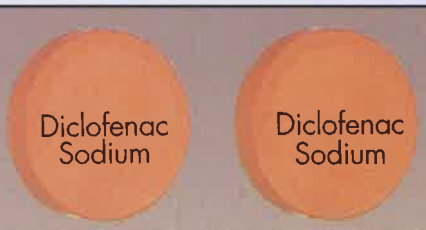


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# THE SINGAPORE FAMILY PHYSICIAN – LOOKING AHEAD

"Time passes so fast..." - a commonly heard lament, and yet, how true! Twenty-four years have passed since the College of General Practitioners, Singapore, was established in June 1971, and twenty-two since the publication of the first issue of the College Journal, entitled the "General Practitioner". Dr Lim Boon Keng, the then Chairman of the Publications Committee, wrote in the first editorial that "to provide better health care is the prime objective of the College of General Practitioners". At that time, many GPs worked alone and had little time to keep up with advancement in medical knowledge. "The role of the College is to provide education", and the publication of the "General Practitioner" was an effort at "written education", quoting Dr BR Sreenivasan, the first College President who, in his "Foreward to the 'General Practitioner'", went on to say that the journal would be "introducing new knowledge, that is, advancing the frontiers of knowledge and disseminating known facts and views, in other words, research and instruction."

What was written all those years ago still holds true today, though the names and terminology have been changed. The College has untiringly provided continuing medical education for practising Family Physicians, many of whom are still working long hours in solo practices. The Journal, too, had played its part in education and advancement of new knowledge, with the publication of invited articles on specific topics of interest, and research papers. So, where do we go from here?

We will go from strength to strength, and continue to play an important role in the major function of the College. Each issue of the Journal will cater to continuing education through the thematic approach and the Home Study section. The Journal will also encourage research efforts by the publication of research papers and case reports. The essence of the Journal will be academic, focusing on the continual updating of the practising Family Physician, for the betterment of his clinical practice.

In this context, the Journal welcomes contributions from the readership in the form of written articles that may be of interest and relevance to family physicians. It is not necessary to be invited in order to write. The motivation is from the felt need to share with others what we know or have learnt, for the improvement of our fraternity.

In order to make the Journal better and more relevant to everyone involved in Family Practice, letters to the Editor in the form of comments and suggestions are most welcome. Comments on articles published are also solicited and, where necessary, they will be passed to the authors concerned for reply. In this way, the learning process comes full circle and everyone benefits. In the same context also, the Journal will commence the peer review system for free papers, to improve the standard of writing and presentation of research material. It is our commitment to encourage scientific writing, and we shall endeavour to publish as many of the articles that are of relevance to Family Practice as possible.

Even though the practice of family medicine has been around for a long time, it is only in recent years that Family Medicine was considered a specialty in its own right. There is still resistance to the general acceptance of this, and it is an uphill task to gain recognition and to maintain our just position among the larger fraternity of all doctors.

Hence the great need to change others' perception of family doctors, and to keep continually up to date in current knowledge and practice.

So, fellow family physicians, support your Journal by reading it and contributing to it, and in so doing, play a part in gaining recognition for Family Medicine as a discipline that will be a vital force in medical care in the years ahead.

***Dr Hong Ching Ye***

# WORK AND HEALTH

** K S Chia, MBBS, MSc(OM), MD*
*** J Jeyaratnam, MBBS, MSc, PhD*

*"...to the questions recommended by Hippocrates, (the doctor) should add one more - What is your occupation?"*

Bernardino Ramazzini, 1633-1714

This innocent-sounding sentence by the Father of Occupational Medicine is of profound significance in clinical practice. Through his observations on the health of the working-class, he recognized the effect of working conditions on the health of a wide variety of workers: miners, chemists, cleaners of latrines and cesspits, tanners, cheese makers, midwives, nurses, learned men, nuns, etc. He recognized that incorrect diagnosis may occur or inadequate treatment be given if the occupation is ignored. Due to the omission, the patient's recovery may be prolonged or his illness exacerbated.

A local example is a worker with baker's asthma who was diagnosed as a case of adult onset asthma without taking into consideration his occupational history[1]. It took nine years after he was first diagnosed with asthma before an attempt was made to evaluate the contribution of the work environment. He was subsequently transferred to another section in the factory and within one year, his asthma improved dramatically and after two years, he did not have any further asthmatic attacks.

**Work-related diseases**

Workplace factors can be a direct causal agent of disease. On the other hand, they may play a role together with other risk factors in the causation of multifactorial diseases. The term work-related diseases was recommended by a WHO Expert Committee[2] to describe diseases other than occupational diseases where workplace factors play a contributory role in its causation. Occupational diseases are at one end of the spectrum of work-relatedness where the relationship to specific workplace causative factors is well established. At the other end of the spectrum are 'general diseases' where the relationship with workplace factors is weak, inconsistent and unclear. Work-related diseases are in the middle of this spectrum where there is a possible causal role of workplace factors but the strength and magnitude may vary.

In work-related diseases, workplace factors may be partially causal, or aggravate, accelerate or exacerbate existing disease. For example, a known asthmatic with infrequent wheezing attacks may develop more frequent attacks when exposed to workplace agents. Similarly, an old back injury may be aggravated by poor working posture.

In clinical practice, it is therefore important not to merely identify the occupational factors when an occupational disease is suspected. For example, if a worker is diagnosed with mesothelioma, the occupational history is then taken retrospectively to confirm exposure to asbestos. It is more crucial for patient management to evaluate the role of occupational factors in a suspected work-related disease. For example, a worker who is an asthmatic may have several different triggering factors. Some of these are in the home environment and others in the workplace. For the effective control of his asthmatic attacks, the work-related factors will have to be identified and controlled.

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However, it may be difficult to quantify the role of workplace factors in work-related diseases. The stength of the workplace factors varies in time and place. It is greater when exposure levels are high and may even be modified by other risk factors like smoking, dietary fat intake and ethnic differences[3]. Epidemiological studies in work-related diseases have great difficulty in identifying the role of occupational factors which account for less than 20% increase in incidence of a disorder among the exposed population. In the clinical situation, the decision is therefore often based on subjective judgment derived from knowledge of the degree of exposure and the known health effects of the hazard. The confirmation is seen when the patient improves while away from the hazard.

Another issue concerning work-related diseases involves educating patients who have known non-occupational risk factors. For example, a patient with poorly controlled diabetes mellitus may intend to take or is currently in a job with exposure to a nephrotoxic chemical like lead or cadmium. The functional reserve capacity of the kidneys may have already been compromised from the underlying diabetes mellitus. The exposure from the nephrotoxic agent may further reduce the reserve capacity contributing to an earlier onset of renal insufficiency[4]. It is prudent for the practitioner to advise the worker to minimize the exposure and monitor both the exposure and disease status even after the worker may have left the exposure situations.

## Taking an occupational history

Ramazzini's exhortation in today's context is inadequate. Most patients when asked for their occupation will give a job title which is totally inadequate to assess the type and degree of exposure to workplace hazards. For example, a common title is "production operator". A production operator in a car battery plant has very different exposure from a similar worker in an electronics factory. Hence, when an occupational or work-related disease is suspected, the cursory question: 'What is your occupation?' is grossly inadequate.

A full occupational history will include a careful description of the nature of work in all previous occupations. Most occupational diseases have long latent periods. Hence, the present occupation is often misleading. However, training in medical school is narrow, focusing on recognizing disease manifestations. It is difficuilt for the doctor to understand the workplace descriptions provided by their patients. The doctor will have to visit the workplace to have a visual image of the workplace practice and environment. Unfortunately, the current remuneration scheme for doctors makes visiting workplaces unattractive. On the other hand, it is not possible to manage ill-health among workers without some first hand experience of the workplace. Many clinical specialists like chest physicians and dermatologists who have a special interest in occupational and work-related diseases have improved their skills not through reading books and papers but by visiting workplaces and understanding how exposure can occur and giving practical recommendations on how the hazards can be controlled.

## Conclusion

Practicing physicians should shift their focus from occupational to work-related diseases. The implication is that they have to understand how workplace factors may contribute to the disease causation. This cannot be acquired through mere reading but requires first hand study of the workplace.

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# OCCUPATIONAL NEUROLOGICAL DISORDERS

*S E Chia, MBBS, MSc (OM), FAMS*

## INTRODUCTION

A 55-year old man was seen at a medical clinic on many occasions for the last few months for complaints of giddiness. He gave a history of being well before going to work and only developing the giddiness when he started work. Physical examinations done by the attending doctors on all these occasions were normal. But he insisted on a medical certificate as he could not go to work. He was in fact diagnosed as "malingering" by the doctors at the clinic.

The patient was referred to the Occupational Clinic for management of "malingering". On getting an occupational history from the patient, it was found that he was woking as a fitter in a shipyard for the last 15 years. Each day he had to use considerable amount of organic solvents to clean the ship engine. Over the last few months, he developed giddiness after the degreasing job -- this was the reason why he did not want to go to work! Further investigation was conducted for the patient that showed that his symptoms were suggestive of early chronic toxic encephalopathy due to the organic solvents exposure.

The above case was seen by the author. It demonstrates the importance of some knowledge of occupational medicine, if we are serious about the total care of our patients.

In workers exposed to potentially neurotoxic agents who may manifest signs and symptoms of neurotoxicity, there are many problems in trying to establish a direct cause-effect relationship, especially about the central nervous system. The nervous system responds to neurotoxic substances in many ways. The actual mechanism of the effect of substances (for many) is still unclear. Furthermore, there is relatively little information about which chemical is neurotoxic and which is not. A small number of the estimated 60,000 chemicals in the workplace have been evaluated for toxic effects. However, 1000-1500 new chemicals are being introduced into the industries each year[1].

As a family physician, a pratical approach to the awareness of an occupational neurological disorder may lie in the knowledge of some common work situations in Singapore which give rise to these occupational diseases.

## COMMON WORK SITUATIONS WITH POSSIBLE EXPOSURE TO NEUROTOXIC SUBSTANCES

### Metals

In Singapore, the commonest exposures to ***arsenic*** are from the manufacture of electronics components and wood preservation industries[2]. Although the electronic industry has the most number of workers, their exposure is usually very low. The exposure is confined to the manufacture of electronic wafers where arsenic is used to enhance electrical conductivity. This process is enclosed although exposure is possible during maintenance[2].

Arsenic exposure can be high in wood preservation plants. Dust is generated during the pouring and mixing of dry wood preservatives that contain arsenic. Although no dust is generated in those

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using the paste form of wood preservative skin contact is unavoidable during the release of treated wood from the pressurised tanks[3].

Some common industries where workers can be exposed to ***lead*** include telecommunication, manufacture of electronic parts and components, manufacture of plastic materials and manufacture of storage and primary batteries. Chia et al[4] reported that industries which manufacture plastic materials (stabilisers in PVC compounding), storage and primary batteries and fabricated metal products had 17.3, 18.0 and 27.1 per cent of exposed workers respectively, exceeding the recommended health-based limit of 40ug lead/dl.

Organic lead exposure is usually confined to refining and uses of gasoline (organic lead used as antiknock agent) and production and transportation of antiknock agents.

Other lead exposure could be from printing industry (type setting), manufacture and use of antifouling paints, lead soldering, manufacture and use of glazes for China porcelain, enamels, glazed tiles, etc.

***Manganese*** is used in the manufacture of dry cell batteries, animals feed, matches and fireworks, iron and steel industry, potassium permanganate, etc. Exposure could also occur in mining, smelting, refining and milling of manganese. A local study conducted by Gan et al[5] reported that the highest manganese exposure was in manganese mills.

The chlor-alkali plant produces chlorine, hydrogen and sodium hydroxide by brine electrolysis using elemental ***mercury*** as a flowing cathode. The mercury is kept under brine or water during normal operation. Mercury exposure can occur during "rebuilding" when the electrolysing chambers are drained off, exposing the mercury[6].

In laboratories, elemental mercury is used as a pressure medium in various pressures gauges for carrying out pressure, volume, and temperature measurement. Other possible sources of exposure to mercury include dentistry amalgam's preparation, paint and pigment manufacture, pharmaceutical industry (preparation of drugs and disinfectants), etc.

**Solvents**

Solvents are used in industry for a variety of purposes. Different forms of surface coatings are made possible by solvents e.g. printing inks and paints, dilutants for paints, spreading preparations for papers and fabrics. They are also used for extracting oils, fats, and other substances from different materials. Some solvents are used for degreasing and dry cleaning purpose. The extent and amount of solvent usage varies from industry to industry.

***Toluene*** is probably the most extensively reported for causing toxic encephalopathy especially among toluene abusers[7]. It is widely used as a paint, lacquer and ink dilutant. Shoemaking, leather and glove industries are among the most frequently reported sources of peripheral neuropathy from organic solvents[8]. The main solvents responsible are n-hexane, methyl n-butyl ketone and carbon disulphide. Most of the cases occur in subjects who work in small, poorly ventilated rooms where good work hygienic conditions are absent[9].

**Pesticides**

Approximately 90% of all pesticides produced are used for commercial and the remainder for structural pest control, horticulture, and home and garden purposes. Common work situation exposure usually involves agricultural workers. Horticultural workers may be exposed to significant levels of pesticides too. In horticulture, occupational exposure to the pesticides occurs mainly during the mixing of the compound with water and in the spraying of the mixture[10].

Workers involved in the formulation and manufacture of pesticides are also exposed to its hazards. Packers who do repacking of pesticides (most do not know the nature of what they are packing) are also at risk. These operations are done in warehouses or cottage industries with no preventive measures adopted.

## CLINICAL PRESENTATION

In the workplace, workers are generally exposed to more than one chemical. It is therefore, in practice, difficult to isolate the effect of a single chemical. Very few symptoms or signs of

neurologic impairments are specific for neurotoxicity caused by chemicals. It may be difficult at times to differentiate other (non-occupational) causes of neurological dysfunction.

In order to establish that the presenting problem is one that is related to or caused by work exposure, a detailed occupational history is important. This should be followed by environmental assessment (where feasible) to determine the types of agents and level of exposure. Biological monitoring (if available) of the patient and other workers would help to have a better picture of the body burden of the exposed substance.

**1. How to distinguish this from a non-occupational disease**

*Occupational history*
In general, the symptomatology of a non-occupational neurological disorder cannot be differentiated from that of an occupational related disease, apart from a suggestive history. This is where taking of a comprehensive occupational history becomes very important in helping to distinguish an occupational disease from one that is not work related.

*Subjective symptoms questionnaire*
Recording of subjective complaints using a standardised questionnaire is of importance to provide a consistent information base for all patients with neurotoxic exposure. Symptoms reports are usually the first manifestation of the disease before any detection by neurological or psychologic testing. Subtle changes can be detected especially if the questionnaire is used periodically for the workers. Table 1 shows a sample of the questionnaire[11].

*Clinical history and examination*
Other than a general examination of the various systems, specific emphasis should be placed on the nervous system. The neurological examination should include cranial nerves, co-ordination, sensation, strength, gait and tendon reflexes[12]. Particular emphasis should be placed on a careful mental status examination as suggested above.

*Peripheral nerve function*
An early symptom of peripheral nerve dysfunction is numbness or tingling of the extremities, starting usually in the lower limbs, then the upper limbs. If exposure persists, weakness (distal more than proximal) may follow with sensory symptoms (diminished vibration or pain sensation, bilateral reduced or absent ankle reflexes). Atrophy and muscular fasciculation may develop later.

*Central nervous system*
Acute exposure to high concentration of a neurotoxic substance generally results in a non-specific narcotic effect. The toxic substance is easy to identify because of its acute onset.

Chronic low-level exposure is much more difficult to relate to central nervous system dysfunction because of the lack of specific symptoms, the lack (in many instances) of objective methods for assessment, biases introduced by compensation and possible "healthy worker effect". The most common complaints are difficulty with concentration and memory. Verbal reasoning, remote and recent memory, complex concept formation, and dexterity may also be affected. In addition, patients may report headache, light-headedness, vertigo, blurred vision, poor co-ordination, tremor, and weakness of the extremities. The more severe ones can complain of difficulties with attention and organising ability together with general depression, irritability and fatigue.

It must be stressed that patients who have been exposed to a central neurotoxin (e.g. solvents) may complain of cognitive dysfunction without any other physical signs. A standard neurobehavioral test battery is therefore an important adjunct investigative tool.

**2. Diagnostic and laboratory tests**

*Environmental and biological tests*
Environmental monitoring is used to assess the types of chemical and exposure levels at the work site. It is best to consult an industrial hygienist for the environmental monitoring. However, in certain factories, the safety officer or engineers may be able to do the monitoring if they have been trained. Knowledge of the types of chemical that the workers are exposed to and the exposure levels are very useful information that a physician needs to obtain.

Biological monitoring is complementary to environmetnal monitoring. Where biological monitoring techniques are available, they provide information on body burden (internal exposure) which reflects the balance between uptake, biotransformation and excretion, in contrast to environmental monitoring that measures airborne concentration in the workplace or breathing zone. Biological monitoring for some of the heavy metals is quite well established. Blood lead and manganese are useful measures of body burden. Similarly this is true for urinary level of mercury, arsenic and manganese. Measure of rbc or plasma cholinesterase activity would be useful in determining the acute effect of organophosphate. There are, however, a limited number of biological monitoring techniques applicable to solvents.

*Neurophysiological and neurobehavioral tests*
Other tests can be carried out to confirm clinical findings of nervous lesions. These include electroencephalography, electroneuromyography neurobehavioral tests e.g. World Health Organisation Neurobehavioral Core Test Battery. It would probably be better for the physician to refer to the relevent specialists for further evaluation of the patient who is suspected to be suffering from an occupational neurological disease. But what is crucial is that the family physician must be able to pick up the case!

## PRE-EMPLOYMENT AND PERIODIC EXAMINATIONS

Recognising that many family physicians may also be involved in pre-employment and periodic medical examination, what are some pointers that one needs to bear in mind with respect to occupational neurology?

**Pre-employment examination**
As in any pre-employment examination, the general principles apply: Is the worker fit for this particular job for which he is seeking employment? What are the baseline examinations and investigations that should be conducted?

To answer the above questions with sufficient confidence and clear conscience, the attending physician must know the job requirements and the possible hazards. What is the working environment? What is the work process? What are the work tools? Does the job expose the worker to any substances that may cause him/her to be more susceptible to developing ill-health?

The physician would need to know also what are the likely agents that the worker may be exposed to. What are the likely target organ systems? Based on this knowledge, the appropriate tests (as discussed earlier) may be conducted to obtain base line results. Wherever possible, the relevant and available biological monitoring markers should be done to determine the pre-exposure levels.

Workers with certain medical conditions/ complications may be more susceptible to neurotoxic substances at the workplace. Extra caution must be taken in deciding if such workers are fit for employment. The list of medical conditions in Table 2 (adapted from Johnson et al) is by no means complete nor exhaustive. It merely serves as a guide for the attending doctor. When in doubt, it is always good practice to consult and discuss the worker's medical condition with specialists in that particular field.

**Periodic examination**
The objective of periodic examination is the detection of early cases of subclinical effects or excessive absorption of the exposed substances. The frequency of the examination is dependent on the extent of exposure of the hazards.

History taking and clinical examination should be specific to the hazard concerned. Serial results of the worker are more important than a single result. It is always good practice to study the relationship of the results over different medical examination periods. Rising trends of the results should caution the physician to the likelihood of pending excessive absorption or early effects of the agent. The appropriate intervention should be carried out.

If the worker's biological monitoring results exceed the permissible values. he should be transferred to another section where there is no exposure to the hazard. Similarly, this would apply to workers who develop symptoms and/or signs of neurological or behavioral dysfunction.

**Table 1: Symptoms Questionnaire (taken from: Johnson[11])**

*A. CHRONIC SYMPTOMS*

Below is a list of questions concerning symptoms you may have had. Check the appropriate box if you have been experiencing the symptoms in the past month. If you have experienced the symptom, please indicate in the space provided.

1. Are you tired more easily than expected for the amount of activity you do?
(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

2. Have you felt lightheaded or dizzy?
(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

3. Have you had difficulty concentrating?
(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

4. Have you been confused or disoriented?
(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

5. Have you had trouble remembering things?
(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

6. Have your relatives noticed that you have trouble remembering things?
(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

7. Have you had to make notes to remember things?
(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

8. Have you found it hard to understand the meaning of newspapers, magazines and books you have read?
(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

9. Have you felt irritable?
(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

10. Have you felt depressed?
(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

11. Have you had heart palpitations even when not exerting yourself?
(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

12. Have you had a seizure?
(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

13. Have you been sleeping more often than is usual for you?
(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

14. Have you had difficulty falling asleep?
(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

15. Have you been bothered by incoordination or loss of balance?
(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

16. Have you had any loss of muscle strength in you legs or feet?
(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

17. Have you had any loss of muscle strength in your arms or hands?

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

18. Have you had difficulty moving your fingers or grasping things?

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

19. Have you had numbness or tingling in your fingers lasting more than a day?

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

20. Have you had numbness or tingling in your toes lasting more than a day?

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

21. Have you had headaches at least once a week?

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

22. Have you had difficulty driving home from work because you felt dizzy or tired, even though you had slept enough, etc?

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

23. Have you felt 'high' from the chemical you smell at work?

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

24. Have you had a lower tolerance for alcohol (takes less to get drunk)?

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

### *B. ACUTE SYMPTOMS DURING THE WORKDAY*

During the last month that you have worked have you noticed that you felt or experienced any of the following symptoms during the workday:

1. Headaches

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

2. Tired

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

3. Lightheaded or 'high'

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

4. Difficulty concentrating

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

5. Confusion

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

6. Difficulty remembering things

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

7. Irritable

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

8. Incoordination

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

9. Loss of muscle strength

(1) not at all ___ (2) a little ___ (3) moderately ___
(4) quite a bit ___ (5) extremely ___

If you have answered yes to any of the symptoms above, do these symptoms come on when you are using a specific substance? Please explain.

**Table 2: Exposure to Agents Contraindicated in Some Medical Conditions.**

| MEDICAL CONDITIONS | NEUROTOXIC SUBSTANCES | | | | | | |
|---|---|---|---|---|---|---|---|
| | Pb | TEL | Hg | Mn | $H_2S$ | $C_6H_6$ | $CS_2$ |
| Haemopoietic system and secondary anaemia | x | | | x | | | |
| Chronic liver and kidney disease | x | x | x | x | x | x | x |
| Cardiovascular diseases | x | x | | | x | | x |
| Gastrointestinal diseases | x | x | x | | x | | |
| Autonomic dysfunction | x | x | x | x | x | x | x |
| Endocrine diseases | | x | x | x | x | x | x |
| Organic CNS diseases | x | x | x | x | x | x | x |
| Diseases of peripheral nerves | x | x | x | | x | | x |
| Mental illness | x | x | x | x | x | x | x |
| Respiratory diseases | | x | | x | x | | x |

*Adapted from Johnson et al[11]*

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# THE WORK ENVIRONMENT AND THE SKIN

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## INTRODUCTION

The effects of the work environment on the skin are rarely life threatening. However, they can cause much morbidity and suffering to the workers, and are a significant cause of decreased productivity and sickness absence in industry[1].

Occupational dermatoses are defined as any pathological conditions of the skin for which job exposure can be shown to be a major direct or contributory factor[2].

## EPIDEMIOLOGY OF OCCUPATIONAL DERMATOSES

In a reported series of 1,727 cases of occupational dermatoses which were confirmed by the Ministry of Labour in Singapore between 1983 to 1987, contact dermatitis was the most common presentation of occupational dermatoses[3]. It accounted for 86% of all cases. About one fifth of the cases were from the construction industry, while the rapidly expanding electronics industry contributed to 15% of all cases. Many of these cases were assessed in a government skin hospital.

A published series of 557 patients with occupational dermatoses seen at a Singapore government skin hospital between 1984 and 1985 reported that the majority of cases were contact dermatitis[4]. Irritant contact dermatitis was the most predominant (56%) followed by allergic contact dermatitis (39%). A small proportion (5%) of the cases were non-contact dermatitis, such as fibreglass dermatoses, miliaria and oil folliculitis. Most of the affected workers were from the construction (30%), metal and engineering (21%), electrical and electronic (16%), transport (6%) and food catering (4%) industries. Cutting fluids, oil, cement, solvents, detergents and soldering flux were the commonest occupational irritants. The common occupational allergens included chromates, rubber chemicals, resins, nickel and cobalt. A few workers had contact urticaria to proteinaceous foods.

It should be remembered that most statistics from notification of occupational diseases are an underestimation of the true magnitude of the problem. Most of the cases reported also required tertiary assessment and management. The types of cases seen at the primary health care level would be different.

Cross-sectional prevalence surveys provide a better reflection of the situation at the industry level. Some prevalence studies have been undertaken in

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different industries in Singapore (Table 1). However, the reported rates in all the studies were not strictly comparable, as they vary between point and period prevalence rates. The prevalence rates would differ for different industries, and also for different countries.

**Table 1. Prevalence Rates of Occupational Dermatoses in Some Industries**

| | Industry | Prevalence rate | Numbers | % |
|---|---|---|---|---|
| 1. | **Metal workers**<br>Coenraads, 1985[5]<br>(Six month period prevalence) | All dermatoses<br>Occupational dermatoses (mainly dermatitis) | 50/751<br>42/751 | 6.7<br>5.6 |
| 2. | **Prefabrication construction workers**<br>Goh et al, 1986[6]<br>(Unspecified period prevalence) | All dermatoses<br>Occupational dermatitis | 46/272<br>38/272 | 16.9<br>14.0 |
| 3. | **Furniture sanders**<br>Gan et al, 1987[7]<br>(Unspecified period prevalence) | All dermatoses<br>Occupational dermatoses | 34/497<br>19/497 | 6.8<br>3.8 |
| 4. | **Chrome platers**<br>Lee and Goh, 1988[8]<br>(Point prevalence) | Occupational dermatoses<br>(50% of cases were chrome ulcers) | 14/37 | 37.8 |
| 5. | **VDU workers**<br>Koh et al, 1990[9]<br>(One year period prevalence) | All skin complaints<br>Work-related dermatoses | 82/672<br>?33/672 | 12.2<br>?4.9 |
| 6. | **Electronics workers**<br>Koh, 1993[10]<br>(Point prevalence) | Occupational dermatoses | 377/2567<br>(2/3 of all cases were solder burns and abrasions) | 14.7 |

*?These are estimated figures, based on a history of improvement of the skin condition while off work.*

## CLINICAL PRESENTATION OF OCCUPATIONAL DERMATOSES

The commonest presentation of occupational dermatosis is contact dermatitis. It accounts for over 90% of all cases seen at the secondary and tertiary levels of care, and a large proportion of the cases seen at the primary care level. Occupational dermatoses can also present in other forms, such as contact urticaria, disorders of pigmentation and skin cancers, although less commonly.

**Dermatitis**

Dermatitis or eczema (synonymously), is an inflammation of the skin with characteristic morphology but varied cause. Dermatitis is characterized by redness, swelling, small fluid filled blisters, and oozing in the acute state and as a scaly lichenified, thickened, fissured with pigmentary changes in the chronic stage.

Contact dermatitis refers to dermatitis caused by skin contact with an environmental agent. Most occupational dermatoses are eczematous reactions to an environmental contactant.

Endogenous dermatitis such as atopic, seborrhoeic, varicose and discoid dermatitis, are dermatitis which are genetically inherent skin disorders. They are not caused by environmental agents. However, environmental factors may often aggravate existing endogenous dermatitis.

***Irritant Contact Dermatitis***

Irritants are substances which directly damage skin at the site of contact or application. Skin inflammation caused by contact with irritants is called irritant contact dermatitis. The inflammation process in irritant contact dermatitis is not mediated through an immunologic mechanism. Irritant contact dermatitis is more common than allergic contact dermatitis. Irritant contact dermatitis is classified into acute irritant dermatitis/reaction and cumulative insult irritant contact dermatitis.

*a. Acute irritant dermatitis*

Strong irritants e.g. concentrated acids, alkalis or solvents cause an acute irritant contact dermatitis following a single exposure or repeated exposures. The skin structures are damaged directly by the irritant. The cause of acute irritant contact dermatitis is often obvious.

Strong irritants cause irritant contact dermatitis in almost all individuals. In contrast, weak irritants such as water and mild detergents tend to cause irritant contact dermatitis in susceptible individuals only (e.g. individuals with previous atopic dermatitis or hand eczema). Weak irritants tend to cause dermatitis only after repeated skin contact.

In the workplace, cases of acute irritant dermatitis often occur as accidents or as a result of workers' poor work habits e.g. failure to use gloves, boots or aprons when indicated, or from careless handling of acute irritants. It also results from workers' failure (usually due to ignorance) to recognize the hazards of corrosive work materials. Acute irritant dermatitis can very often be prevented and affected workers need not require a job change. Health education is very important here. Where permissible, the use of impervious gloves, aprons and boots during work can prevent acute irritant contact dermatitis.

*b. Cumulative insult irritant contact dermatitis*

This type of irritant contact dermatitis is caused by repeated skin contact with weak irritants. Weak irritants cause irritant contact dermatitis in susceptible individuals only. The duration between first exposure to the irritant and the appearance of dermatitis varies from weeks to years, depending on the nature of the irritant, frequency of contact, and host susceptibility. The clinical presentation is usually a chronic dermatitis.

Cumulative insult dermatitis is exemplified by the chronic hand dermatitis caused by water and detergents among dishwashers and housewives, and by cutting fluid dermatitis among metalworkers. Solvents such as thinners and kerosene when used inappropriately as skin cleansers often cause cumulative insult dermatitis.

***Allergic Contact Dermatitis***

Allergic contact dermatitis is an immunologic inflammatory reaction of the skin due to contact with an allergen. In contrast to irritant contact dermatitis, the inflammatory reaction is mediated through an immunological process. An individual does not develop any reaction to the allergen during his initial exposure to the allergen. Often

repeat contacts are necessary before an individual becomes sensitized to an allergen. The expression "I have been in contact with the substance for many months and never had any rash with it previously and therefore the substance cannot be the cause of my rash" is a misconception.

Different substances have different sensitizing potential, and there is individual susceptibility to sensitization by an allergen. Once an individual becomes sensitized to an allergen, further contact with the allergen will trigger a type IV hypersensitivity reaction, during which chemical mediators are released from immunocompetent cells, leading to the manifestation of dermatitis. The dermatitis usually appears 36 to 48 hours after contact with the allergen. The dermatitis may be acute, subacute or chronic, depending on the sensitivity of the worker. Allergy to a substance is specific, and once developed, is usually life-long.

Common allergens in industry include nickel, fragrances, hexavalent chromate, rubber chemicals and epoxy resins.

Unlike a worker with irritant contact dermatitis, a worker who develops allergic contact dermatitis to a work substance may require a job change. Hence, it is important to differentiate an irritant from an allergic contact dermatitis. Once an allergen has been identified as the cause of occupational dermatitis, it is necessary to inform the worker of the sources of the allergen and to avoid contact with these substances permanently. One must also be aware that "automated processes" need maintenance and workers maintaining such processes are exposed to chemicals used in the automated machines and may also develop contact allergy to the chemicals[11].

***Patch Testing***

Patch testing is the definitive test for allergic contact dermatitis. The patch test procedure allows the dermatologist to identify the allergen that causes the dermatitis. The patch test procedure consists of applying a set of suspected allergens under occlusion on the skin of the upper back for 48 hours. The reaction to the test allergens is scored after the allergens are removed at 48 hours. A second scoring is made at 96 hours. Patch testing must be carried out by an experienced dermatologist to avoid false positive and false negative test results. For example, a false positive reaction may result if the concentration of the test allergen applied on the skin is too high and a false negative patch test recording may result if the concentration of the test allergen is too low[12].

***Phototoxic and photoallergic contact dermatitis***

A phototoxic substance is a substance which absorbs ultraviolet light and causes skin inflammation. Examples of phototoxic substances include medicaments (e.g. phenothiazines and tetracyclines), industrial chemicals (e.g. tars) and plant resins. Phototoxic contact dermatitis is not mediated through an immunologic mechanism. The reaction is dose related. Phototoxic substances tend to cause reactions in almost all individuals who are exposed to them.

Photoallergic contact dermatitis, like allergic contact dermatitis, is mediated through an immunological mechanism. The allergen becomes activated only in the presence of ultraviolet light. There is individual susceptibility to photoallergy. Examples of photoallergens include medicaments, fragrances, sunscreens and antiseptics. Photoallergic contact dermatitis can be confirmed by a photopatch test.

**Other types of environmentally induced skin disorders**

***Contact Urticaria***

Contact urticaria is an immediate wheal and flare reaction of the skin to a contactant (an urticant). Unlike contact dermatitis, which tends to develop several days after skin contact, contact urticaria develops very soon after skin contact with the urticant. The clinical presentation is usually immediate urticarial eruption (within 30 minutes of contact), and in long standing cases dermatitis. Contact urticaria is not uncommon.

Contact urticaria may be immunologically mediated (type I hypersensitivity reaction = allergic contact urticaria) or non-immunlolgically mediated. The latter reaction is usually localized and not life-threatening, unlike allergic contact urticaria which can be generalized and life-threatening. Hence, there is a need to differentiate

allergic from non-allergic contact urticaria. Allergic contact urticaria can be confirmed by a skin prick test.

Causes of contact urticaria include foodstuff (e.g. meats, eggs, seafood, vegetables), animal danders and secretions (e.g. from caterpillars and other arthropods), plants and spices (e.g. seaweed, thyme and cayenne pepper), fragrances and flavourings such as Balsam of Peru and cinnamon oil, several types of medicaments (e.g. some antibiotics), metals (e.g. cobalt), some preservatives (e.g. formaldehyde and benzoic acids), and rubber latex (e.g. gloves).

*Non-eczematous presentations*

Other environmental agents, including physical agents (e.g. ionizing radiation, mechanical factors, ultraviolet light, heat, and cold) can damage the skin. Some chemicals are absorbed percutaneously and can cause systemic toxicity (e.g. dioxins causing chloracne). Oils and greases can cause oil acne. Phenolic compounds such as para-tertiary butyl phenol formaldehyde resins may cause skin depigmentation. Table 2 summarizes the causes of non-eczematous presention of occupational dermatoses. Non-eczematous presentations of occupational dermatoses are uncommon. They account for less than 10% of all occupational dermatoses.

**Table 2. Examples of non-eczematous occupational dermatoses**

**Non-eczematous occupational dermatoses caused by physical agents**

- Mechanical injury e.g. frictional callosity, abrasions/lacerations, Raynaud's phenomenon (vibration)
- Temperature e.g. miliaria from heat, frostbite from cold
- Ultraviolet light e.g. photodermatitis, actinic damage
- Ionizing radiation e.g. radiation burns, skin cancers

**Skin infections and infestations**

- Viral e.g. herpetic whitlow
- Bacterial e.g. pyoderma, pitted keratolysis
- Fungal e.g. superficial and deep mycoses
- Parasitic e.g. larva migrans, mite infestations

**Others**

- Acne and folliculitis - e.g. caused by oil and grease, aggravated by heat
- Skin ulceration - by chromic and other acids
- Pigmentary changes
  - Hyperpigmentation - post-inflammatory, tar and pitch
  - Hypopigmentation - phenolic compounds
- Generalised skin eruption - from trichloroethylene
- Lichen planus like eruptions - paraphenylenediamine dyes, photographic colour developers
- Scleroderma - exposure to silica or vinyl chloride monomer
- Acquired porphyria cutanea tarda - hexachlorobenzene

*Skin cancers*

Skin cancers from environmental carcinogens (such as ultraviolet light, polycyclic aromatic hyderocarbons, and arsenic) are often induced after many years following exposure. In some countries such as in Singapore, statutory regulations require designated factory doctors to undertake special medical examinations of the skin to screen for skin cancers in workers exposed to potential skin carcinogens such as arsenic, tar, pitch, bitumen and creosote.

## INDUSTRIES AND OCCUPATIONS AT RISK

Workers in some occupations are at higher risk of developing occupational dermatoses than others. Table 3 lists some industries with risks of occupational dermatoses and some of the commonly encountered occupational irritants and allergens[13].

**Table 3. Common Irritants And Allergens In Some Industries**

**Chemical and Pharmaceutical Industry**
Allergens: All chemicals and medicaments, gloves and masks (rubber chemicals)
Irritants: Chemicals, acids, alkalis, solvents, water, detergents, surfactants

**Construction and Building Industry**
Irritants: Cement (alkalis), wood dust, wood preservatives, fibreglass, solvents, oils, pitch, tar, paints
Allergens: Cement (chromates, cobalt), rubber gloves/boots, leather gloves/boots (chromates, PTBPF, resins) epoxy resins, woods, paints

**Electronics and Electrical Industries**
Irritants: Solvents, soldering fluxes, acids, alkalis, resins, fibreglass, metallic salts
Allergens: Resins (e.g. epoxy, acrylates, isocyanates, formaldehyde resins), soldering fluxes (amines and colophony, metals (nickel, chromates and cobalt), gloves/cots

**Electroplating Industry**
Irritants: Acids and alkalis (metal cleaners, pickling and plating solutions), chromic acid fumers, cleansers
Allergens: Metals and their salts, gloves, boots, aprons

**Metal and Engineering Industries**
Irritants: Cutting fluids, solvents, abrasives, metal slivers, grease, oils, hand cleansers
Allergens: Cutting fluids (metals, biocides, antioxidants, fragrances, resins), barrier creams, gloves

**Food and Catering Industry**
Irritants: Vegetables and fruit juices (enzymes, acids, alkalis), water and detergents, polishing agents
Allergens: Foods (vegetables, seafood, salad dressings, meat, fruits, flavouring agents), gloves, antioxidants, preservatives, utensils (nickel)

**Hairdressing Industry**
Irritants: Shampoos, permanent wave solutions, water
Allergens: Nickel, formaldehyde, hair dyes, fragrances and preservatives, gloves

**Healthcare Industry**
Irritants: Water, soaps, detergents, solvents, resins, disinfectants, antiseptics, medicaments
Allergens: Gloves, medicaments, antiseptics, disinfectants, metals, formaldehyde, preservatives, resins

**Woodworking and Furniture Making Industries**
Irritants: Wood dust, resins, soaps and detergents, solvents, oils, turpentine, lacquer, polishes
Allergens: Woods, plants, gloves, resins, formaldehyde, wood preservatives, turpentine

## MANAGEMENT OF OCCUPATIONAL DERMATOSES

### An approach to the diagnosis of occupational dermatosis

The diagnosis of an occupational dermatosis requires not only a good knowledge of dermatology, but also a working knowledge of the patient's work process, materials, practice and habits. The clinical appearance of an occupational dermatosis (e.g. dermatitis, acne, skin cancer) is exactly the same as a non-occupational related skin disorder. The danger of overlooking an occupational dermatosis is that the patient's skin problem will recur when he returns to work. The failure to identify and avoid the causative agent of occupational dermatosis at a workplace may also result in failure to recognize similar skin problems in other workers.

It is essential that a detailed occupational history be obtained during any dermatological consultation. Occupational dermatosis should always be suspected when a worker presents with hand dermatitis and dermatitis on the exposed parts, as this is the commonest presentation of an occupational dermatosis. Important elements to look out for in the occupational history and during clinical examination are listed in Table 4.

**Table 4. Checklist of Important Considerations during History Taking and Clinical Examination**

| |
|---|
| **Occupational History** |
| Place of employment |
| Job Title |
| Typical workday activities |
| Materials handling techniques |
| Protective clothing and equipment |
| Hygiene facilities and practice |
| **Occupational Factors In Relation To The Skin Disorder** |
| New job, materials, processes |
| Health and safety information on materials handled |
| Whether other workers affected |
| Improvement on weekends or holidays |
| Sick leave taken for skin disorder |
| Past occupational history |
| Past history of occupational dermatosis |
| Concurrent occupation(s) |
| **Other General History** |
| Atopic background (personal and familial) |
| Skin allergies |
| Other skin disorders |
| Treatment for skin disorder |
| Domestic exposure |
| Hobbies |
| **Clinical Examination** |
| Is it dermatitis? |
| Is it contact (exogenous) dermatitis? |
| If it is contact dermatitis, is it irritant or allergic? |
| Are additional factors involved (e.g. sunlight)? |
| Is it a non-dermatitic occupational dermatosis? |
| **Are there any predisposing and aggravating factors for the occupational dermatosis, and are these preventable?** |

### *Additional Information And Follow Up*

Occasionally, further information on the nature of the chemicals which are handled by the worker may be required during investigation. The usual way of obtaining such information is to ask the worker for the Material Safety Data Sheets (MSDS) which may be available for the work chemical which is used. The MSDS provides information on the nature of the substance and its possible health effects. Chemical safety and health databases (available either at the Poisons Centres, or Occupational Health Centres) are other sources of information.

Where indicated, samples of the work materials handled by the worker should be obtained for patch testing or for chemical analysis. This may be necessary for the detection of impurities which may not be specified in the information sheet, or detection of decomposition products. The physician may need to arrange for a factory visit to better assess the worker's work conditions, to screen other workers for similar occupational dermatoses or to learn more about the work process.

### Specific Management of Occupational Dermatoses

The management of occupational dermatosis depends on its morphological presentation and cause. An accurate diagnosis is essential. The causative agent must be identified. A detailed

history, thorough physical examination, and where indicated, relevant investigations including patch tests and laboratory tests together with a factory visit, will often enable the physician to arrive at a correct diagnosis.

The worker should avoid the causative agent immediately if the dermatitis is severe. A temporary job change may be necessary. Severely affected workers should be given medical leave or hospitalized. Workers with mild dermatosis should be encouraged to resume work with proper pretective garments and advised to abserve good work habits.

Dermatitis is treated according to its severity. Acute dermatitis should be treated with wet compresses of normal saline or potassium permanganate (1:10,000) lotions until the dermatitis dries up. Chronic dermatitis should be treated with topical steroid creams or ointments of mild to moderate potency (e.g. hydrocortisone, betamethasone valerate, fluocinone acetonide).

Potent steroids such as clobetasol dipropionate should be avoided or used for short periods only because of their potential side effects. It is advisable to avoid combination steroid/anitbiotic/antifungal preparations as they may pose problems of sensitization. Contact allergy to neomycin and quinolines present in such preparations is not uncommon. Oral antibiotics should be administered where secondary bacterial infection is suspected. Oral antihistamines should be given to relieve pruritus.

Other occupational dermatoses are treated according to diagnosis; for example, cutaneous larva migrans with cryotherapy and/or oral antihelmetics, and chromomycosis with oral antifungal agents.

**Causes of Chronicity of Occupational Dermatoses**

Occasionally, the patient with an occupational dematosis may not respond to treatment. Chronicity of an occupational dermatosis can be due to one or more of the following:

a. Continued exposure to the offending agent.

b. Severe long standing dermatitis which generally takes longer to recover because the barrier functions of the skin are severely impaired.

c. Complications of treatment, such as superimposed contact allergy to medicaments.

d. Untreated complications, e.g. secondary bacterial infection.

e. Underlying endogenous factors e.g. atopic dermatitis.

f. Medico-legal problems. An avaricious worker may malinger or even self-inflict injury in attempts to seek compensation.

These conditions have to be considered and managed accordingly in a patient with a chronic occupational dermatosis.

**Rehabilitation**

The primary consideration in the rehabilitation of a worker with occupational dermatosis is to get him back to work as soon as possible, and at the same time prevent a relapse. The worker should be taken off work during the acute stage of the disease, but the physician should not encourage a long absence from work.

Permanent job change should be avoided wherever possible. A job change will require the worker to retrain for another job which may be expensive to the employee and the employer. It will also mean social adjustment for the worker - he has to adapt to a new working condition, colleagues and workplace. He may also suffer a salary reduction.

The physician should therefore consider the worker's age, skills, capability, intellect and available preventive measures before recommending a job change. Job change is usually indicated only for workers with allergic contact dermatitis and rarely for those with irritant contact dermatitis. This is because in allergic contact dermatitis, relapses tend to be more severe with each subsequent episode and even brief exposures to the allergen will trigger a reaction. However, when substitution of the allergen is possible, or

contact with the allergen can be totally avoided by changing work procedures, job change may not be necessary.

Studies have shown that allergic contact dermatitis from some occupational allergens (e.g. chromate from cement, nickel and cobalt) has a poor prognosis[14]. The dermatitis tends to persist even with avoidance of the allergen. Therefore job change may not benefit the worker significantly.

Another important factor to consider before recommending a job change is whether a personal history of atopy is present. Workers with an atopic background, especially those with a history of childhood atopic dermatitis or hand dermatitis, have a higher risk of developing irritant contact dermatitis when they are exposed to irritants. Job counseling is important for these workers, and they should be encouraged to do dry jobs.

The physician must distinguish between medical and social prognosis in workers with occupational dermatoses. Many workers with occupational dermatosis are able to continue work despite their dermatosis. Indeed, many do prefer to remain in their job despite their skin disorder, in order to avoid a salary reduction or a change to a less interesting or challenging job. Some who continue to be exposed to the work irritants or allergens may develop tolerance and hardening.

## PREVENTION OF OCCUPATIONAL DERMATOSES

All occupational dermatoses are theoretically preventable. Standard principles of prevention[15]. include substitution or removal of the offending agent, isolation of the worker and enclosure of work process. A well ventilated workplace is desirable when volatile solvents and irritant dusts and fibres are used in the work process.

Pre-placement medical examinations and advice to workers and employers on job suitability (e.g. advising atopics to avoid wet work) and regular health education and training of workers (for hazard awareness, proper handling techniques, and to stress the importance of good personal hygiene) play important roles in prevention.

The availability of conveniently sited washing and drying facilities at the workplace will encourage workers to utilize these facilities during breaks and after work. Proper skin cleansers should be provided, while abrasive detergents and solvents should be removed. The choice of cleanser will depend on the nature of the chemicals handled. A mild soap is usually adequate for office work. Non-aqueous cleansers may be needed to remove grease and oils. Unfortunately, strong cleansers tend to be corrosive and are more likely to cause irritant contact dermatitis.

The habit of using organic solvents and abrasive detergents as skin cleansers must be discouraged. The most effective prevention against occupational dermatitis is to avoid skin contamination during work. It may be better to have slightly dirtied hands than to suffer from chronic dermatitis from vigorous cleansing. Disposable towels should be provided for drying. Emollients or moisturizing creams applied after work may help to restore the barrier function of the skin.

### Barrier Creams

The efficacy of barrier creams against occupational dermatitis is questionable. Most studies have found them to provide limited protection. Workers using barrier creams may have a false sense of security. However, the use of barrier creams has the advantage of increasing the worker's awareness for cleaning their skin during breaks and after work. It also facilitates skin cleansing.

### Gloves

Personal protective equipment (e.g. gloves, sleeves, aprons and boots), if properly maintained and correctly used can be a very effective means to prevent occupational dermatoses. One limitation of using gloves is the risk of accidents. The correct type of gloves should be used. The choice of the type of gloves is based on the type of chemical handled and the type of work process. They should cover the distal third of the forearm to be effective. Where dripping of liquid towards the elbow is inevitable, elbow length gloves should be used. Alternatively, the dripping may be prevented by lowering the workbench or elevating the work platform. Impervious gloves are occlusive, and may cause skin maceration. Gloves with a cotton

lining may act as a wick and absorb sweat, enhancing a high humidity microclimate adjacent to the skin. Workers should remember to remove gloves periodically and to change them when they become moist or when the inner lining is contaminated. Workers should be provided with several pairs of gloves to change. It should be remembered that workers can occasionally become sensitized to rubber chemicals in rubber gloves, or chromates and resins in leather gloves. Allergic contact dermatitis to gloves and boots is characteristic and should not be overlooked. The use of clean work clothes is also advisable. Skin contact with clothing contaminated by irritants and allergen may cause dermatitis.

**Surveillance**

The company safety officers, nurses and physician must maintain a vigilant surveillance on the occupational health of their workers so that prompt investigation and management of any outbreaks of occupational dermatoses can be undertaken.

**Legislation**

Different countries have different medico-legal legislation regulating occupational dermatoses. This may include regulatory laws on environmental standards on cutaneous hazards, the provision of skin hygiene and washing facilities at workplace, notification of occupational dermatoses, statutory medical examinations, and workmen's compensation. Occupational health physicians and nurses, safety officers, general practitioners and anyone responsible for the health care of workers should be familiar with the occupational laws and regulations in their countries.

## PERCUTANEOUS ABSORPTION OF TOXINS

The skin is exposed to all environmental elements in the workplace. In addition to being a direct target organ for environmental chemicals, the skin is an important portal of entry of some environmental toxins into the body. The amount and rate of percutaneous absorption of contactants depends on several factors.

Different body sites have different skin permeability to chemicals. There is also individual variation. Permeability also depends on the state of the skin barrier. Absorption is enchanced through damaged skin or when substances are placed under occlusion. Another factor which affects skin absorption rate is the physical and chemical nature of the chemical, for example, whether it is lipid or non-lipid soluble.

**Skin notation in environmental standards**

The skin notation is sometimes encountered in environmental standards for toxic agents. This notation serves to highlight the skin as an important portal of entry for the toxin. For example, in the American Conference of Governmental Industrial Hygienists (ACGIH) guide-lines for Threshold Limit Values (TLVs), this notation is described by the ACGIH to "refer to the potential contribution to the overall exposure by the cutaneous route including mucous membranes and eye--either by airborne, or more particularly, direct contact with the substance". It draws attention to the need for having appropriate measures to prevent cutaneous absorption of substances having a "skin notation" so that the TLV is not invalidated.

Thus for chemicals having a skin notation, (important examples of which inculde solvents and pesticides), respiratory protection alone may be inadequate, even for exposure levels within the prescribed TLVs. It should also be remembered that the skin notation of a chemical only refers to its potential for percutaneous absorption being an important portal of entry into the systemic circulation, and not to the capacity of the substance to cause skin irritation or sensitisation in workers.

## CONCLUSION

The skin is an organ which is commonly affected by work related disordrs. As such, a good working knowledge of the epidemiology, aetiology, diagnosis, management and rehabilitation of occupational dermatoses is required for the practising health professional.

Occupational dermatoses are preventable. The principle of prevention, which is a major part of the ethos of occupational health practice, should be applied to safeguard the skin of the worker wherever possible.

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# ASSESSMENT FOR INJURY COMPENSATION

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## INTRODUCTION

Doctors are occasionally requested to examine an individual for the purpose of assessing him for the presence and severity of disability for compensation purposes. The disability is usually the result of injuries sustained either at work or a motor accident.

Compensation for work accidents is provided for in the Workmen's Compensation Act if the injured falls within the definition of a "workman". The Act defines a "workman" as any person hired to work under a contract of service but excluding, amongst others, domestic servants and non-manual employees earning more than $1500 a month. Under the Act, compensation is awarded whether or not the employer is to be blamed for the accident.

Alternatively, compensation may be sought under common law, in which case the defendent will have to be shown to be at fault in order to be liable.

## DEFINITIONS

Compensation is paid for disability, but two other terms are often met with in this context. The three terms - *impairment, disability, and handicap* - are used by the World Health Organisation to classify the consequences of disease or injury on a person's ability to function and to fulfil his role in society[1,2].

An *impairment* is an abnormality in the structure or function of the body or part of the body. It is therefore a purely medical (anatomical or physiological) condition.

A *disability* is the effect that the impairment has on a person's behaviour or on his performance of activities. These may be activities of daily living or of gainful employment. In Singapore, the Workmen's Compensation Act uses instead the terms *incapacity* and *loss of earning capacity*. In conformity with local usage these latter terms will be used for the remainder of this article.

A *handicap* is the result of how a person's impairment and incapacity affect his place in society. It is a disadvantage that he has been placed in relation to his peers.

## ASSESSMENT OF IMPAIRMENT OR INCAPACITY

An impairment or incapacity may be either temporary or permanent. But since compensation is awarded for permanent residual incapacity, assessment should be deferred until the condition has stabilised. All treatment possibilities should have been explored, and the doctor should satisfy himself that adequate time has been given for the condition to settle so that it is unlikely to improve or deteriorate any further.

Since impairment is an anatomical or physiological abnormality, assessing the degree of impairment

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is a function that doctors alone can perform. It requires careful physical examination, with objective measurements of structural abnormalities such as loss or shortening of limbs or of restricted movements, and of other impaired functional capabilities. Pain itself is not compensable, unless the pain results in objective limitation of function.

There are several good sources of information on disability determination[3], but the definitive work, and "probably the most complete book of its type anywhere", is the *Guides to the Evaluation of Permanent Impairment* by the American Medical Association (AMA) Committee on Rating of Mental and Physical Impairment. The *Guides* cover impairments of every organ system, and translate impairment of a bodily part to impairment of the whole man. As an example, amputation of the thumb at the metacarpophalangeal joint results in 100% impairment of the digit, equivalent to 40% of the hand, and 36% of the upper extremity. This is to be reduced by 5% if the non-dominant (often the left) hand is involved, resulting in an impairment of 31% of the upper extremity, which is equivalent to 19% of the whole man[4].

The assessment of incapacity is not solely a medical responsibility, because incapacity takes into account not only the common medical factor of impairment but also other variable factors such as age, sex, education, and employment. The loss of the distal phalanx of a ring finger, while causing the same impairment to the whole man, would result in vastly different incapacity or loss of earning capacity in a teacher as compared to a concert pianist. This is an extreme example, but these factors are very difficult to measure, and very often impairment is the only major criterion that can be reliably used to determine incapacity. In practice, the final award of permanent incapacity is usually an administrative decision as to the victim's entitlement[4].

The need for administrative input in assessing incapacity is illustrated by the collaboration of doctors of the Department of Industrial Health and officials of the Workmen's Compensation Department in producing for the Ministry of Labour (MOL) *A Guide to the Assessment of Traumatic Injuries for Workmen's Compensation*[5]. This *Guide* however is limited only to the coverage of orthopaedic conditions such as amputations, shortenings of limbs, ankyloses, and restricted movements of joints.

## MULTIPLE INJURIES

When there are two or more injuries, the impairment caused by each should be individually assessed, and then combined. This is not the same as adding the impairments. The combined value of A and B is not A + B, but A + B(1 - A), where A and B are the decimal equivalents of the percentage impairments.

Thus, if injury A results in A% impairment, and injury B B% impairment, then having lost A%, what remains of the whole man is 100% - A%, and the further B% impairment can only be deducted from the remaining (100 - A)%.

Tables for combining the percentage impairments of multiple injuries are given in both the AMA and the MOL Guides.

## COMPARISON BETWEEN IMPAIRMENT AND INCAPACITY

As noted earlier, the AMA Guides are for assessment of percentage *impairment* of the whole man, while the MOL Guide has additional administrative input for assessment of percentage *incapacity or loss of earning capacity.*

If would be interesting to see how *impairment* is translated into *loss of earning capacity* by a comparison of four examples (Table 1).

Assessment of *impairment* is therefore the basic medical assessment, upon which the *loss of earning capacity* is derived from administrative considerations of a host of other factors.

## PRACTICAL DIFFICULTIES

Practical difficulties can be anticipated when assessments have to be made on injuries that result in permanent residual incapacities not confined to the musculo-skeletal system. Since the MOL Guide deals only with orthopaedic conditions (and loss of sight and hearing from the First

Schedule of the Workmen's Compensation Act), where can doctors turn to for reference of local values if injuries result in loss of a kidney or spleen, or extensive scarring, or even loss of sphincter control and impotence?

In the past, Singapore has experienced several mass casualty situations from refinery and shipyard fires. In one such incident, workers were left with permanent residual impairments which included extensive scarring and keloid formation of the skin with consequent contractures and restriction of mobility of joints, corneal abrasions with partial diminution of visual acuity, and vertebral fractures with urinary stress incontinence and impaired potency.

The MOL Guide was clearly inadequate to deal with such a complex range of residual incapacities resulting from these impairments. So after medical evaluation of impairment, based on the AMA Guidelines, the incapacity or loss of earning capacity was finally determined by consensus of human resource, legal, and medical advisers.

The first stage in the exercise was to apportion that part of impairment which had an impact on gainful employment. Thus all impairments due to restricted mobility, as well as diminished vision, were thought to have an effect on gainful activity, which merited a premium loss of earning capacity above the basic percentage impairment of the whole man. The premium was a function of the worker's salary. On the other hand, impairments such as skin scarring per se, and impaired sexual potency, were thought to have no or negligible effect on gainful exployment, and therefore commanded no premium, the impairment being equated with incapacity. Such consensus from human resource and legal advisers constituted the administrative input used to convert impairment of the whole man, a purely medical decision, to loss of earning capacity, an administrative decision.

Ultimately what really mattered was the total compensation that each individual received and how this compared with known court awards in precedent cases[6,7]. In these cases they compared well with previous awards made in the courts of Singapore.

## CONCLUSION

In making assessments for injury compensation, the doctor has to ensure that adequate time has been allowed for the condition to stabilise so that it will neither improve nor deteriorate after the assessment has been made.

It is important to distinguish between assessment of *impairment*, which is a purely medical function, from assessment of *incapacity* or *loss of earning capacity*, which has a strong administrative element. While the Ministry of Labour *Guide to the Assessment of Traumatic Injuries for Workmen's Compensation* is useful for assessment of incapacity due to orthopaedic injuries, it offers no help when other organ systems are affected. In such situations, the American Medical Association's *Guides to the Evaluation of Permanent Impairment* forms an excellent resource for the assessment of impairments, but to translate *impairment* to *loss of earning capacity* will need subsequent administrative input.

**Table 1. Examples of how Impairment is Translated into Loss of Earning Capacity.**

| | AMA Guides impairment of whole man | MOL Guide loss of earning capacity |
|---|---|---|
| Total loss of vision of one eye | 20% | 50% |
| Amputation of thumb at mp joint | 19% | 30% |
| Amputation of distal phalanx of ring finger | 3% | 5% |
| Total loss of plantar-flexion of ankle | 6% | 12% |

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# OCCUPATIONAL HEALTH LEGISLATION AND THE LEGAL RESPONSIBILITY OF A DOCTOR IN SINGAPORE

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## INTRODUCTION

The one main legal responsibility of a medical practitioner in Singapore under the Factories Act is the notification of industrial diseases. For medical practitioners who are registered as designated factory doctors(dfds), there are additional responsibilities listed in the Factories (Medical Examinations) Regulations 1985. These are in relation to the conduct and reporting of statutory medical examinations of workers exposed to specific occupational hazards.

## NOTIFICATION OF INDUSTRIAL DISEASES

Section 67 (1) of dthe Factories Act states "Every registered medical practitioner attending on or called in to visit a patient whom he believes to be suffering from any of the diseases specified in the Sixth Schedule and contracted in a factory shall (unless such a notice has been previously sent) forthwith send to the Chief Inspector a notice in the form set out in the Tenth Schedule".

A copy of the notification form or Tenth Schedule is shown in appendix 1. Note that the latest copy includes the six newly notifiable industrial diseases (as of 1 April 1995): poisoning by carbamate, cyanide, hydrogen sulphide, organophosphate and halogen derivatives of hydrocarbons and repetitive strain disorder of the upper limb. There are now a total of 31 notifiable industrial diseases. Copies of the form can be obtained from the Department of Industrial Health, Ministry of Labour, 18 Havelock Road, #05-01, Singapore 0105, (telephone no: 5395135).

The forms should be properly completed by the doctor and sent to the Department of Industrial Health (DIH). Besides the diagnosis, basic particulars of the patient such as his name, NRIC number, age, sex, race, occupation, home address and the employer's name and address should be completed on the form. This would enable DIH's staff to contact the patient for further details. It is also useful for any relevant documents to be attached e.g. audiograms in the case of noise induced deafness, the "industrial dermatitis investigation form" (appendix 2) in the case of industrial dermatitis and the chest x-ray in the case of asbestosis or silicosis. A brief summary of the case giving the clinical findings and any relevant laboratory results e.g. blood lead concentration in the case of lead poisoning would be very helpful. Of course, the notifying doctor should give his name, clinic address and contact number.

DIH's doctors and nurses would investigate the more severe or serious cases to confirm the diagnosis, recommend specific preventive measures helpful to the individual patient and also for the protection of other workers who may be at similar risk and refer the case to the Workmen's Compensation Department where temporary or permanent disability may be involved. At a national level, the data on the confirmed cases are used to identify factories or industries at particular risk as well as any trends in the various types of industrial diseases or the causative agents.

*Specialist Medical Adviser*
*Department of Industrial Health*
*Ministry of Labour*

Table 1 gives the statistics on occupational diseases in Singapore over the last three years. Almost all the cases were from notifications by doctors. The most common notifications were those for noise induced deafness (resulting from the statutory medical examinations of noise exposed workers) and industrial dermatitis. Some of the cases came from referrals by medical practitioners to one of the three specialist clinics run by doctors from DIH: the occupational health clinic at Ang Mo Kio Polyclinic, the occupational lung disease clinic at Tan Tock Seng Hospital and the occupational dermatoses clinic at National Skin Centre.

Failure to comply with this requirement for notification could result in a fine not exceeding $500.

**Table 1. Confirmed Occupational Diseases, Singapore, 1992 - 1994**

| Occupational Disease | 1992 | 1993 | 1994 |
|---|---|---|---|
| Noise Induced Deafness | 655 | 560 | 754 |
| Industrial Dermatitis | 164 | 168 | 161 |
| Poisoning/Gassing | 49 | 140 | 57 |
| Occupational Asthma | 7 | 6 | 9 |
| Silicosis/Asbestosis | 7 | 11 | 5 |
| Miscellaneous | 15 | 15 | 13 |
| **Total** | 897 | 900 | 999 |

## MEDICAL EXAMINATION OF PERSONS EMPLOYED IN CERTAIN OCCUPATIONS IN FACTORIES

While any registered medical practitioner can conduct medical examinations on workers, only dfds can carry out the specified medical examinations (both pre-employment and periodic) required for factory workers exposed to specific occupational hazards listed in the Factories (Medical examinations) Regulations 1985. The list of hazards is given in Table 2.

If you are a dfd, there are certain legal responsibilities listed in the Regulations including the conduct of the examinations, the reporting of the results to the employer and advising on the fitness or unfitness for work with the particular hazard.

**Table 2. List of Specific Occupational Hazards Requiring Statutory Medical Examinations for Exposed Factory Workers**

| | |
|---|---|
| 1. | Arsenic or its compounds |
| 2. | Asbestos |
| 3. | Benzene |
| 4. | Cadmium or its compounds |
| 5. | Raw Cotton |
| 6. | Lead or its compounds |
| 7. | Manganese or its compounds |
| 8. | Mercury or its compounds |
| 9. | Excessive Noise |
| 10. | Organophosphates |
| 11. | Silica |
| 12. | Tar, Pitch, Bitumen, Creosote |
| 13. | Vinyl Chloride |
| 14. | Compressed Air |

## DISCUSSION

Listed above are the few legal obligations that a medical practitioner has under the Factories Act and its subsidiary regulations. In the area of occupational health practice, the doctor has to sometimes deal with the conflicting interests of workers, employers, managers, unions, government bodies and fellow doctors. There are ethical issues involved in the area of medical records, release of information and fitness for work. The Society of Occupational Medicine has published a Code of Ethics for Occupational Health Practitioners in Singapore to provide some principles to guide our doctors. One should also consult the Singapore Medical Association Code of Ethics and also be aware of the other legal responsibilities of a medical practitioner in Singapore (See Reference).

**Reference:**

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*Appendix 1*

TENTH SCHEDULE.

THE FACTORIES ACT.
CHAPTER 104
SECTION 67(1)

## NOTICE OF PATIENT SUFFERING FROM INDUSTRIAL DISEASES.

(This notice shall be completed by a registered medical practitioner attending on or called in to visit a patient whom he believes to be suffering from an industrial disease and forwarded to the Chief Inspector of Factories, c/o Department of Industrial Health, Ministry of Labour, 18 Havelock Road #05-01, Singapore 0105)

| Name of Patient | Age | Sex | Race |
|---|---|---|---|
| NRIC/FIN No. | Present Occupation | | |
| Residential Address | Case Summary | | |
| Name and Address of Employer | If patient is deceased state date of last attendance. | | |
| Name of Doctor | | | |
| Name and Address of Hospital/Clinic | | | |
| Tel. No. / Doctor's Ref. No. | | | |
| Diagnosis | | | |
| Date Signature of Doctor | | | |

LIST OF NOTIFIABLE INDUSTRIAL DISEASES

Please tick relevant box

- ☐ ANILINE POISONING
- ☐ ANTHRAX
- ☐ ARSENICAL POISONING
- ☐ ASBESTOSIS
- ☐ BAROTRAUMA
- ☐ BERYLLIUM POISONING
- ☐ BYSSINOSIS
- ☐ CADMIUM POISONING
- ☐ CARBAMATE POISONING
- ☐ CARBON BISULPHIDE POISONING
- ☐ CHROME ULCERATION
- ☐ CHRONIC BENZENE POISONING
- ☐ COMPRESSED AIR ILLNESS
- ☐ CYANIDE POISONING
- ☐ EPITHELIOMATOUS ULCERATION (due to tar, pitch, bitumen, mineral oil or paraffin or any compound product or residue of any such substance)
- ☐ HYDROGEN SULPHIDE POISONING
- ☐ INDUSTRIAL DERMATITIS
- ☐ LEAD POISONING
- ☐ LIVER ANGIOSARCOMA
- ☐ MANGANESE POISONING
- ☐ MERCURIAL POISONING
- ☐ MESOTHELIOMA
- ☐ NOISE INDUCED DEAFNESS
- ☐ OCCUPATIONAL ASTHMA
- ☐ ORGANOPHOSPHATE POISONING
- ☐ PHOSPHORUS POISONING
- ☐ POISONING FROM HALOGEN DERIVATIVES OF HYDROCARBONS
- ☐ REPETITIVE STRAIN DISORDER OF THE UPPER LIMB
- ☐ SILICOSIS
- ☐ TOXIC ANAEMIA
- ☐ TOXIC HEPATITIS

Labour 73-2061-77

NOTE FOR THE REGISTERED MEDICAL PRACTITIONER

All items in this Notification Form must be completed and accompanied by the relevant documents, viz AUDIOGRAM for a Noise Induced Deafness notification and INDUSTRIAL DERMATITIS INVESTIGATION FORM for Industrial Dermatitis notification.

*Appendix 2*

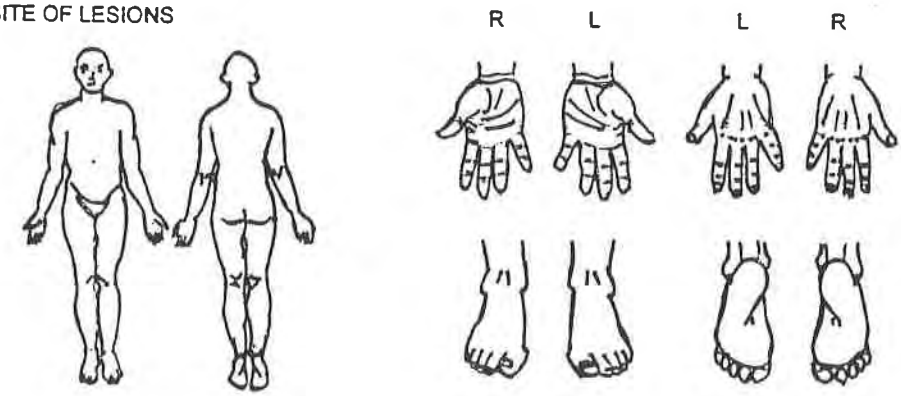
# Department of Industrial Health
# Ministry of Labour

## Investigation Form

1. TYPE OF LESIONS

| | | | | | |
|---|---|---|---|---|---|
| Erythema | ☐ Yes | ☐ No | Folliculitis | ☐ Yes | ☐ No |
| Itch | ☐ Yes | ☐ No | Acneiform | ☐ Yes | ☐ No |
| Papules/Macule | ☐ Yes | ☐ No | Pigmentary changes | ☐ Yes | ☐ No |
| Urticaria | ☐ Yes | ☐ No | eg. (depigmentation, hyperpigmentation) | | |
| Pus | ☐ Yes | ☐ No | Neoplastic changes | ☐ Yes | ☐ No |
| Discharge/Vesicles/Bullae | ☐ Yes | ☐ No | eg. (basal cell Ca, squamouscell Ca) | | |
| Lichenification/Fissuring Crusting | ☐ Yes | ☐ No | Others: _____ eg. (keratosis etc.) | | |

2. SITE OF LESIONS




3. SUSPECTED CAUSATIVE AGENT(S) _____
EXPOSURE DURATION _____YR(S) _____MTH(S)

4. REFERRED TO DERMATOLOGIST
☐ No ☐ Yes Name of clinic: _____ Referral Date_____

5. PATCH TEST DONE
☐ No ☐ Yes Date done:_____ Result:_____

6. SKIN LESIONS STILL PRESENT
☐ No ☐ Yes

7. MEDICAL LEAVE GIVEN
☐ Nil ☐ 1-3 days ☐ > 3 days

8. ENDOGENOUS FACTOR ☐ Present ☐ Absent

_____
Date

_____
Signature of Doctor

# CHEMICAL INJURIES – CASE STUDIES AND THEIR PREVENTION

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*SUMMARY*

*Because of the widespread use of chemicals in industry, injuries due to chemicals are commonplace occurrences. These can range from the relatively mild case of occupational dermatosis to one of acute poisoning such as gassing from hydrogen sulphide.*

*This article takes a look at these injuries from a problem-oriented standpoint, citing six case studies to illustrate the fact that most injuries due to chemicals are preventable.*

*Finally, a pro-active approach by management, workers, safety and health personnel and unions involving chemical substitution, hazard monitoring and control, hazard labelling, worker education and training and provision of personal protective equipment is recommended to tackle this problem.*

**Key words:** *chemical injuries, case studies, prevention*

## INTRODUCTION

There are literally thousands of chemicals in use in industry. Whether a particular chemical poses a health hazard depends on its physical and chemical properties, its toxicology as well as its mode of usage.

There are three main routes by which chemicals, enter the body:

1. Inhalation (e.g. respirable dusts, gases, fumes)
2. Absorption (e.g. organophosphates, tetramethyl lead, certain solvents)
3. Ingestion (e.g. pica, lead and cadmium compounds from contaminated fingers).

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Injury due to chemicals may be acute (e.g. death from cyanide poisoning) or chronic (e.g. renal impairment from cadmium poisoning). It may be local (e.g. industrial dermatitis due to contact with cement, skin cancer from exposure to arsenic, nasal septum perforation from nickel), regional (e.g. silicosis in granite quarry workers, toxic hepatitis from hepatotoxic solvents, renal impairment due to cadmium) or systemic (e.g. poisoning from organophosphates, gassing from hydrogen sulphide, carbon monoxide or organic solvents). Rarely, chemicals may cause severe allergy (e.g. Steven-Johnsons syndrome from trichloroethylene)[1].

Whatever the classification, the old adage that prevention is better than cure holds especially true for injuries due to chemicals. This article presents a number of case studies from a problem oriented standpoint and discusses the preventive aspects.

## LABELLING

The proper labelling of containers of poisonous or hazardous chemicals is provided for in the Factories Act[2]. Yet, unlabelled or improperly labelled chemical containers are to be seen in many companies locally. The following case reports serve to emphasize the importance of hazard labelling of containers of such chemicals.

### Skin burns from methylisothiazolines used in water treatment

In the early part of 1993, Mr A, a facilities technician in an electronics plant, carried an unlabelled container of a chemical used for cooling tower water treatment on his right shoulder. He did not notice any leakage or irritation at the time and subsequently returned home at the end of his shift.

Some 9 hours later, Mr A started to experience severe pain over the right shoulder region which became intolerable despite self medication with pain killers and he proceeded to the Accident and Emergency department of a nearby hospital where he was admitted.

On admission, his general condition was stable. A large 10 cm diameter (3%) mid-dermal burn was seen over the right shoulder and scapular region. He was seen by a burns specialist and daily Tulle-Gras dressing ordered and applied. He was discharged after 5 days of hospital stay and recovered fully about two months later.

Subsequent investigations showed that the container carried by Mr A contained 1.15 per cent of Kathon CG[3,4] (a biocide containing methylisothoiazolines) as the active ingredient. It was found to be leaking from a defective screw-on cap. In addition, this container was not labelled as containing corrosive or otherwise hazardous chemicals despite the fact that the Material Safety Data Sheet (MSDS) obtained from the local suppliers had listed this chimical as being a skin irritant, with the possibility of causing delayed skin burns and sensitization.

### Poisoning by perchloroethylene

Factory B blends pigments which are used in the formulation of paints and inks. Pigment blending is carried out in large 2500 l capacity drums which are then mechanically rotated. Whenever there is need to change the colour of pigments to be blended, the production technician in charge has to clean these drums by entering the tank and wipe-cleaning the inside walls with a kerosene-soaked cloth.

About 30 minutes after the commencement of cleaning of one such tank in the early part of 1995, the production technician involved was found by his colleagues lying unconscious inside. He was admitted to a nearby hospital and fortunately recovered fully after two days. The technician had mistakenly used the container labelled "thinner" instead of kerosene for cleaning (the containers were similar in appearance). This "thinner" was found later to contain over 70% by weight of perchloroethylene (tetrachloroethylene).

In the first case, the lack of labelling was probably a contributing factor in the injury. The second case, however, serves to emphasize the equally dangerous practice of improper labelling of chemical containers. Thinners are a general name for a blend of aromatic and aliphatic hydrocarbons which are of relatively low toxivity. Tetrachloroethylene, on the other hand, is a chlorinated solvent used mainly in dry cleaning which has a recommended exposure limit of 25 parts per million[5]. In addition, because of its extreme volatility, this chemical can achieve very high levels in poorly ventilated spaces and should never be used in this context without proper ventilation or the use of respirators.

## LACK OF KNOWLEDGE

It is a sad fact that many workers are unaware of the nature of the chemicals they are handling in the workplace, their potential hazards and proper precautions to be taken during normal usage and in emergency situations. The following case studies emphasize the point that ignorance is not bliss.

### Excessive absorption of cadmium used in silver brazing

Factory C is involved in the manufacture of refrigerator compressors. Copper pipes are joined together by brazing (a process using a filler at

temperatures above 430°C). The filler contained copper, zinc, silver and cadmium, and had been in use in the factory for over ten years.

In early 1993, a member of the factory's safety committee had noticed that the filler used carried a label warning of potential health hazards from its fumes. Subsequent investigations found that a total of 103 workers had excessive absorption of cadmium[6] (blood cadmium lavels exceeding the biological threshold limit value of 10 g/L[5]). In fact, a few workers were subsequently found to have impaired renal function[7] (raised urinary 2-microglobulin levels).

Although all the workers came from sections where silver brazing was carried out, most of them were production operators not directly involved in the silver brazing process itself. Environmental exposure monitoring showed that, due to poor control, all workers in the silver brazing room were exposed to high levels of cadmium fumes.

**Optic atrophy due to methanol**

Company D was involved in the manufacture of solid heating fuel used as food warmers by catering establishments. The process entailed the mixing of methanol (MeOH) with various other chemicals and leaving the mixture to solidify. Because of trade secrets, the mixing process was carried out in a room with all its windows sealed, creating a confined space. No respirators were provided for use during mixing.

An experienced Indonesian worker was brought in to start up the manufacturing process. After working for a number of days, he felt unwell and returned to Indonesia to rest. He returned and continued work subsequently, where, after about a week of continuous daily mixing, he again felt unwell with symptoms of giddiness, nausea and lethargy. On the night of admission to hospital, he was found by his colleague to be severely dyspnoeic.

At admission, his blood MeOH concentration was found to be high (138 mg/dL) and arterial blood gas analysis suggested a diagnosis of metabolic acidosis. Binocular indirect ophthalmoscopic examination also revealed bilateral swollen optic discs with optic atrophy. The patient was discharged after a few days and returned to Indonesia with a visual acuity of less than 6/60 bilaterally. In a subsequent work simulation exposure study, MeOH levels were found to exceed 4000 ppm during mixing (recommended exposure limit[5] for MeOH is 200 ppm).

MeOH can cause metabolic acidosis when ingested and there have been many reports of death from ingestion of adulterated liquor containing this chemical. Optic atrophy is also a well known sequelae of methanol intoxication[8]. What is less common is acidosis and optic atrophy due to MeOH in an occupational setting.

Worker ignorance of the nature of chemicals and their potential hazards can lead to tragic consequences. Under the Factories (Amendments) Act[9] which came into force in April 1995, among other requirements, it is mandated that occupiers of factories in which hazardous chemicals are used obtain Material Safety Data Sheets (MSDS) for these chemicals. In addition, they are to implement the relevant control measures recommended in the MSDS and ensure that all workers handling these chemicals are conversant with the contents of the MSDS.

## STANDARD PROCEDURES AND PERSONAL PROTECTIVE EQUIPMENT

Most companies have standard operating procedures (SOP) for hazardous work processes and emergency situations. However, these procedures are often forgotten, or worse still, not communicated to the target population, as illustrated in the following two cases:

**Carbon monoxide poisoning**

In early 1994, a fishing trawler docked into a local port for servicing and supplies. The captain on board the vessel had instructed two of his crew (sailors with many years experience) to pump out the waste water in the forward bilge area of the ship.

The two crewmen then entered the forward hold area (a confined space) in order to gain access to the manhole cover of the forward bilge tank. They then proceeded to pump out the waste water with a petrol driven pump. As it was raining at that

time, the crewmen decided to place the pump in the forward hold area instead of on deck. They then took a 45 minute lunch break.

After lunch, they switched off the pump and were about to wash the forward bilge tank when both of them experienced severe headache and giddiness. They managed to stagger on deck where both subsequently collapsed. They were evacuated to a hospital and fortunately recovered fully after two days.

Subsequent investigations confirmed that the two crewmen had been overcome by carbon monoxide. In addition, the ship's standard operating procedures stipulated (in accordance with requirements under the Factories Act[2]) that all petrol or diesel-driven pumps were to be used only in well ventilated areas, or, in the case of pumps used in confined spaces, that forced ventilation be provided. This oversight very nearly caused their deaths.

**Poisoning by 1,1,1-trichloroethane**

Factory E is involved in the manufacture of precision metal parts for the aerospace industry. The machined parts are cleaned in an ultrasonic degreasing process utilizing 1,1,1-trichloroethane (1,1,1-TCE). Changing of the particulate filters of the degreasing tank is part of the regular maintenance schedule.

In the early part of 1995, a worker was dismantling the housing of one of these filters located at the rear of the tank when a retaining bolt gave way, resulting in spillage of about 30 litres of 1,1,1-TCE onto the cleaning room floor. The worker involved attempted to control the spill by holding the housing in place whilst three other workers proceeded to mop up the spilled 1,1,1-TCE. None of them wore respirators or attempted to evacuate the premises at that time.

After about 30 minutes, all four workers started having giddiness and nausea. Eventually, one of the workers collapsed and was evacuated to a nearby hospital where she recovered after two days. All four workers, however, had residual symptoms of light-headedness and nausea for several days following the incident.

On investigation, it was found that the company had written procedures on chemical emergencies such as spillages, and that a trained emergency chemical response team was on standby for such eventualities. These SOP's recommended immediate evacuation, contacting the emergency response team and use of proper personal pretective equipment during spillages. However, none of the victims were conversant with the SOP nor were they aware of the existence of the emergency response team.

1,1,1-TCE is a chlorinated organic solvent used mainly in degreasing and cleaning of metal parts. Due to its volatitlity, high concentrations are easily attained in poorly ventilated areas and there have been other reports of deaths due to this solvent[10].

It is important to have standard operating procedures, especially for potentially hazardous operations or emergency situations. Needless to say, these SOP's are of no use if they are not followed or are not transmitted to the target population.

## WHAT CAN BE DONE?

A pro-active approach involving management, workers, occupational safety and health professionals and unions is needed to prevent injuries due to chemicals in the workplace.

**Role of management**

1. Health and safety should be made part of the corporate culture. This should be reflected in a policy statement.

2. All hazardous chemicals should be substituted with less hazardous ones.

3. Ensure that worker exposure to hazardous substances is kept to a minimum through engineering and other control measures.

4. Obtain MSDS for all chemicals used in the workplace and follow the recommendations stipulated therein especially those pertaining to exposure control, personal protection and emergency procedures.

5. Ensure that containers of hazardous chemicals are clearly labelled.

6. Provide suitable personal protective equipment, ensure that workers are adequately trained to use them and enforce their usage.

7. Formulate SOP's for potentially hazardous processes in the workplace and emergency situations. Ensure that all workers are thoroughly briefed on these. Regular drills may be necessary.

**Role of workers**

1. Read the MSDS provided in order to be familiar with the nature of all chemicals handled in the workplace, their potential hazards and precautions to be taken during normal usage and in an emergency.

2. Be alert to potential hazardous situations in the workplace. Bring these matters up to safety personnel, committee or management.

3. Use all personal protective equipment provided and ensure that they are properly maintained.

4. Participate actively in training and education packages run by the management. Be familiar with all SOP's and the use of personal protective equipment.

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ORIGINAL ARTICLE

# PRIMARY AND SPECIALIST CARE : COMPETITION OR CO-OPERATION?*

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## INTRODUCTION

Whether there is competition or co-operation between specialists and primary care doctors, the patient, patient care and partent welfare must always be the all important guiding principles.

In order to understand, appreciate and hopefully to resolve misunderstanding, competition or co-operation, we need to define primary and specialist care.

The World Health Organisation in 1974 had contrasted primary care and specialist care in the following definitions:

*Primary Care:* This is front line medical care, as a rule, not limited to patients in specific age groups; it is the field of medicine where the patient usually makes his first contact with the doctor and has direct access to him or her.

*Specialist Care:* This is care requiring attention of a special nature, usually more sophisticated and complicated than could be handled by the general practitioner or primary care doctor.

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Expanded further, the primary care physician's role is to provide comprehensive, continuing and primary medical care. The specialist's role is to address the problem that led to the referral, assess the patient and promptly communicate findings and recommendations to the patient and the referring primary care physician.

If these basic definitions and roles are followed, then there are no grounds or practice territory to debate and dispute. Instead there will be co-operation, no competition; better still, specialist care and primary care will be complementary. We must not forget to look at the prevailing forces affecting the practice of medicine today, taking into consideration that healthcare in developing and developed conutries has become an increasingly costly business, involving governments, insurance agencies, trade unions, professions and the people for which the care is provided. Furthermore, the primary care doctor-specialist relationship has often come under threat.

## HEALTH DELIVERY SYSTEMS

An overview of the health care system in different countries would generate understanding of the precarious, potentially sensitive and sometimes even explosive relationship between primary care doctors and their specialist counterparts.

### United States of America

In America, the growth of specialisation has been the dominant feature of medicine in the past 50 years where the health care industry is one of the largest, most adverse and fastest growing

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industries. Another feature is that most health care in this country is provided through a free choice of doctors in a fee for service basis. It is now widely acknowledged that a surplus of doctors exists in the United States together with a surplus of hospital beds and excess utilisation of hospital services. This trend towards over production of doctors who are specialists, together with overbedding in the hospital sector and incentives in various third party reimbursement systems favouring utilisation of high technology, procedure oriented use of hospitals and emergency rooms has led to a crisis of spiralling costs of health care.

The final outcome of all these is that because of an increasing surplus in many of the limited specialities, many non-primary care specialists now provide some incomplete primary care services which are outside their training or principal interest. Since the present health care system in the United States lacks any systematic structure for primary care, discontinuity and fragmentation of health care will result. [Competition] There will also be problems with the entry of managed health care.

**United Kingdom**

In the United Kingdom, the National Health Service is the backbone of the health care industry where probably about 97% of the population receive their medical care. Six percent of the population subscribe to private insurance schemes, but these tend to be for specialist and hospital care, not for primary care. Specialists are employed by the NHS and work in NHS hospitals. General practitioners or primary care doctors provide all necessary medical care, including arranging referrals to specialists. The general practitioner is the portal of entry into the medical part of the NHS and admission to hospitals, with the exception of accidents and emergencies. The only way in which specialist consultation and treatment can be obtained is by referral from the partient's general practitioner by letter. This applies to private practice as well as to public health service practice. When referral is necessary, it is assumed that the patient will be returned to the care of the GP once the specialist's contribution has been made. [No competition]

**Scandinavia**

What about the Scandinavian countries of Denmark, Norway and Sweden? In Denmark, the primary health care system has the general practitioner as its central figure. Here, through the National Health Insurance whose membership is compulsory to the population, its members receive free medical attention by general practitioners as well as free attention by specialists if referred to them by their personal GP. In Norway, it is not compulsory to have a referral from a general practitioner before the individual patient can obtain specialist attention.

It is worthwhile and interesting to study the evolution of the health care system in the Scandinavian countries. Where National Health Insurance was introduced early as in Denmark and Norway, it provided occupational and financial incentives that caused doctors to resist the pressure for specialization. Sweden was a late starter in this. In Scandinavia, there were state legislation and sickness fund finances supporting and protecting a stronger market for general practice. It was similarly noted that in countries where this type of evolution took place, with general practice as an important part of the total health services, it became more and more obvious that the more specialization accelerated, the more important general practice became. As a result of this, both governments and medical associations tried to protect general practice from bitter boundary disputes between physicians. In Denmark, there was even regulation preventing hospitals from providing outpatient care, and preventing part-time hospital specialists and full time practising specialists from competing with general practitioners in the primary care market.

**Australia**

In Australia, the health care system is still dominated by the temples of technology and specialisation - the large public hospitals. There was a surplus of specialists and in some disciplines, more were being trained than the community could possibly absorb. Today this surplus of specialists has reversed when we refer to the graph of specialist-doctor population in Australia.

### Japan

In Japan, the health care system has a history of more than one thousand years, and its evolution has been witnessed by Chinese, German, Dutch and after World War II, American medicine. One of the most important points to consider in comprehending the Japanese health care system is the role played by private practitioners. The private practitioner in Japan is not a general practitioner. A large number of these private practitioners in Japan have spent 5 years or more in a university after graduation in order to get the higher degree of doctor of medical science, i.e. they are specialists. Thus, in Japan, the doctors in private practice, the private practitioners who have postgraduate speciality training are expected to assume the role of family primary care physicians and some of them really regard themselves as such. There is no definite structure for primary care medicine in Japan.

### Singapore

In Singapore, there is no National Health Service like that of the UK Primary health care in Singapore is provided by both the government and the private sectors. The organisation of primary health care in the public sector is under the Primary Health Care Division of the Ministry of Health, providing primary medical care through the many polyclinics situated in almost all the major housing estates. The private general practitioners form an important component of the primary care system as they manage two thirds or more of the total outpatient consultations. Then, there are the specialists in government and restructured hospitals, National University Hospital and private specialists with consulting suites at medical centres of the various private hospitals. The public is free to choose and be treated at government polyclinics or private general practitioner clinics. Also, they can go directly to see any specialist in private practice. However, the specialists in government and restructured hospitals and the National University Hospitals see patients by referral system.

## COMPETITION OR CO-OPERATION

Competition or co-operation between primary care doctors and specialists depends on several factors:

1. The number of specialists trained within the doctor population
2. The organisation of the health care system
3. The patient
4. The specialist
5. The primary care doctor.

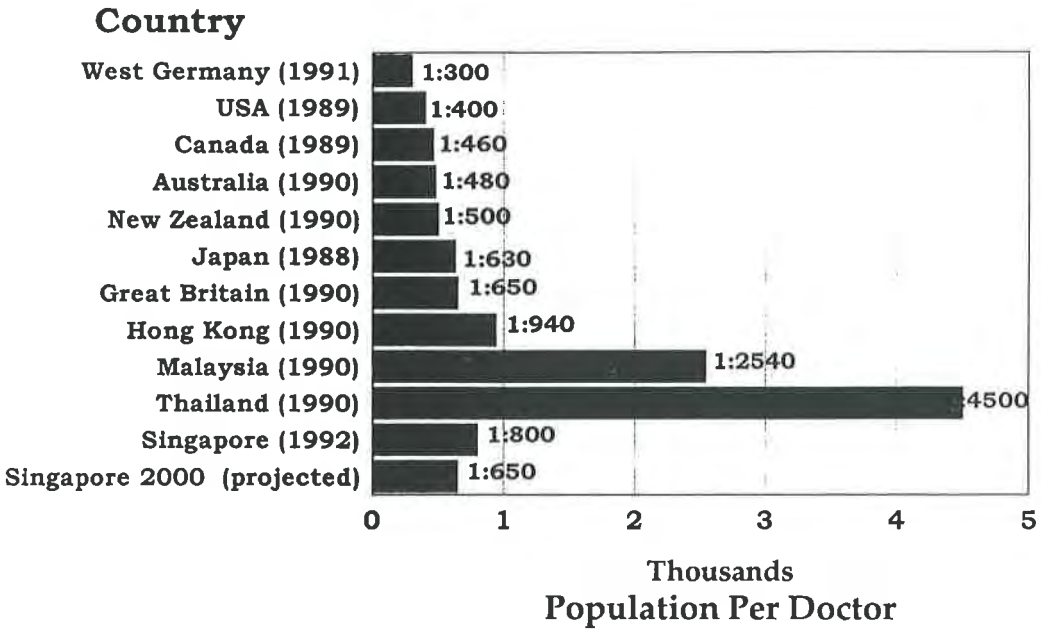
### The Doctor Population

Governments all over the world, whether in developing or developed countries, will always ensure an adequate supply of medical manpower and facilities to meet the health care needs of their people. At the same time they also realise that there is no magic formula to determine the optimal number of doctors in their countries (refer Fig1 - 3). Note that Germany stands out with the best doctor population ratio, specialist population ratio and also the specialist doctor population ratio. Next comes the United States, followed by Canada, Australia and the United Kingdom. It does not follow that having the best doctor population and specialist population ratios, your health care system is free of problems.

Now what do all these figures show, and what is the status of medical practice in these countries? In each case, increasing specialisation over the past 20 to 30 years has resulted in a steady decline in the number of primary care doctors. This has resulted in a tangle of related problems, viz. limited access to care, increasing fragmentation of care, depersonalisation of care, deemphasis of comprehensive care – all pointing to competition between primary care doctors and specialists. Also speciality and geographic maldistribution of doctors have resulted from overproduction of specialists.

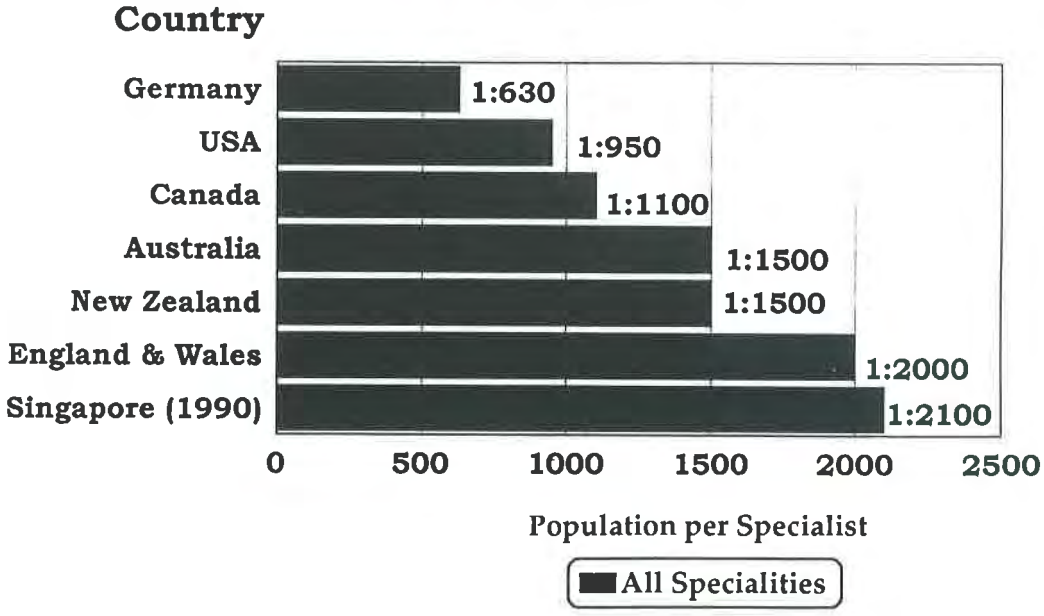
It is also interesting to note that the pendulum of specialty maldistribution has swung to different degrees. Take Australia. There the population of general practitioners to total physicians in private practice has never dropped to below 50% in 1976, reached 54% in the eighties and today the figure is 65% GPs to 35% specialists. In the United States, the proportion dropped from 80% in 1930, to less than 20% in the seventies, and today the figure is 50%. In Singapore, as she developed in every field, specialists also increased in number till today's figures of 40% specialists to 60% GPs.

## Fig 1. Population Per Doctor In Different Countries



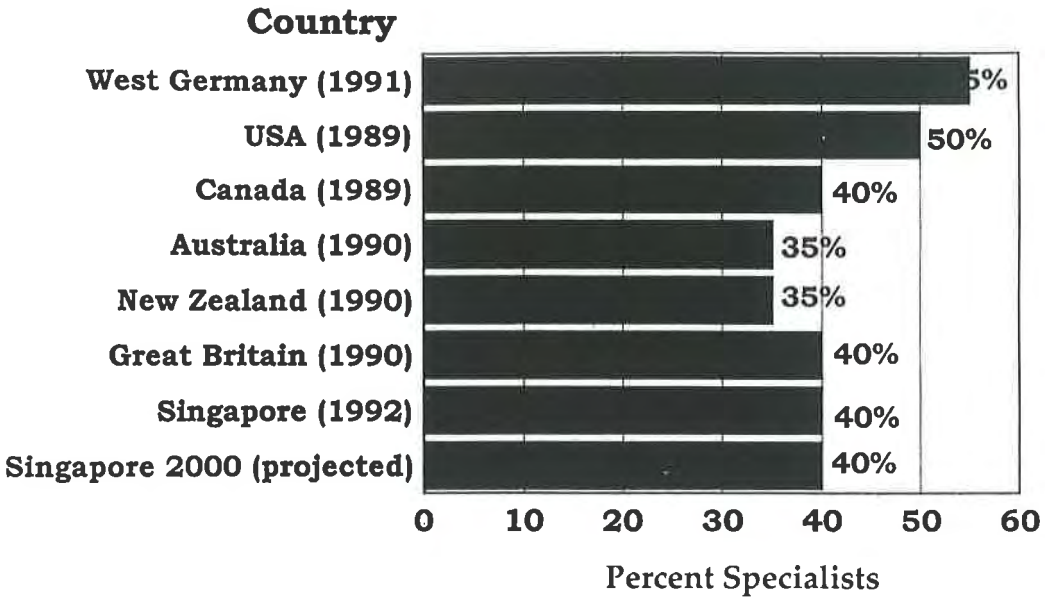

*Source: White Paper on Affordable Health Care, Singapore, October 1993*

## Fig 2. An International Comparison Of Specialist Manpower (circa 1990)




*Source: Research and Evaluation Department, Ministry of Health, Singapore*

## Fig 3. Percentage Of Doctors Who Are Specialists




*Source: White Paper on Affordable Health Care, Singapore, October 1993*

Studies have shown that those countries with high proportions of GPs or primary care doctors, e.g. UK, Canada, Australia, have clear-cut divisions of responsibilities among specialists and primary care doctors exemplified most clearly by the firmly established gatekeeper role of the GP in the UK [no competition] whereas counties with comparatively low proportion of primary care doctors, e.g. USA, Japan and Germany, have diluted and fragmented responsibilities among specialists and primary care doctors [competition]. This is illustrated by the so-called hidden system of primary care (actually a non-system) in the US where non-primary care specialists, e.g. surgeons, may provide limited primary care services for which they are often poorly prepared and little interested. It is interesting to note at this point President Clinton's health system reform bill. If it had been passed, a national council on graduate medical education would be created. This would limit the number of specialists, allocate specialists and primary care residencies among qualified institutions, and steer federal aid accordingly. The goal was to nearly triple the percentage of graduates going into primary care by the academic year 1998 - 1999.

In Singapore, the number of specialists at various government and restructured hospitals are limited because the Ministry of Health has defined the number of specialists and subspecialists needed in each discipline. There are 825 specialists working in the public sector where 205 specialists are at government hospitals and 620 specialists are in government restructured hospitals, and at the National University Hospital are 167 specialists. But in the private sector, there is no control (see Table 1) - it is a free market place dictated by the popular phrase "let market forces come into play". In the private sector, there are 713 specialists with consulting suites at private hospitals (Mount Elizabeth, Gleneagles, East Shore) and other medical centres. These specialists in private practice not only compete with one another, they also see cases direct off the streets, without any referral, and some even attend to primary care medical cases. It is thus very clear that over production of specialists will force them to

encroach onto the GP's terrain.

**Table 1. Statistics on Specialists in Singapore**

| |
|---|
| **713 specialists in private sector** |
| **- private hospitals** |
| **- medical centres** |
| **825 specialists in public sector** |
| **- 205 government hospitals** |
| **- 620 government restructured hospitals** |
| **- administration** |
| **- primary health department** |
| **- industrial occupational health** |
| **167 specialists in University Hospital** |
| **55 specialists not working** |

*Source: Evaluation and Planning Department, Ministry of Health, January 1995*

**The Organisation of the Health Care System**

A national health care system is one of the characteristics of that nation. The manner in which it has been created and evolved greatly depend on historical, political, cultural, philosophic, economic, religious, grographic and medical health factors. In some countries, there may also be a non-system, with no recognisable, organised and well-defined statutory system. Both systems in their own ways, can affect the relationship between primary care doctors and specialists. A non-system situation may fit exactly into the free-enterprise philosophies of a country, creating confusion and problems in the practice of medicine. Then, there is also a considerable variation in health care structures, ranging from the full gatekeeper role in the UK to the largely unstructured system in Japan.

Next, the role of general practitioners in hospital practice in any country will also affect the relationship between primary care doctors and specialists. In UK and the Scandinavian countries, GPs play no significant role in hospital practice. This is in sharp contrast to primary care doctors in the US, Canada and Australia where substantial hospital care is part of their everyday practice. Take Australia. Although GPs have been gradually excluded from public hospitals, in the private hospital system the situation is quite different. Many GPs have patients in these hospitals, with care being provided by them alone [Competition], or in association with a specialist [Co-operation]. Also, in Australia, 40% of GPs practise obstetrics [Competition]. Their good perinatal and maternal mortality rates have led to a re-appraisal of the role of GPs in obstetrics. There is now a joint diploma of the Royal College of Obstetricians and Gynaecologists and the Royal College of General Practitioners being offered for GP obstetricians [Recognition and Co-operation, and CME and further education]. Another area of competition is in anaesthesia where about one third of GPs administer anaesthesia, and a similar proportion perform elective and emergency surgery.

In Singapore, GPs are excluded from public hospitals, but private hospitals allow accredited GPs to admit and treat patients. Lately, these hospitals have been encouraging joint management with a specialist [Co-operation]. Also, in Singapore, very few GPs now deliver babies in private hospitals. The many maternity homes where GPs used to deliver babies have practically all been closed down. I do not know of any GPs administering anaesthesia in private hospitals.

In the health care system of any country, the areas of practice must be clearly defined because the absence of such definition will encourage competition. This definition will be reinforced if there is a specialist register listing doctors in the field of medicine for which they had undergone post-graduate advanced specialty training, after obtaining their post-graduate degree. When, and if, primary care medicine is recognised as a speciality, then competition will not be so blatant and widespread, as specialists usually try not to encroach into another area of speciality for which they had not undergone further training in.

In the United States, both the terms "primary care" and "generalist" are used in defining primary care physicians. However, these terms also characterize a group of disciplines, a set of skills, and a range of services. The recognized primary care specialities in the United States are family medicine

/ general practice, general internal medicine and general paediatrics. Non-primary care specialists (referred to simply as specialists) comprise a large portion of the physician workforce and their numbers have increased progressively during the past four decades. Specialists can be segregated into six major function groups: (1) the subspecialities of internal medicine; (2) a broad group of "medicine" specialities; (3) obstetrics and gynaecology; (4) surgery of all types; (5) the hospital based triad of radiology, anaesthesiology and pathology; (6) psychiatry.

This separation of primary care and speciality medicine is, to a large extent, an independent variable. There is overlap in ability and a grey zone of definition, but there is a distinction between a primary care need that is historical and can be quantitated on a per capita basis, and a speciality care need that has evolved relatively recently and is determined principally by what science and technology make possible. It is significant to note that in the United States, many subspeciality internists, other "medical" specialists and obstetrician-gynaecologists devote a part of their effort to fulfilling the primary care needs of their speciality patients and some even serve as general physicians for other patients as well. [Competition]

In Singapore, as family / primary care medicine is not a specialty in the specialist register, there will be continuing problems. However, Singapore is making progress towards recognising Family Medicine as a speciality. Firstly, the School of Postgraduate Medicine is now awarding the further degree of Master of Medicine (Family Medicine). There is also now an advanced speciality training programme in Family Medicine under the auspices of the College of Family Physicians. This brings Family Medicine in line with the other specialities in terms of a postgraduate degree and advanced speciality training.

**Patient Factor**

When a member of the public goes and seeks treatment from a specialist on his own freewill, that is not competition. On the other hand, if while he is under the care of the referred specialist, the specialist continues to treat the referred patient for a primary care condition, then there is competition.

There is also a third scenario, where the patient after being cured by the referred specialist requests the specialist to look after his other primary care ailments, then it is no fault of the specialist initially. Thus patient education in these areas is important.

**Primary Care Doctor-Specialist Relationship**

Finally, the general practitioner-specialist relationship factor, in my view, is most important. Competition or co-operation between them will depend on:

1. General practitioners having trusting relationships with their specialist colleagues, relationships that are marked by mutual respect for each other's skills and abilities.

2. Formed, informed and successful communication.

3. A more thorough understanding of doctor referral patterns which can help to explain how competitive forces function in any particular market.

4. Better understanding of physician characteristics and credentials.

5. Ethical issues arising out of relationships between GPs and specialists. In this area, there seems to be both direct problems between the doctors themselves and indirect problems as a result of patients expressing concern about the specialist chosen by their GP. Also, an ethical issue arises when the specialist continues to see the patient for what appears longer than necessary by not referring back to the GP when the reason for the initial referral has been dealt with.

6. Complementary relationships between GPs and specialists should be encouraged. Such a relationship has synergistic effects to the benefit of their common patient, especially those suffering from chronic illnesses. Here, depending on the stage of the illness, and presence or absence of complications, the patient can be under different levels of care. Another area is the field of shared obstetric care.

## SOLUTIONS

Here, manpower planning appears to be the answer, but there are problems. In the September 1994 issue of The Journal of American Medical Association an article "seeking a balanced physician workforce for the 21st century" has revealing figures, like in the United States, less than 30% of practitioners are primary care doctors who also comprise less than 50% of the physician workforce in Europe. To rectify this disproportion, the American Medical Association, the Council on Graduate Medical Education and the Association of American Medical Colleges are now working towards a better balanced ratio. But the problems facing them are:

1. Because the science and technology underlying speciality medicine are so unpredictable, it is difficult to estimate the appropriate size of the speciality workforce over time or to relate it to any one standard or proportional characteristic.

2. Medical schools have only limited influence on students career choices. Medical students also give weight to other factors such as intellectual challenge, financial rewards and society's perception of value. No matter what career choices students make today, there will be a near term surplus of specialists as the turn-of-the-century bulge continues to evolve in the United States.

The author of this article concludes that achieving a balanced workforce in the future will require a balancing of governmental intervention with initiatives undertaken by the medical professions, a balancing of regulation with the dynamic forces of the market and a balancing of near-term objectives with long-term goals.

In this respect, the Singapore government has, in its Affordable Health Care White Paper of October 1993, the policy that the government must continue to control the number of doctors trained and the type of training they receive. The Ministry of Health will regulate the number and type of specialists to be trained, and the development of specialist departments and subspecialists in government and restructured hospitals.

Another solution is to define the areas of practice and roles of GPs and specialists. In Singapore, we hope that the implementing of the specialist register in 1995 will lead to recognition of Family Medicine as a speciality in the future. A well structured referral system like the one in UK will also regulate and stabilise the relationship.

## CONCLUSION

1. Aside from what has been written, whether co-operation or competition exists, primary care doctors and specialists should work towards playing complementary roles for their patients' benefit, welfare and well-being.

2. For a stable relationship, there must be a well structured health care system like in the United Kingdom where the GP has a definite gatekeeper's role.

3. General practitioner-specialist relationship problems would be minimised if there was mutual trust and respect for each other's skills and abilities. Mutual respect underlies successful communication, and communication in referral or the lack of it reflects the lines of responsibility that are assumed by the referring GP, patient and specialist.

   In situations where all parties respect each other's area of competence, then responsibility is shared, and communication can be expected to be free of problems.

   Further, as the boundaries of general medicine shrink, it will be more and more necessary for referring GPs to make their patients and specialists aware that they wish to be actively involved in their referrals.

4. It is important for primary care doctors to improve their skills and abilities to establish both patient and specialist respect. The patient must be convinced that his primary care doctor has adequate knowlege and skill to treat him, and specialists must feel comfortable and confident that they can send referred patients back to their general practitioners for continuing care. Hence the importance of

continuing medical education.

5. On the patient factor, there must be patient education on seeking unnecessary medical treatment and identifying appropriate and correct medical consultations.

6. Then, there is difficult but necessary control of doctor population, specialist population and specialist-doctor ratios. This lies heavily in governmental regulations with co-operation from academic institutions and the medical profession.

7. Finally, specialists on their part should also undergo training in Family Medicine like in the United States, if they want to practise primary care medicine.

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ORIGINAL ARTICLE

# NOISE INDUCED DEAFNESS – THE NUMBER ONE OCCUPATIONAL DISEASE IN SINGAPORE

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***SUMMARY***

*Prolonged exposure to excessive noise has long been known as a cause of deafness. Noise-induced deafness (NID) is the leading occupational disease in Singapore today. In 1994, 754 new cases of NID were confirmed by the Department of Industrial Health of the Ministry of Labour. Of these, 46 had severe, disabling deafness which is compensable under the law. In this country, NID is a notifiable disease and workers exposed to excessive noise have to undergo statutory medical examinations.*

*This article reviews various aspects of NID, including its pathophysiology, epidemiology, legal facets and prevention strategies, together with a discussion on the various components of a Hearing Conservation Programme (HCP).*

***Key Words :***
*NID, occupational disease, pathophysiology, epidemiology, prevention, Hearing Conservation Programme*

## WHAT IS NOISE-INDUCED DEAFNESS?

That deafness can be caused by exposure to excessive noise has been known for many years. In fact, as early as the eighteenth century, Bernadino Ramazzini, the father of Occupational medicine cites milling and coppersmithing as occupational causes of deafness[1].

Short-term, single exposures to very loud noise of above 130 dB (e.g. gun shot, burst of machine gun fire, cannon fire, explosion), have been reported to cause deafness and tinnitus[2,3] through cochlear, tympanic or ossicular damage.

Noise-induced deafness (NID), on the other hand, is caused by prolonged exposure to noise of lower intensities (e.g. between 85 to 120 dB) leading mainly to damage of the outer hair cells of the organ of corti[4,5]. Occupational hearing loss involves temporary threshold shift (TTS) and permanent threshold shift (PTS). TTS has been postulated to be caused by changes in the size and shape as well as conduction failure in hair cells[6,7] and has been reported to last from 24 hours to 6 days[8,9]. PTS takes a longer time to develop. For example, it was reported that occupational exposure to a noise level of between 85 to 90 dB(A) over 40 years presented a 35 and 51% risk, respectively, of sustaining a hearing loss of 30 dB(A)[10].

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## CASE STUDY

The following case study typifies NID cases seen in Singapore:

At the age of 19, Mr ARA joined a local shipyard as an apprentice steel worker. It was not until the 1980's that he was issued ear plugs to protect him against noise from the cutting, grinding and hammering of steel plates. In 1990, at the age of 46, Mr ARA started experiencing tinnitus which was described as usually one-sided and more obvious at night. At the same time, his wife and children also noticed that they had to repeat words or raise their voices when conversing with him. They also complained that Mr ARA was turning up the volume of the television and radio.

An audiometric examination performed in 1991 showed that Mr ARA had severe sensori-neural hearing loss bilaterally with a characteristic dip at 4 and 6 kHz. His company doctor then notified him to the Ministry of Labour as a suspected case of NID.

In the course of investigations conducted by the Department of Industrial Health (DIH), Mr ARA was found to be exposed to a time-weighted average noise exposure level of 95 dB(A) (full-shift personal dosimetry) during a typical work-day and that the average hearing threshold over 1,2 and 3 kHz in his better ear was 60 dB(A), indicating that he had a disability. He was referred to the Workmen's Compensation Department and subsequently received over $15,000 in Workmen's Compensation.

## DIAGNOSIS OF NID

### History

A diagnosis of NID cannot be made without a definite history of noise exposure. One should not concentrate only on the worker's present job exposures but should also take some time to elicit exposure patterns in his previous jobs. In a recent study of cases (unpublished data) of NID seen in the DIH, it was found that workers with occupations such as grit blasters, boiler makers, steel workers, shipyard electrical fitters, panel beaters and carpenters (Table 1) are exposed to average noise levels exceeding 90 dB(A). The duration of noise exposure is equally important, as NID takes a number of years to develop.

**Table 1. Job-types with Noise Exposure Levels >90 dB(A).**

| JOB-TYPE | Lav*/dBA |
|---|---|
| Grit Blaster (shipyard) | 100 |
| Boiler Maker (includes other pressure vessels) | 96 |
| Steel Worker (shipyard) | 95 |
| Grinder (spice) | 95 |
| Grinder (metal cylinders) | 94 |
| Panel Beater | 93 |
| Fitter (shipyard) | 93 |
| Operator (weaving machine) | 93 |
| Operator (stamping and other machines) | 92 |
| Carpenter | 91 |
| Forklift Driver (metal industry) | 91 |

* *indicates times-weighted average values (full-shift personal dosimetry)*

A past medical history of ear discharge, hearing loss, tinnitus or vertigo[11,12], head trauma, severe viral infection or treatment with ototoxic drugs (e.g. streptomycin) is important. Where the social history is concerned, part-time musicians and band-members are at greater risk of developing NID, so are workers with frequent exposures to noise in a disco or personal stereo systems[10]. Barotrauma developing in SCUBA divers is not uncommon and it has also been reported that smoking increases the risk of developing NID[13].

### Audiometric results

Hearing loss in NID is sensori-neural. The initial frequencies that are affected are those from 3 to 6 kHz[14,15] and the "4 kHz dip" has traditionally been viewed as almost pathognomonic of NID[16]. As human beings are most sensitive to the "speech frequencies" of between 500 to 3000 Hz, most people with early NID are asymptomatic and are identified only on audiometric examination. Hearing loss at 4kHz is rapid in the first 10 to 15 years of exposure and is largely unchanged thereafter. At 2 kHz, however, the most rapid change in hearing threshold occurs after 20 to 40

years of exposure[17], by which time, a disability usually develops and the patient may have complaints of difficulty with conversation especially in the presence of background noise.

When performing audiometric examinations for noise exposed workers, it is imperative to take TTS into account. Some authors have reported that hearing thresholds obtained in industry are usually 5 to 15 dB worse than those obtained in clinical situations[18,19]. In fact, a recent local study[20] found that 83% of workers surveyed were tested during work with little intervening non-noise exposure time. This may have contributed to the statistically significant differences found in the audiometric results between industry-based centres and the clinic-based test centre.

In Singapore, NID is classified as early NID or severe NID. Table 2 lists the criteria used by the Department of Industrial Health (DIH) of the Ministry of Labour in the diagnosis and classification of NID.

**Table 2. Diagnostic Criteria for NID**

| CATEGORY | Early NID | Severe NID |
|---|---|---|
| Sensori-neural hearing loss at | 4 and/or 6 kHz | 4 and/or 6 kHz |
| Duration of exposure | ≥5 years | ≥10 years |
| Average hearing threshold at 1,2 & 3 kHz | < 50 dBA | ≥50 dBA |

*Note: Other causes of hearing loss should be excluded.*

## LEGAL ASPECTS

NID is a notifiable disease under the Factories Act[21]. This Act also requires factory occupiers to provide suitable hearing protective devices to all workers exposed to excessive noise and, wherever practicable, to reduce noise by engineering means. The workers themselves are not exempt and are required to wear the hearing protectors provided under Section 80 of this Act.

In addition, all noise-exposed workers are required to undergo statutory medical examinations as required under the Factories (Medical Examinations) Regulations[22]. These include pre-employment and annual audiometric examinations.

Finally, workers with severe, disabling NID are eligible to claim compensation under the Workmen's Compensation Act[23]. The amount of compensation paid is a function of the worker's last drawn salary, his age (correction for presbyacusis), exposure duration and his duration of employment at the particular workplace at the time of diagnosis of severe NID.

## EPIDEMIOLOGY

NID has been and is the leading notifiable occupational disease in Singapore (Table 3). In 1994, 754 new cases of NID were identified. Of these, 46 were diagnosed as severe NID and referred to the Workmen's Compensation Department of the Labour Ministry.

**Table 3. Confirmed Occupational Diseases in Singapore, 1991 - 1994***

| Occupational Disease | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Noise Induced Deafness | 693 | 842 | 655 | 560 | 754 |
| Industrial Dermatitis | 154 | 173 | 164 | 168 | 161 |
| Poisonings/ Excessive Absorption of Chemicals | 48 | 22 | 40 | 124 | 40 |
| Gassing | 23 | 4 | 9 | 16 | 17 |
| Silicosis | 7 | 8 | 4 | 9 | 9 |
| Occupational Asthma | 11 | 5 | 7 | 6 | 3 |
| Asbestosis | 0 | 2 | 3 | 2 | 2 |
| Miscellaneous | 4 | 14 | 15 | 15 | 13 |
| Total | 940 | 1040 | 897 | 900 | 999 |

* *Department of Industrial Health Annual Reports 1990 - 1994.*

As can be seen from Table 4, the shipbuilding, shiprepair and metal working industry accounted

for almost 70% of new NID cases in 1994. It is not surprising to find, therefore, that the jobs with the highest noise exposures are from this industry (Table 1).

**Table 4. NID Cases by Industry - 1994**

| INDUSTRY | CASES | % |
|---|---|---|
| Shipbuilding, Shiprepair and Metal Working | 523 | 69.4 |
| Electronics, Water and Gas | 45 | 6.0 |
| Wood and Furniture Manufacture | 44 | 5.8 |
| Manufacture of Chemical Products | 33 | 4.4 |
| Manufacture of Food, Beverages and Tobacco | 27 | 3.6 |
| Transport, Storage and Supporting Service | 22 | 2.9 |
| Printing, Publishing and Paper Products | 17 | 2.3 |
| Others | 43 | 5.6 |
| Total | 7541 | 100.0 |

* *Department of Industrial Health Annual Report 1994.*

NID is also a major problem in other countries. In Great Britain, for example, the Health and Safety Executive (HSE) has estimated that 1.7 million Britons are deaf as a result of occupational noise exposure[10].

## PREVENTION

Detection of new cases of NID only forms part of the secondary prevention strategy, and as NID is incurable, tertiary prevention is limited to helping the worker with severe NID by providing him with a hearing aid or in coping with his handicap. Primary prevention, therefore, is the goal in NID.

A comprehensive in-plant, self-regulatory programme can be implemented to prevent NID in the workplace - the hearing conservation programme (HCP). In the USA, for example, implementation of a HCP in workplaces where noise levels exceed 85 dB(A) is mandated under Federal Legislation[24]. In Singapore, the essential components of a HCP (e.g. noise control, provision of hearing protectors and medical examinations) are required by law. Currently, HCP's have been implemented in more than 800 establishments employing over 50,000 noise exposed workers.

The main components of an effective HCP are listed below[25-27]:

1. Management support, allocation of resources and designation of a person (preferably of managerial grade) to coordinate and run the programme;

2. Environmental monitoring. A proper noise survey includes comprehensive noise mapping of the entire production area in order to identify noise areas and workers at risk;

3. Noise control. This includes :

   a. a "Buy Quiet" policy i.e. a policy of preferential purchase of "quiet" equipment [noise levels of which should not exceed 85 dB(A)],

   b. control of noise from existing machines and processes by engineering control measures such as substitution, isolation, enclosure, damping, regular maintenance of equipment, and

   c. administrative control measures such as worker segregation, minimisation of exposure duration by shift rotation, etc.

4. Provision and fitting of hearing protectors and enforcement of usage;

5. Audiometric testing of all noise-exposed workers. It is essential that TTS is taken into account during audiometry (e.g. testing a

worker only after 16 or more hours of noise-free exposure). In addition, audiometric examinations should be conducted by trained individuals and in a proper test environment (e.g. audiometric booth);

6. Worker education, training and motivation. This includes educating workers on the effects of noise, selection, fitting and proper usage technique of hearing protectors. Some companies give workers a small cash incentive in order to motivate workers to use the personal protective equipment provided;

7. Proper record keeping, and finally,

8. Programme evaluation. This includes monitoring of noise levels which should show a decreasing trend, evaluation of audiometric examination results (computer databases are useful in this context), worker attitudes (e.g. hearing protector usage), etc.

## CONCLUSION

NID is the leading occupational disease in Singapore and severe NID is a disabling disease. At the time when people look forward to retirement after many years of toil, workers with severe NID have to learn to cope with an illness that reduces their quality of life.

As our country develops, more and more effort should be directed towards keeping the workplace safe, healthy and free of hazards. The "traditional" occupational diseases such as heavy metal poisoning, silicosis or asbestosis are things of the past in Singapore. Only with increased awareness amongst physicians, factory management, safety and health personnel, workers and unions can we hope to begin to write the final chapter in the book of NID.

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# DARE TO DREAM

I am indeed honoured to have been invited to deliver the 15th Screenivasan Oration. Dr B R Screenivasan was an eminent Physician, Scholar and Administrator. When he retired as Vice-Chancellor of the University of Singapore, he resumed his career as a family physician.

As the first President of the College of General Practitioners he under-pinned the importance of Family Medicine even thought it was fashionable to specialize. The daunting task was to educate the patients as to when to consult a family doctor and when he should be referred to a specialist. Specialization was inevitable and indeed necessary with the deluge of advanced medical knowledge. However, patients still needed a good family physician who still is the best doctor of first contact and who provides a personalized, integrated and continuing medical service.

I chose "DARE TO DREAM" as the topic of the Oration because of an article in the Straits Times published on 18th January 1995. The heading, *"Dream big and dare to fail - 89 year old climber"*. Mr Norman Vaughan took 65 years, $2.5 million, one failed attempt and 9 days of climbing to reach the peak named after him in the Antarctic.

On 16 December 1994, he travelled miles through snow with dogsleds. He climbed the 3,140 metre mountain, 385 km from the South Pole and fulfilled his big dream. He failed once but succeeded after a lapse of 65 years!

To achieve greater heights in our medical field we too have our mountains to climb. We need to work hard towards achieving our goals however tough the going may be. If we fail, we try again until we succeed. On the contrary, we should not indulge in day dreaming whereby there is total inertia.

Permit me to dare our doctors to dream in several pertinent medical issues facing our medical profession. Due to time constraint, let me confine myself to five "DARES".

**To DARE our doctors to actively participate in voluntary Continuing Medical Education Programme in spite of our busy schedule.**

One could practise medicine the same way as our pioneer doctors did after World War II and could be quite adequate and contented. Nevertheless, as our patients' level of education increases, a high standard of health care is expected of their family doctors. Continuing Medical Education (CME) Programme was first launched in 1989 on the recommendation of the Singapore Medical Council. In July 1993 the Academy of Medicine (AM) and the College of Family Physicians (CFPS) automatically registered their members in the programme.

The 1993 data showed the number of practitioners registered as follows:

| | |
|---|---|
| Members of the Academy of Medicine | 994 |
| Members of the College of Family Physicians | 700 |
| Others | 332 |
| Total Registered | 2,026 |
| Total practising doctors in Singapore | 4,146 |

**(Total Registered = 49% of all practitioners)**

*Delivered by Lee Suan Yew*
*on 26 May 1995*
*at 5th Scientific Conference,*
*College of Family Physicians Singapore*

It is encumbent on us to keep abreast with recent advances in medicine however busy we are. If we are unable to attend lectures, seminars or workshops, there are video-tapes, audio-tapes and journals to update our knowledge. With the advent of Internet even our patients can gain access to the latest advances in medicine from many countries. Internet and teleconferencing will be more commonly used by doctors and hence, the dissemination of new knowledge will be worldwide. The whole scenario on transfer of medical information using "electronic skyways" will make it easier for the younger doctors who are computer intelligent. Those of us who are older may have to learn computer technology or gain information through conventional methods.

The College and the Academy are well placed to challenge our doctors to participate in our CME programmes.

However, a review of a study on the effect on CME intervention on physician performances and health care outcomes may be useful. In the US an objective study was done by a group of doctors:- Davis, Thomson, Oxmen and Haynes. They coordinated with many centres to gather "Evidence for the effectiveness of CME". They concluded that:

*1) PREDISPOSING CME INTERVENTIONS* i.e. communicating or disseminating information through lectures, week-end symposia, reading journals and communicating with colleagues did not change doctors' performance. It was not effective alone. The findings were somewhat negative.

**BUT**

*2) ENABLING FACTORS* were more effective. Enabling factors help to facilitate a desired change in the practice site. Setting up "hotlines" would provide the physician the necessary help in the process of change. The physician defines his objective in simple and measurable terms. For example,

(a) to increase the screening of diabetic patients for retinopathy, or

(b) to convey to every diabetic patient the importance of weight and dietary control.

Physicians improved their outcomes if they attended lectures given by "Opinion Leaders" or "Eminent doctors" because they found that the new information given by such persons was reliable.

*3) REINFORCING FACTORS* were also helpful in permanently changing physician performances. Examples are reminders or feedback.

Both enabling and reinforcing factors consistently improved physician performance and improved patient or health care outcomes. Doctors who wanted to improve their performance through formal CME should select courses that begin with a needs assessment, provide performance rehearsal and facilitate practice change in the clinician's practice setting. Hence, effective CME courses must be more individualized to be effective.

**To DARE more of our younger doctors to sit for the Master of Medicine (Family Medicine) Examination.**

The College has played a key role in conducting the Member of the College of General Practitioners (MCGP) DIplomate course and examination. With the introduction of the M Med (Family Medicine) in 1993, the standard of family medicine will improve even further. With the two--year structured rotation postings in hospital and one-year posting in the Polyclinics, medical officer trainees receive a well rounded exposure to a wide spectrum of medical conditions. Since the course is so popular, perhaps more vacancies could be made available to them in other restructured hospitals in Singapore. In time, there will be more post-graduates with the M Med (FM) degree. There are 19 presently.

In ten to fifteen years when there will be more such post-graduates, the NUS would be tempted to open a full Department of Family Medicine. Meanwhile, the NUS would be in a position to increase the staff in the Division of Family Medicine commensurate with the expansion of Primary Health programme in the curriculum.

In the foreseeable future, more research will be conducted by the Division jointly with the College and the Ministry of Health. One example is the use of Hormone Replacement Therapy (HRT) in menopausal Asian women. What are their benefits and drawbacks? We should not rely on Western studies alone. There are many studies that can be made to benefit our citizens.

It is quite apparent that as more of the physicians specialize and sub-specialize, there is a void in the body of physicians. This is worrying because there is a need for good General Physicians.

This void can be filled by the post-graduate of the M Med (Family Medicine). This may well be a "Paradigm Shift" as it were. There is a need to change our mind-set. All our young graduates are better trained and are capable of taking on a wider responsibility as General Physicians. As education advances so does productivity and quality of health care. The time has come to widen the scope of the Family Physician.

**To DARE our doctors to understand the impact of Traditional Medicine in Singapore.**

Traditional Medicine in Singapore probably existed long before the founding of the King Edward VII College of Medicine in 1925.

According to a book on Principles and Practice of Contemporary Acupuncture, Traditional Chinese Medicine (TCM) was brought to Korea in 541 AD It was probably the beginning of the spread of acupuncture in the Far East. A Chinese physician brought acupuncture books and charts to Japan in 562 AD In the early 7th Century, Japanese scholars studied medicine in China. In 1362 AD an acupuncture school was established in Japan. Acupuncture went to Southeast Asia along with the trade and the emigration of the Chinese.

Chinese herbal medicine dates back to the earliest periods of Chinese history, and over a span of time many pharmacopoeias were written and revised. The oldest is the "Pen Ts'ao Ching", in which the *"Red Emperor", Shen-ung* described various medicaments and included instructions for their use. The *"Yellow Emperor", Huang Ti* reigned from about 2697 to 2595 BC. He was said to have composed *"The Yellow Emperor's Book of Internal Medicine"*.

An American cardiologist, Dr E Grey Dimond visited China and was quoted to have said, *"We in the West had to learn to use primitive herbs in digitalis, in ephedrine, and the rauwolfa tranquillizers; there must be lot of pharmacology the Chinese can teach us too."*

In Singapore, Traditional Medicine is allowed to practise independently without regard to training and licensing of herbal medicines or practitioners. There are over a thousand herbal shops in Singapore. There is a large market for Chinese Medical products. Many Singaporeans use herbal medicine, acupuncture, bone-setters, reflexology, Indian Ayurveda (in Sanskrit it means knowledge of health and long life) and Bomohs. Different co-existing medical systems are practised in Singapore.

Many Singaporeans use such alternative medicine. Eastern trained doctors naturally take a critical view of such traditional practices with no scientific basis. It is unlikely that the two systems will integrate as in the case in China.

Several countries are beginning to re-look at traditional medicine as an adjunct treatment. Our Government will be setting up an acupuncture research programme in the Ang Mo Kio Community Hospital but its involvement in other aspects of Tradition Chinese Medicine will be limited for the time being. The Ministry for Health, Information and the Arts, BG George Yeo informed Parliament on 20 March 1995 that acupuncture experts from China and the World Health Organization will be asked to help define research areas and identify the conditions under which this treatment will be clearly useful. He was cautious about other aspects of TCM since there are no regulations in the practice of herbal medicine. He encouraged TCM practitioners to self-regulate the profession before any legislation can be contemplated in the future.

In the British Medical Journal of 22 April 1995, Peter De Smet, Clinical Pharmacologist of the

Royal Dutch Association for the Advancement of Pharmacy posed the same question, *"Should herbal medicine-like products be licensed as medicine?"*

European Union legislation requires herbal products to be authorized for marketing if they are industrially produced and if their production or function or both bring them inside its definition of a medicine product. The problem is that such medicinal products may be contaminated with undeclared toxic botanicals, heavy metals, or pharmaceuticals. Consumers are in no position to distinguish between safe and less safe herbal medicine-like products.

One answer could be herbal licensing, De Smet suggested. The authorities are then able to screen the declared constituents, demand proof of product quality, restrict the level of potentially dangerous constituents, and enforce warning about correct and safe usage. Such marking surveillance will protect our consumers.

In the US a similar situation is present. The safety of patients, the efficacy, and fraudulent claims to "miraculous cures" are being assessed by the National Institute of Health under the division of "Alternative Medicine". They are using stringent and proper scientific principles. They will allow such practices to be introduced only when such standards are met.

It is just possible that our authorities could regulate such practices so that public safety be protected. Unproven practices can be dangerous and ultimately, costly. By the same token, closing a blind eye to their existence will not help our citizens.

**To DARE all our doctors to practise a high ethical standard of medicine.**

On 2nd May 1995, for the first time in the history of the medical profession in Singapore, the newly registered doctors made the Singapore Medical Council Physician's Pledge before the Medical Council.

In his address to the doctors, the President of the SMC, Prof N Balachandran described the practice of medicine as a calling. I quote: *"Success cannot be measured in financial terms only. It must be measured by the sum total of good we do for the community."*

I wish to quote the next passage because Prof Balachandran encapsulated the essence with clarity and depth:

*"We have the responsibility to build a trusted and caring medical profession. We are today beginning to drift without an ethical consensus. We have to address these problems as it concerns the very soul of medicine. The sense of value which we still hold, and believe in, will not be sufficient for long when the system comes under strain. It is the fundamentals of our moral commitment that are going to determine the future of our profession and the trust of our patients. The profession is under continuous pressure. It is our ethical code and finally our own conscience that should guide us when there are conflicts in our financial interests and our social goals. To maintain our patient's trust, we must have moral integrity in our profession. Physicians are privileged heirs to a distinguished tradition and established traditional values and more urgent today than ever before in the practice of our profession."* These are words of wisdom worth remembering.

In his interview with the Straits Times on 13 May 1995, Prof Lenny Tan, Dean of the Faculty of Medicine, NUS, was asked, *"What can be done to instil this sense of ethics and social responsibility in doctors?"* Prof Tan replied, *"Ethics is not something that can be taught. You can test people. People read it, remember it, say the right things to pass the examinations.*

*But ethics is a culture. The senior doctors have to be role models. You have not only got to be ethical, you have got to be seen to do the right thing, you have got to live a reasonable lifestyle. On the other hand, unfortunately, it is those less desirable role models that attract the attention that are held up as being successful."*

There will be more ethical issues facing the medical profession. Not long ago, the Abortion Bill and the Organ Transplant bill were debated and approved. Soon, we will be finalizing the Advance Directives Bill (or the Living Will Bill).

The Law recognises the rights of an individual to accept or to refuse medical treatment. However, a patient is only able to exercise these rights if he or she is conscious and mentally sound. A patient who is terminally ill may lose that capacity to make decisions. An Advance Directive provides the patient with an option to make known his desire regarding life-sustaining therapy before he arrives at such a state.

Terminally ill patients often prefer to die in dignity and not be subjected to unnecessarily prolonged, painful and expensive treatment with no real benefit at the end. Euthanasia is out of the question and will remain a serious offence, whereas Advance Directives will be acceptable to most citizens.

The medical profession is a noble one. The doctor's character, conscience and skills are being tested all the time. Our profession can only be sustained in high esteem if doctors play their role in such a way that a high level of conduct, empathy and tradition is maintained.

**To DARE our doctors to practise with compassion.**

Patients often know when their doctors are doing their utmost to get them well. Hence, minor faults, if any, are being overlooked. When doctors practise medicine with compassion, rewards of any kind, monetary or otherwise, play a secondary role. When every effort is made to heal, to relieve pain, or to comfort a distressed patient, the restoration of health is primary on the doctor's agenda.

Problems arise when medical fees are exorbitant and out of proportion to the time, skills and effort expanded by the doctor. When medicine is equated with an "industry" or "trade", the public views the medical profession with disdain. While it is good to acquire entrepreneurial skills, it must not be used at the expense of our patients. By all means apply such skills to hospital administration as cost containment is important, to the manufacture of pharmaceutical products or medical instruments.

Patients look up to doctors with a human touch, not a midas touch. If we are not born with such a compassionate character we can learn by practising it. Acquiring such a skill is not difficult.

Doctors must practise with compassion. It is the hallmark of our profession. By the same token, compassion is not the exclusive virtue of doctors. Many people have as much compassion as, if not more than, doctors.

At the entrance to the College there is the famous Sir William Osler quotation inscribed so as to remind us that:

*"The practice of medicine is an art, not a trade; a calling, not a business; a calling in which your heart will be exercised equally with your head."*

Our profession is not far from the order of priesthood. We have very strict entry, a rigorous training and a strict ethical code of practice, conduct and confidentiality. The only difference is that priests lay up treasures in heaven while doctors are reputed to lay treasures on earth first and in heaven as an option!

## CONCLUSION

I have tried to dare or to challenge our doctors, in particular, our Family Physicians. I have attempted to pose five challenges:

(1) To actively participate in the CME programme.

(2) To sit for the M Med (Family Medicine).

(3) To understand the impact of Traditional Medicine in Singapore.

(4) To practise a high ethical standard of medicine.

5) To practise medicine with compassion.

These challenges are not beyond our doctors. Like the climber, Norman Vaughan, he failed once but he finally fulfilled his dream because he dared to fail and dared to dream.

We may not succeed at the first attempt but, knowing our Singapore doctors, we have the same grit and tenacity. We are already achieving something but it is not enough. We need to excel so that the beneficiary will be our patients.

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# HOW TO READ AND WRITE A REVIEW ARTICLE

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## INTRODUCTION

Good review articles are valuable. They make it possible for a family physician to arrive fairly quickly at what is the state of the knowledge on a particular clinical problem without having to personally wade through all the original research papers that have been written on the subject. This of course, presupposes that whoever takes on the task of reviewing will tediously sift and sort data sources, systematically appraise data quality, and thoughtfully integrate essential data into a unified whole.

Contrary to what is commonly thought, writing a review article is no mean task. It has defined criteria to satisfy. Also, what is interesting to note is as recent as 1986, an evaluation of 50 review articles which appeared in four peer-reviewed journals with a circulation of more than 50,000[1] showed that no one single review article clearly met all the eight criteria from published guidelines. One met six criteria; 32 met four or five criteria; and the remaining 17 met three criteria. Clearly, there is much room for improvement. Another false belief, in my opinion, is the notion that only experts can write review articles. So long as one is knowledgeable about the subject and so long as the criteria for writing a cogent review article are followed rigorously, the effort will be a scientifically worthy one.

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*Occupational and Family Medicine*
*National University of Singapore*

There are then two tasks related to review articles. For each of us, there is need to assure ourselves that the review paper picked up is worth reading scientifically. For some of us ,there is a further task, namely to take on the task of reviewing a topic and writing about it, either out of academic interest or as a requirement of postgraduate training.

This home study paper addresses the two tasks consecutively: reading critically and writing critically a review article. Two papers are suggested for further reading on this subject. They are a very good paper by Cynthia Mulrow[1] in the Annals of Internal Medicine published in 1987 and a more recent paper by Brian Hutchison in the Canadian Family Physician in 1993.

## READING A REVIEW ARTICLE — CRITICALLY

To be worth reading, a review paper must satisfy as many as possible of the 8 criteria listed in Mulrow's paper. These are reproduced in Table 1. An explanation of these criteria follow.

### Criteria explained

***Specified purpose***

Clearly stated purposes are important. They give the reader a frame of reference for deciding whether to read further. Specific purposes help determine strategies to select information. For example, reviews concerning therapeutic efficacy might be limited to data from controlled clinical trials; reviews specifically addressing natural history might emphasise data from inception cohort studies; and reviews addressing aetiology might include data from case-control studies. Finally,

**Table 1. Published Guidelines for Assessing Research Reviews**

| | | | |
|---|---|---|---|
| 1. | Specified purpose | : | Was the specific purpose of the review stated? |
| 2. | Data identification | : | Were sources and methods of the citation search identified? |
| 3. | Data selection | : | Were explicit guidelines provided that determined the material included in and excluded from the review? |
| 4. | Validity | : | Was a methodologic validity assessment of material in the review performed? |
| 5. | Qualitative synthesis | : | Was the information systematically integrated with explication of data limitations and inconsistencies? |
| 6. | Quantitative synthesis | : | Was the information integrated and weighted or pooled metrically? |
| 7. | Summary | : | Was a summary of pertinent findings provided? |
| 8. | Future directives | : | Were specific directives for new research initiatives proposed? |

*Source: Mulrow, Annals of Internal Medicine 1987:106:485.*

the specific purpose of the review can determine appropriate methods of information assessment. Questions concerning where and in whom a particular diagnostic test be done, or intervention, prevention strategy works might require careful assessment of population and setting. Questions concerning optimal timing of a diagnostic test, intervention, or prevention strategy might concentrate on the actual methods of the test or intervention.

A broad or general topic is regarded as a negative feature[2]. The argument is that if the subject is too broad, it will be dealt with briefly and superficially. This may be true but this is not to deny the usefulness of broad overviews as an introduction or orientation to an area of knowledge.

***Data identification***

This is often not specified. Readers are then left to conjecture whether included data were identified from automated databases, expert consensus, textbooks, present contents of reference files, or a personal favourite selection.

***Data selection***

Such information tells the reader whether included data were selected on the basis of predetermined criteria, such as particular study designs or population characteristics. Material rejected should also be mentioned so that the reader can evaluate for himself whether there is any selection bias, where authors preferentially cite data that support their opinions.

***Validity assessment***

A standardised methodologic assessment of data is necessary and often not done. Failure to examine details of study design such as diagnostic and measurement techniques; disease, exposure, and outcome definitions; and intervention and analytic approaches will leave the quality of data included open to question.

***Data synthesis***

This is both qualitative and quantitative. Qualitative synthesis requires comment on why variance in reports occur. This may be the result of selection and reporting biases, for example. Quantitative methods such as comparing prevalence information amongst studies by converting data to a common numerator and denominator[3] is needed for meaningful comparison. Pooling of results that are homogenous may identify small effects not readily detectable by individual small studies (namely, the Type II or ß error)[4].

***Summaries and future directives***

Summaries are helpful in compressing review results into an easily manageable form but care

**Table 2. Criteria to Decide Whether to Read a "Relevant" Review Article**

| *The article should be rejected should any of the following statements be true* | | |
|---|---|---|
| 1. Purpose | : | It addresses a broad topic *(Unless one is looking for a broad overview of a topic, this is a rejection criterion).* |
| 2. Data identification | : | It has no references or scanty references. |
| 3. Data selection | : | The author is obvious biased. |
| 4. Validity assessment | : | It has no description or minimum description of primary studies. |
| 5. Qualitative and quantitative synthesis | : | The magnitude of effect is not discussed. |

*Source: Hutchison BG. Can Fam Physician, 1993;39:1101*

must be taken to ensure that these are supported by valid review processes. Properly written, directives for future studies help the next designer of a study to identify what had been learned from all the studies conducted so far and what is the gap of knowledge that needs to addressed.

**Criteria as guidelines for journal reading**

Hutchison has turned the criteria into guidelines which can be used in a variety of ways in regular journal reading. For example, one can select a cluster of criteria against which to assess potentially relevant reviews.

Table 2 shows a way of using a cluster of criteria in deciding whether to read a "relevant" review article. The criteria are arranged in order of ease with which they can be applied. Failure to meet any one of the criteria disqualifies an article. The first criterion can be applied by examining the title or, at most, the introduction; the second by examining the reference list; and the third by reading the author's introduction. Application of the last two criteria usually requires scanning the tables and text. Additional criteria could be added: for example, a requirement for a description of the methods used to identify the primary studies included in the review.

For literature searches designed to answer questions that arise in clinical practice, the guidelines can be used to identify the best reviews that are (readily) available. Where relevant review articles are plentiful, stringent criteria are appropriate. Where few papers are available, one may have to loosen the selection criteria (or, alternatively, search for articles reporting high-quality original research). This may of course, prompt the idea of undertaking to write a review to fill a need for it.

## WRITING A REVIEW ARTICLE

The prospective reviewer has several options depending on what is available in the literature, If there is no good quality review article available, (s)he may attempt to write one. If there are good review papers available, (s)he can always consider the usefulness of updating the subject by a further review of the topic. (S)he has to be mindful that (s)he should satisfy the eight criteria described above, as far as possible if (s)he is to produce something scientifically useful.

To improve the scope, impact and quality of reviews, Mulrow suggests six steps to be followed. These are quoted fairly extensive here from her paper[1]. First, a well-conceived review always answers a question. This question should be made clear at the beginning of the review. It should be precisely formulated, rather than broad or ill-defined.

Second, efficient strategies for identifying relevant material of substantive quality and excluding irrelevant or poor quality material are needed. Computer searches of the literature cross-checked with references from other review articles can be used to identify pertinent literature. Explicit guidelines for determining what data to include in the review should be stated. These guidelines should coincide with the purpose of the review. In fact, the precise definition of the review's purpose may determine whether characteristics such as study designs, study populations, disease definitions, or time frames should be used as criteria for selecting information for the review.

Third, to manage large quantities of data objectively and effectively, standardised methods of appraising information should be included in the review process. Standardised appraisal forms addressing the appraisal of research designs, implementations and analyses can be used by reviewers to optimise uniform assessment of data.

Fourth, final synthesis of information should involve systematic rather than selective integration. Data regarded as scientifically unsound on the basis of the standardised appraisal should be discarded but this should be mentioned. Quantitative methods can be used to provide a common unit of comparison between studies and to combine data from several studies. These methods can be used to evaluate generalisability, consistency, interactions and small effects that are not readily recognisable from individual studies.

Fifth, the conclusions should be succinct and logically ordered summarisations of data. If the appraisal and synthesis of data involves weighting of evidence according to some type of quality assessment, the conclusions too should reflect the relative weighting.

Finally, the reviewer should clearly identify gaps in present knowledge and suggest future initiatives. Unsolved issues and problems can be delineated, and appropriate methods for addressing these issues can be suggested. In this way, the reader finishes the review with a view of what is not known about the subject as well as what is known.

## CONCLUSIONS

This paper has set out to describe the criteria to be used to critically appraise a review article as well as to use the criteria to help decide whether a relevant article is worth reading. To some, there may be a challenge to undertake to review a subject and to write this up. By using the systematic methods of exploration, evaluation and synthesis described in this paper, the good reviewer can accomplish the task of advancing scientific knowledge.

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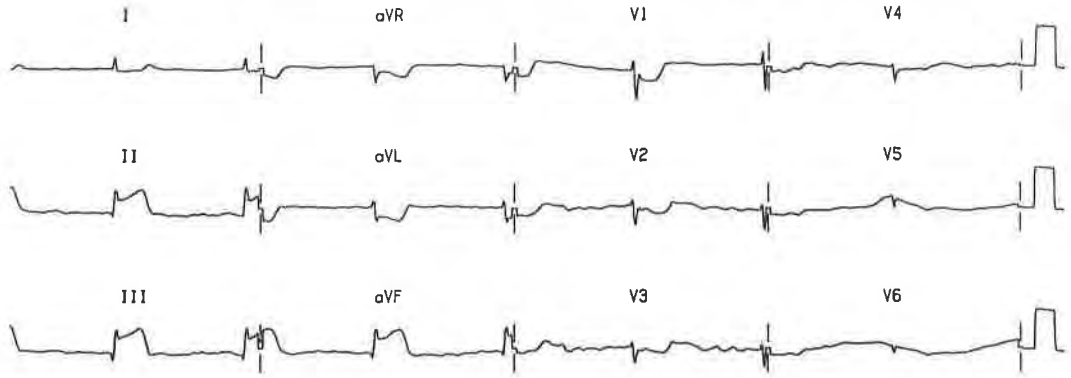
# ECG QUIZ

*W L Ng, MBBS (Adelaide), FRACP, FAMS*

## ECG 1



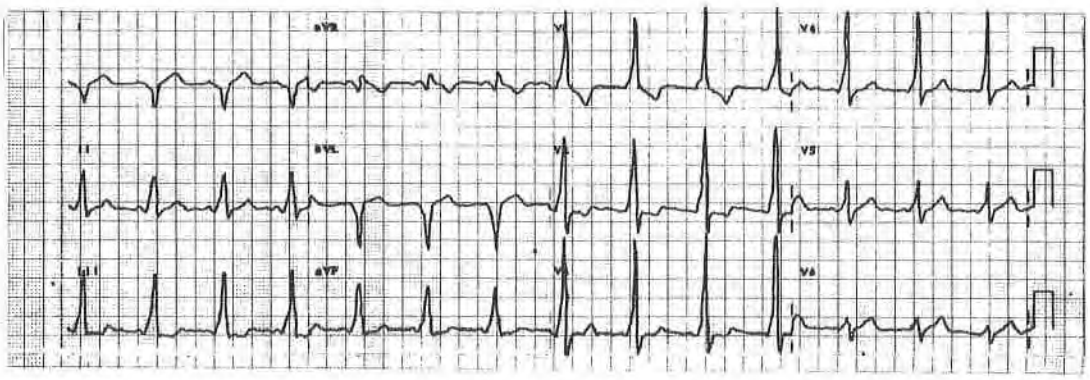

**Question on ECG 1**

a) Describe the ECG abnormalities.

b) What is the rhythm?

c) What treatment might be necessary?

## ECG 2



**Question on ECG 2**

a) Describe the ECG abnormalities.

b) What potential problems can the patient have?

Senior Registrar
Cardiac Department
National University Hospital

*Answers on page 165*

# ANSWERS TO ECG QUIZ

## ECG 1

(a) (i) Acute inferior myocardial infarction with reciprocal ST depression in I, aVL, V1-3.

(ii) Loss of R wave in V5-6, aVL
?old lateral myocardial infarction.

(b) Atrial fibrillation with complete heart block and junctional escape thythm.

(c) (i) Streptokinase for the myocardial infarction.

(ii) Pacing for the heart block if haemodynamically compromised.

## ECG 2

(a) Sinus rhythm, Right axis deviation
Pre-excitation (→WPW)
Short PR interval
Widened QRS
Delta waves.

(b) Arrhythmias, sudden death.

WORLD HEALTH ORGANIZATION PUBLICATIONS

# NEW BOOK ANNOUNCEMENTS

## The World Health Report 1995

Bridging the gaps
1995, 120 pages
ISBN 92 4 156178 5

What are the most important diseases that afflict humanity today, and why do they occur? Are advances in knowledge and technology having a real impact on health? Which are the actions most urgently needed, and what will they cost? At a time when resources are shrinking nearly everywhere, what should be the priorities for improving world health?

These are some of many questions being addressed in the World Health Organization's new series of annual World Health Reports. Drawing upon a greatly expanded database, *The World Health Report 1995 - Bridging the gaps* documents the attributed causes of ill-health and death for each age group throughout the human life span, around the globe. Analytical as well as descriptive in its approach, the report also explores the effects of ill-health on people's lives and what can be done to improve conditions. Issues covered range from the causes of infant mortality to the health impact of global climate change, from the importance of poverty and lack of knowledge to the projected toll of the AIDS pandemic.

While progress is evident for some disease in some countries, others show trends that are deeply disturbing. As the report reveals, today's global health situation is characterized by ominously widening gaps between rich and poor, between one population and another, and between age groups. Knowledge and technologies continue to advance, but fairness is lost when their benefits are distributed. Though many countries have already reached the health targets set by WHO for the year 2000, in some parts of the world, life expectancy is actually decreasing and populations lack access to even the most basic health care.

For virtually all the major diseases that kill children or cut short the lives of adults, the picture that emerges is one of immense suffering easily prevented or treated by technologies that already exist and cost surprisingly little to implement. As the report makes abundantly clear, the gaps that need to be bridged include the discrepancy between knowing exactly what should be done and finding the will and resources to do it. Facts and figures gathered in the report also underscore the fundamental importance of health to socioeconomic development: when the poor are made healthy, they can earn more and become less poor.

By ranking the major causes of death and ill-health, and showing how they can be prevented, *The World Health Report 1995 - Bridging the gaps* provides a foundation for priority setting and action and challenges the world conscience to face the difficult ethical issues raised by so much preventable suffering.

## Community-based Distribution of Contraceptives

A Guide for Programme Managers
1995, xi + 135 pages
ISBN 92 4 154475 9

This book provides guidelines for the introduction and management of family planning programmes that rely on trained non-professional members of the community to distribute contraceptives, usually the pill and barrier methods, to other community members. Such community-based distribution services are usually less costly than clinic-based services, easier for people to reach, available in a wider range of settings, and more likely to be accepted and used.

Addressed to programme managers, the book offers abundant practical advice intended to help readers plan and implement community-based services with a full awareness of the many factors that can influence a programme's success. Information ranges from a simple step-by-step method for estimating potential demand for services, through examples of job descriptions for different categories of staff, to advice on policy options for procuring contraceptives and charging clients for services. Throughout the book, successful experiences from around the world are used to illustrate the many ways that community-based services can help reach underserved groups and improve both the availability and acceptability of contraceptives. Drawing on these experiences, the book also alerts readers to common problems and the best ways to avoid or overcome them.

The book has six chapters organized to follow the main steps involved in planning, implementation, and evaluation. The opening chapters explain how to develop a programme that is appropriate to the needs of the community, and how to ensure that the programme receives support from both the public and the medical community. Emphasis is placed on factors that have proved to be crucial to any success of any programme for the community-based distribution of contraceptives.

Since successful delivery of community-based services is closely linked to the education of potential users, the book also includes specific recommendations on the training of personnel and the organization and delivery of services. The concluding chapters cover the evaluation and monitoring of programmes, and issue advise on six of the most important issues raised by managers of community-based distribution programmes, service providers, policymakers and researchers.

Further practical information is provided in a series of annexes, which list sources of data, supplies, technical assistance, and information, and present sample materials that can be adapted to local needs.

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## Investing in Women's Health: Central and Eastern Europe

WHO Regional Office for Europe Copenhagen, 1995, xvi + 44 pages (WHO Regional Publications, European Series, No 55)
ISBN 92 890 1319 2

Profound and rapid changes are under way in the countries of central and eastern Europe (CCEE) and the newly independent states (NIS) of the formed USSR. These changes have led to social and economic hardship and, in some cases, to war. The result is a widening gap in health between the eastern and the western halves of the WHO European Region: a serious inequality. A closer look at the CCEE and NIS reveals a particularly disadvantaged group in these countries: women. While women bear more of the burdens imposed by change, they also comprise an invaluable, largely untapped resource for the response to change.

Recognizing both the problem and the opportunity, the WHO Regional Office for Europe created the Investing in Women's Health Initiative. Its goal is to provide governments in the CCEE and NIS with information and policy options, through a European Women's Health Forum. Governments can then use these tools to address women's needs throughout life, and make use of women's strengths in this difficult period of transition.

This book is one of the first fruits of the Initiative. Coordinators from 11 pilot countries and 1 pilot city in the eastern half of the Region gathered data for the first-ever "country profiles" on women's health and the factors that influence it. This book makes a comparative analysis of the profiles. It takes a broad view of women's health, extending beyond the traditional focus on reproductive issues to embrace the whole life cycle. It describes not only health status and health care services but also women's position in society and the influences of daily life and the environment on their health. It concludes by indicating the directions for future action, which should include improving the amount and quality of the data on women.

This book makes gripping and vital reading for anyone interested in women's health, health in the CCEE and NIS, equity, healthy public policy, or the opportunities for beneficial change in the eastern countries of the European Region

# GUIDELINES FOR AUTHORS
# THE SINGAPORE FAMILY PHYSICIAN

Authors are invited to submit material for publication in the Singapore Family Physician on the understanding that the work is original and that it has not been submitted or published elsewhere.

The following types of articles may be suitable for publication: case reports, original research work, audits of patient care, protocols for patient or practice management and review articles.

## PRESENTATION OF THE MANUSCRIPT

### The whole paper

* Normally the text should not exceed 2000 words and the number of illustrations should not exceed eight.

  Type throughout in upper and lower case, using double spacing, with three centimetre margins all round. Number every page on the upper right hand corner, beginning with the title page as

  1. Make all necessary corrections before submitting the final typescript.
     Headings and subheadings may be used in the text. Indicate the former by capitals, the latter in upper and lower case underlined.

     Arrange the manuscript in this order: (1) title page, (2) summary, (3) text, (4) references (5) tables, and (6) illustrations.

* Send three copies of all elements of the article: summary, text, references, tables and illustrations. The author should retain a personal copy.

### The title page

* The title should be short and clear.

* Include on the title page first name, qualifications, present appointments, type and place of practice of each contributor.

* Include name, address and telephone number of the author to whom correspondence should be sent.

* Insert at the bottom: name and address of institution from which the work originated.

### The summary

* The summary should describe why the article was written and give the main argument or findings.

* Limit words as follows: 100 words for major articles; 50 words for case reports.

* Add at end of summary: an alphabet listing of up to 8 keywords which are useful for article indexing and retrieval.

### The text

The text should have the following sequence:

* Introduction: State clearly the purpose of the article.

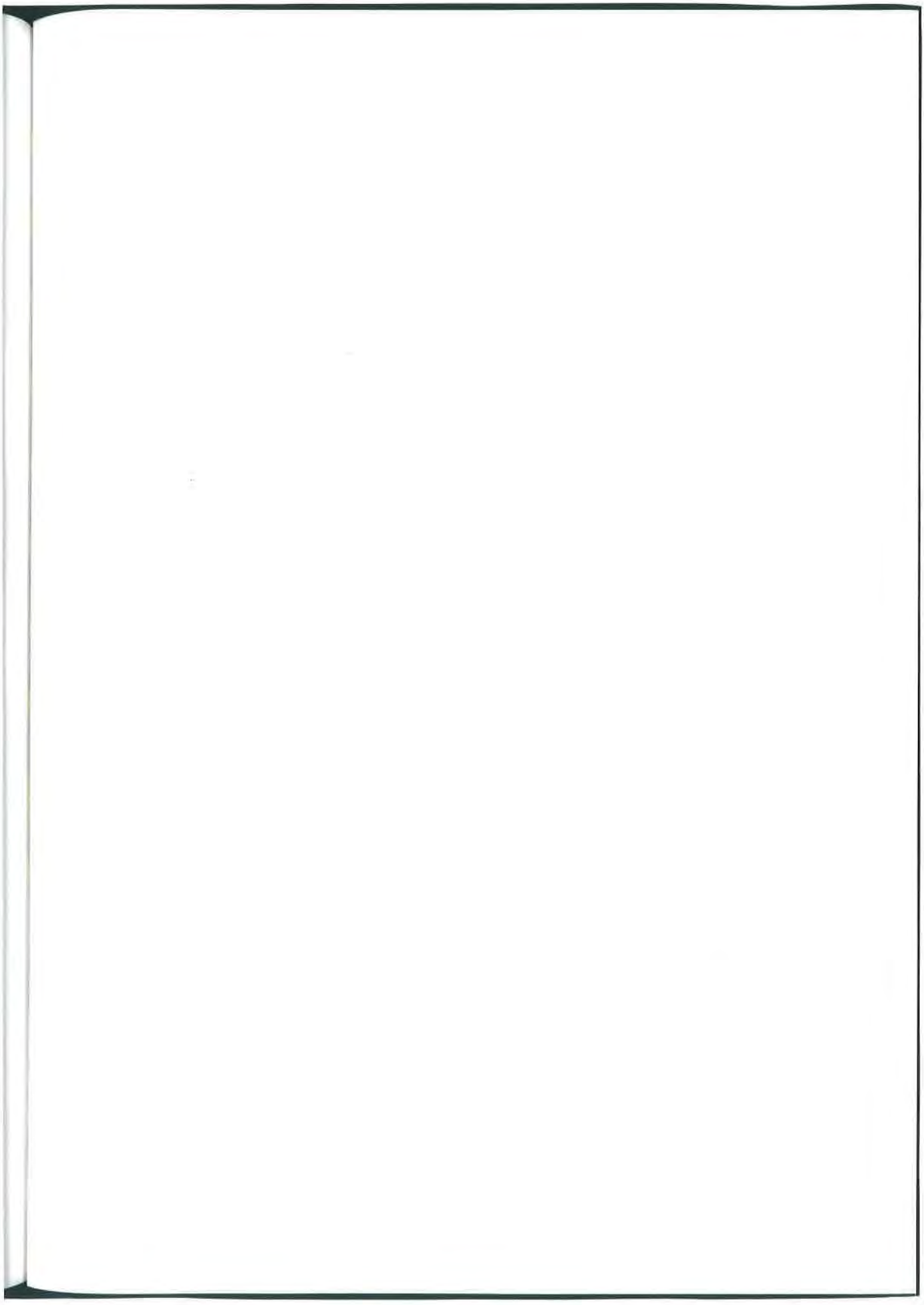
* Materials and methods: Describe the selection of the subjects clearly. Give references to established methods, including statistical methods; provide references and brief descriptions of methods that have been published but are not well known. Describe new or substantially modified methods, giving reasons for using them and evaluate their limitations. Include numbers of observations and the statistical significance of the findings where appropriate.

  Drugs must be referred to generically; all the usual trade names may be included in parentheses. Dosages should be quoted in metric units.

  Laboratory values should be in SI units with traditional unit in parentheses.

  Do not use patient's names, initials or hospital numbers.

* Results: Present results in logical sequence in the text, tables and illustrations.



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