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ALBERTA OCCUPATIONAL MEDICINE NEWSLETTER

GUEST EDITORIAL

The Green Newsletter Salutes the "Green Decade"

You don't have to be a student of popular culture to know that the environment is "the" issue for the 1990's. We are told this by the media, and most of us are aware of grassroots initiatives to improve the environment. Recently, the Hyndman Commission Report highlighted healthy environments as a key prerequisite to the future health of Albertans.

Because of this rekindled interest, we are eager to learn of studies on health effects of various environmental exposures. However, in many cases, studies of occupational cohorts are the closest we can come to such analyses. Thus it is worthwhile to familiarize yourself with the occupational literature, and to get a reasonable idea of how these studies may provide information on environmental health impacts.

First, why are occupational studies often our only useful source of information? Simply put, epidemiologic studies demand knowledge of three factors: the population, the exposure, and the outcomes. Occupational studies have a head start — although by no means an easy time — in identifying all three factors.

The population in most occupational studies is a "cohort" of workers, some of whom are exposed to the agent in question, and some of whom are either less or not at all exposed. Dr. Dulberg's excellent article in this Newsletter typifies this — she found (albeit with considerable effort) all the military personnel and all civilians seconded to the military who were in situations likely to expose them to low-dose radiation. Unexposed individuals were selected also from military records. But what if we wanted to study people who had ever lived near waste site X, and who were not employed by the waste management company? Records of residents in an area over time simply do not exist; even if you could identify past residents, employers are much more likely to be able to find them many years later than is a random investigator. Thus, occupational studies can define their population with more precision than retrospective environmental studies.

Second, if the employer has good records, one may be able to get reasonable estimates of exposure levels of workers over time - although this is still often difficult to establish, as workers vary in their individual exposures. With retrospective environmental studies, often the only correlate for exposure is distance from the site, perhaps weighted for proposed dispersion of suspected environmental agents. Thus, one needs to ensure that studies are as precise as possible in locating residents' distance from a site of interest. Current health and vital statistics data in Alberta (and Canada) do not allow this degree of precision in rural areas, and "shoe-leather epidemiology" is the only way to pinpoint community locations. Even once this is accomplished, the location is akin to having a job title in occupational studies: individual exposures may vary.

Finally, one has to be able to identify what happened to these individuals. The ultimate question in these studies usually can be boiled down to: If someone was exposed to possible toxin X, was she/he more likely to get sick or die than someone else who wasn't exposed? Thus, you have to know who, in each group, became ill or died. Dr. Dulberg's paper details the considerable amount of identifying information needed from the worker's file to make an accurate link. It would be difficult to get this amount of information retrospectively on past community residents.

Thus, occupational studies are often the best (and only) information we have right now. But can they be used to project health effects on community residents? Unfortunately, the answer is that only occasionally do they provide this type of information. Dr. Horne's paper points to the problems here — even if excesses in detrimental outcomes are found, one has to try to narrow down what the causative agent is. If an excess risk is attributed to skin absorption of a given chemical, for example, community effects could be expected only if the chemical escaped from the site. Effects secondary to the waste emissions which get into the community are, therefore, of much more concern. If workers are exposed to these in higher concentrations than community residents and have no apparent health effects (in large numbers and over a long period of time), then the community risk would not seem to be great.

You'll be reading more, then, about occupational studies in the "Green Decade", as often they're the best we can do in getting retrospective data. Read them with interest, and try to link the exposures postulated in such studies with the likelihood of exposures in the environment. In the meantime, we hope that further development of environmental epidemiology will answer these questions more directly in the future.

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The University of Calgary, through funding by Alberta Occupational Health and Safety

MORTALITY AMONG CANADIAN MILITARY PERSONNEL EXPOSED TO LOW-DOSE RADIATION: USE OF THE NATIONAL MORTALITY DATA BASE

Corinne Dulberg, Ph.D., M.P.H.*

INTRODUCTION

This study relied upon a unique source of mortality data, the Canadian National Mortality Data Base. A summary is provided here, more details can be found in the publication by Raman, Dulberg, Spasoff and Scott (1987).

During the 1950's, approximately 1,000 Canadian military personnel were exposed to low levels of radiation while observing atomic test blasts in Nevada (1955, 1957) and in Australia (1956, 1967), and while assisting in clean-up operations of two accidental spills of radioactive materials at the Chalk River Nuclear Laboratories in Ontario (1953, 1958).

In 1982, concerns about the adverse health effects from these exposures were expressed by a group of Canadian armed forces veterans. Their worries were supported by published studies (Caldwell et al., 1980, 1983) on a similar group of exposed individuals: approximately 3,000 U.S. military observers of the 1957 atomic blast, "Smoky". Caldwell reported a statistically significant increase in leukemia: 8 cases were observed versus 3.1 expected on the basis of U.S. national statistics. Concerns were further increased by a CBC radio report of a 3-fold increase in overall mortality and a 6-fold increase in cancer mortality among 54 exposed Canadian veterans, compared to Canadian mortality statistics.

These concerns led the Department of Veterans Affairs of the Department of National Defence (DND) to contract with the Department of Epidemiology and Community Medicine of the University of Ottawa to conduct an epidemiologic study of the effect of exposure to radiation among such exposed Canadian veterans.

DESIGN

While clearly a historical cohort study was in order, decisions had to be reached about three major design issues. The first issue was proper identification of members of the exposed cohort. To avoid the ascertainment bias likely in the CBC radio survey, it was crucial to obtain complete ascertainment of the exposed cohort. We decided to include all military personnel and all civilians seconded to the military, who had observed the atomic test blasts or who had assisted at the Chalk River clean-ups, as these were the groups for which complete ascertainment was feasible.

Second, to avoid a potential "Healthy Worker Effect" arising from comparisons of military personnel to national statistics, we decided to select a cohort of unexposed military personnel as our comparison group. Given the fixed and limited size of the exposed cohort, to increase statistical power, we selected two controls per exposed, with the controls matched on the key potential confounding factors of age +/-5 years, service (Army, Air Force or Navy, civilian), rank, and trade (occupation), with characteristics to be matched to each exposed subject at the time of his initial exposure. The purpose of matching on age is obvious. The purpose of matching on service, rank and trade was to equate life style factors as much as possible.

The third major issue involved choice of the outcome measure. Despite the sensitivity of using cancer morbidity, the cost of tracing approximately 3,000 cohort members would have been prohibitive. We, therefore, decided to take advantage of the existence of the Canadian National Mortality Data Base and to compare total mortality and cause-specific mortality among the exposed compared to the control cohorts. With 1,000 exposed and 2,000 unexposed, it was estimated that we had 80% power to detect a relative risk of 1.5 for all cancers, and a relative risk of 1.2 for deaths from all causes.

THE CANADIAN MORTALITY DATA BASE

Before proceeding to the study methods and results, a discussion of the use of the Canadian Mortality Data Base is in order. What follows is a summary of information from Smith and Newcombe (1980).

Data from provincial death registrations which are routinely computerized for purposes of calculating annual mortality statistics and for creating indices of death registrations, are used to prepare the centralized Mortality Data Base at Statistics Canada. Through record linkage, researchers are able to search the complete Data Base to determine the survival status of individual cohort members from 1950 onwards.

A great amount of information can be computerized from each death registration, including the following: full name, birth data and birth province or country, sex and marital status, parents' names and place of birth, spouse's name, ICDA code for cause of death, date and place of death, last known residence and occupation. While the standard format of the data base provides space for all items, all are not necessarily entered. For example, occupation is rarely included.

The process of record linkage, that is, of establishing whether each individually named study cohort member is represented on the data base, proceeds in two steps. The first or "searching" step, involves bringing two records together for comparison: data on an individual cohort member and data from a particular deceased person. The second or "linking" step, involves calculations of the odds that the two records being compared are from the same person, based on comparisons of all available identifiers.

Rather than relying on a person's subjective judgment to decide whether or not the two records are from the same individual, the linkage step uses probabilistic matching techniques. A computer program has been written to calculate the odds of an accurate linkage.

In using the Mortality Data Base, the more detailed the personal identifying information available on the individuals to be searched, the higher is the chance of accurate record linkage. The level of detail is the key to avoiding errors during record linkage. Statistics Canada encourages detailed identifying information to be routinely collected on all employees, as these data would be invaluable for future occupational cohort studies relying on the Mortality Data Base. Persons interested in using the data base should contact Mrs. Martha Fair, Head, Occupational and Environmental Health, Statistics Canada.

METHODS

Data collection for the study was conducted in five stages:

1. compilation of members of the exposed cohort;
2. an initial review of the personal military files of the members of the exposed cohort, to collect data necessary to select their matched controls;
3. selection of the matched unexposed cohort members;
4. detailed data collection from each cohort member's personal military file; and
5. record linkage with the National Mortality Data Base at Statistics Canada.

Compilation of members of the exposed cohort was based on review of historical documents of lists of men selected to attend the events in question as well as lists of exposures received at the study sites. After extensive review of hundreds of pages of documents, we compiled a list of 957 members of the exposed cohort, among whom were 924 military personnel and 33 civilians seconded to the military. These 957 individuals were exposed at a total of 1,052 events; 884 (92%) of the men received exposure at only one study site, and 73 (8%) at more than one event under study. About 60 percent of the 1,052 exposures occurred while observing the atomic tests and about half of these occurred at the Nevada tests in 1957. The majority of participants in both types of events came from the army. Those exposed ranged in age from under 20 to over 50 years, with about 40 percent between the ages 20 and 39 at the time of their initial exposure.

Several different types of documents had to be used to identify the matched controls, depending upon service, rank and trade of the exposed cohort member. These included Daily Routine, or Part II orders (collections of documents, prepared daily, describing every individual at each base on a given day), lists of the military personnel in two infantry corps, navy promotion lists, and books of lists of officers. For identification of controls for the 33 civilians (physicists, meteorologists, etc.), we had to rely on information collected by our military liaison from data available at the Defence Scientific Personnel Program of the DND.

The only group of exposed subjects which could not be closely matched for trade were the members of the Ground Defence or Radiation Detection Unit, because almost all of the personnel serving in this unit were members of the exposed cohort. Selection of trade of the "matched" control members was therefore based on each man's trade immediately prior to joining the Radiation Detection Unit.

We were successful for all but three exposed cohort members (exposed at the 1958 Chalk River clean-up), in identifying two suitably matched controls. Thus, we had a total of 954 triples (i.e., 954 exposed plus 1,908 controls) available for analyses.

After lists of members of the exposed and unexposed cohorts were compiled, every individual's military file was reviewed in detail. Most of the files were available at the National Personnel Records Centre in Ottawa. For those men still serving in the military, we enlisted the help of the DND to obtain permission to have files temporarily sent to us from their current bases.

Three types of information were collected from the file review:

1. the detailed personal identifying information needed for record linkage;
2. confirmation of exposure as well as information about dosage received;
3. records of death, both to check the accuracy of the record linkage and to obtain information about deaths that might not be contained in the Mortality Data Base either because they had occurred outside of Canada, or they had occurred outside the time frame of the data base available at the time of the study (January 1953 -December 1981).

Upon completion of the file review, a computer tape was prepared of all available data from all cohort members. This tape was then taken to Statistics Canada for record linkage with the Mortality Data Base. Record linkage was achieved without employing death information obtained from file review. Finally, the linked data on deaths were added to the analysis tape, so that statistical analyses could be conducted at Statistics Canada.

RESULTS

Documentation of Mortality

Among the complete study group (954 exposed and their 1,908 controls), for deaths that occurred between 1953-1981, the period covered by the Mortality Data Base, a total of 418 deaths were identified by record linkage. For deaths occurring during the same period, 345 were identified from the file review alone. This number is about 83 percent of the number identified by record linkage. This percentage held in both cohorts.

All but one of the 345 deaths identified from file review to have occurred from 1953-1981 were also identified by record linkage. This one false negative was due to an error in our data recording rather than to a serious deficiency in the record linkage procedure. These results thus indicate the very high degree of accuracy possible with data linkage, provided that detailed personal identifying information is available.

Despite these excellent results on accuracy, since record linkage is only probabilistic and hence subject to error, we sought to verify that there were no omissions in identification of deaths due to the cancers most often associated with radiation, i.e., leukemia and thyroid. To this end, our research staff manually compared a list of all (17,516) deaths of Canadian males due to these two causes, to the list of all cohort members. No omissions were found, and all deaths due to these causes which had been identified by record linkage were confirmed.

Since cause of death was only available from deaths identified using the Mortality Data Base, we had 418 deaths available for our cause-specific analyses. For statistical analyses on overall mortality, however, we used all 452 deaths identified from both sources: the 418 plus the 33 deaths identified from the file review to have occurred during 1982-1983, and the one false negative.

Analysis of Overall Mortality

The key statistical analysis of overall mortality was based on the survival status of the exposed and the control subjects as matched triples. The Mantel-Haenszel matched triples estimates of the odds ratio of mortality among the exposed versus the control subjects was 1.02, and was not statistically significant ($x^2 = 0.02$, df $= 1$, $p = 0.88$).

A number of other statistical analyses were conducted to compare overall mortality between study cohorts. Life-table techniques, analyzing the general pattern of probability survival of cohort members from time of initial exposure, were used to compare the total cohorts as well as to examine particular subgroups: the 73 subjects who had received multiple exposures and each of the exposure-specific groups (atomic test blasts and Chalk River clean-ups) versus their controls. Lastly, a matched triples analysis was conducted on members of the Radiation Detection Unit versus their controls. None of these analyses resulted in either a statistically significant or a meaningful effect of exposure.

Cause-Specific Analyses

The last step was to examine potential relationships of exposure to cause-specific mortality. Using the record linkage data only, the overall relative risk (RR) for total mortality among the exposed compared to the control cohort, was 1.04, a value very close to the previously reported Mantel-Haenszel matched triples odds ratio.

Turning to selected causes of death, there were no cases of thyroid cancer and the RR for leukemia was .40, a value in the opposite direction of what would be expected. We calculated RRs for 56 specific causes of death as well as for overall mortality among the total study cohorts and among the two location specific sub-groups, i.e., Chalk River and atomic blasts. Among all 171 comparisons, the only causes of death which were significantly elevated among the exposed compared to the controls were diseases of the digestive system (RR = 2.5; 10 among the exposed versus 8 among the controls), specifically for cirrhosis of the liver (RR = 4; 6 versus 3; Fisher's exact tests).

CONCLUSION

To summarize the results, neither deaths from all causes nor death from all cancers were found to be associated with the levels of radiation experienced by the military personnel in our exposed cohort. The mean follow-up period for our cohort members was 26 years. It is, therefore, reasonable to assume that causes of death with latency of less than 15 years would have been detected. Our results are consistent with current scientific literature on the effect on mortality of low-dose radiation.

In conclusion, it is of interest to return to the fact that this study was initiated in response to public concern. As a follow-up to the original story, the results of the study were televised on the CBC's "Journal". The response of the originally surveyed members of the Radiation Detection Unit was discouraging. The man who served as spokesman for the Unit was neither comforted nor convinced by our study. It is encouraging, however, to know that other researchers have been made aware of the availability of Canada's unique Mortality Data Base, and its value for the conduct of occupational and environmental cohort studies.

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2. Raman S, Dulberg CS, Spasoff RA, and Scott T. Mortality among Canadian military personnel exposed to low-ose radiation. CMAJ, 1987, 136: 1051-1056.

3. Smith M, and Newcombe H. Automated follow-up facilities in Canada for monitoring delayed health effects. Am J Public Health, 1980, 70: 1261-1268.

UPCOMING CONFERENCES

XIIth World Congress on Occupational Safety and Health.
Hamburg, Federal Republic of Germany
May 6-11, 1990
Contact:
Congress Secretariat
XIIth World Congress on Occupational Safety and Health
Hamburg Messe und Congress GmbH
Postbox 30 24 80
D-2000 Hamburg 36
Federal Republic of Germany

Futuresafe 90.
Conrad International Hotel, Gold Coast, Australia
May 20-23, 1990
Contact:
National Safety Council of Australia Congress and Exposition
Pacific Rim Convention Systems Pty. Ltd.
G.P.O. 853
Brisbane, Queensland 4001
Australia

23rd International Congress on Occupational Health of the International Commission on Occupational Health.
Montreal, Quebec
September 22-28, 1990
Contact:
23rd International Congress on Occupational Health
58 de Bresoles Street, Suite 2
Montreal, Quebec
H2Y 1V5

A REVIEW OF POTENTIAL HEALTH RISKS FOR PULP AND PAPER MILL WORKERS

J. Digby Horne, M.D.*

INTRODUCTION

As the Alberta and Federal Governments determine the fate of a proposed $1,160,000,000 investment in the pulpwood industry, pulp mills have recently come into the public spotlight. Concern has been generated about the potential environmental effects and the possible health and safety hazards for those who work in pulp and paper mills. This subject has been investigated by several workers in the field of occupational medicine and the following article reviews some of the recent literature on this subject.

The studies reviewed concentrate primarily on pulp and paper mills, which may not have complete, direct applicability to the new projects in Alberta. This is because only 520,000 tonnes of pulp out of the 2,425,000 tonnes to be produced annually will remain in Alberta and will be converted to paper. The remainder will be shipped out of the country for this purpose. Nonetheless, these studies provide the most helpful sources of information related to this subject.

The production of paper from pulp utilizes numerous chemicals, and the process varies from company to company, with the age of the pulp and paper plant, and with the type of paper being produced. Some of the common chemical exposures include: chlorinated organic material, hydrogen sulphide, methyl mercaptans, sulphur dioxide, chlorine, chlorine dioxide, ammonia vapors, caustic soda, formaldehyde, lime, wood dust, organic sulphates, alcohols, aliphatic acids, herbicides, dioxins, tannins, and terpenes. A host of other chemicals find their way into paper through the addition of various retention agents, dyes, brighteners and fillers.

It is important to note that the literature is not in agreement on the health effects of pulp and paper mills on their workers, and most studies have simply generated hypotheses about what might be the possible health outcomes. This is because studies have utilized different and often limited methods, different numbers of subjects, and differing populations to draw their conclusions. Length and type of exposure to potential toxins have varied considerably as well. Difficulties have also arisen from separating out the adverse health effects due to work in pulp and paper mills from those due to other factors such as cigarette smoking.

The following is a list of the adverse health effects which some studies have found to be more frequent (though sometimes lacking statistical significance) in pulp and paper mill workers compared to other control groups:

1. pleural mesothelioma (cancer of the lining surrounding the lung);
2. cancer of the lung;
3. death from diseases of the circulatory system;
4. cancers of the digestive tract including stomach, small and large intestines;
5. leukemias;
6. cancers of the lymphoid tissues;
7. death from all types of cancers combined;
8. headaches;
9. compromises in normal lung function.

After consideration of the limitations of these studies, and the number reporting the same findings, some of these adverse health effects would seem to be more likely associated with work in pulp and paper mills than others. Specifically, evidence seems to point the most strongly to a possible association between pulp and paper mill work and the following:

1. cancer of the colon,
2. leukemias and cancer of the lymphoid tissues,
3. a worsening of lung function together with an increase in respiratory symptoms.

The evidence for each of these associations will be outlined in the following paragraphs.

CANCER OF THE LARGE INTESTINE

The suggestion that cancer of the large intestine may have a higher frequency in pulp and paper mill workers than in the general population comes from studies by Milham and Demers (1984), Solet et al. (1989) and Schwartz (1988). Schwartz studied 1071 deaths in pulp and paper mill workers in New Hampshire between 1975 and 1985 and found a statistically significant increased PMR* (proportional mortality ratio) for colonic cancer.

The comparison group in the Schwartz Study was 452 timber cutters and loggers. Milham and Demers also showed an excess of cancer of the rectum but this was not a statistically significant increase, and was only in those pulp and paper workers involved with the sulphite pulping process. Solet et al. studied deaths in pulp and paper mill workers from 1970 to 1984, and in comparing against US mortality tables found a statistically nonsignificant excess.

[*The PMR is a ratio comparing the proportion of persons dying of a specific cause in the study (exposed) group with the proportion dying of that cause in a comparison (control) group considered to be unexposed. If the PMR is increased, this may mean that the study group has a greater chance of dying from this condition compared with the control group. Unfortunately, this ratio sometimes provides erroneous results for reasons not discussed here.]

LEUKEMIA AND CANCER OF THE LYMPHOID TISSUES

Most recently, Band et al. (in press) have found a significantly increased odds ratio (and therefore risk) for non Hodgkin's lymphoma in pulp and paper workers in British Columbia. In the past, this group has also noted a significantly increased PMR for lymphosarcoma and reticulum cell sarcoma in these workers. Milham and Demers found an excess of deaths due to leukemia, Hodgkin's disease and lymphosarcoma in mill workers in Oregon, Washington, Wisconsin, and Quebec. However, the excess was not statistically significant and not found in other geographic areas studied. They postulated that differences in the species of trees utilized and the pulping process used in different study regions might account for this. Solet et al. also found nonsignificant excesses of leukemia, lymphosarcoma, and reticulosarcoma. Schwartz, in studying all cancers of lymphoid tissues, revealed an insignificant excess, while Flodin (1988), during investigation of cases of Chronic Lymphocytic Leukemia, was able to demonstrate a significant association with this cancer and a previous history of exposure to fresh wood. Thus, the research is not in agreement and the association between work in pulp and paper mills and leukemias and cancer of the lymphoid tissues has been a recurrent theme without definite conclusions. For this reason, further research for confirmation and clarification is necessary.

DETERIORATION IN NORMAL LUNG FUNCTION AND INCREASES IN RESPIRATORY SYMPTOMS.

The association of deteriorating lung function and increasing respiratory symptoms is tenuous, but deserves mention at least because two studies have reported its occurrence. Henneberger et al. (1989) described a statistically significant negative 7.2 ml change in FVC (forced vital capacity, a common measure of respiratory function) with each year worked in a pulp mill. They also observed nonsignificant decreases in FEV1 (forced expiratory volume in one second, another measurement of lung function) in pulp mill workers compared with controls. Another study by Andrae et al. (1988) reported an increased risk of allergic asthma and bronchial hyperreactivity in residents living near pulp mills compared with those who were not so located. However, a study by Yeung and DY Buncio (1984) did not give support to declines in normal lung function or an increase in respiratory symptoms in pulp and paper mill workers. A study by Deprez et al. (1986) suggested a positive association between hospital admission rates for respiratory morbidity and the proportion of the work force employed in pulp and paper mills in 66 towns. It did not, however, examine potential confounding factors such as smoking and the prevalence of commercial health insurance.

CONCLUSION

No firm conclusions can be drawn with respect to health risks from employment in pulp and paper mills because of incomplete information and lack of agreement between sources. Careful research, however, is indicated to determine the significance of possible associations already noted between work in this area and colonic cancer, leukemias and cancers of the lymphoid tissues, and adverse changes in respiratory function. In the meantime, caution so as to avoid excessive, unnecessary exposures to chemicals in pulp and paper mills is certainly warranted.

(References available on request)

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BOOK REVIEW OF OCCUPATIONAL HEALTH SERVICES — A PRACTICAL APPROACH*

by Carl Zenz, M.D.,
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Health care professionals and institutions have discovered the potential value for expansion of traditional occupational health services. To initiate, promote or enlarge occupational health activities of high quality requires considerable planning and expert guidance. Recognizing and understanding such needs, the authors, experienced in occupational medical practice, present this book as a reference and as a guide in case of problems and as a "road map" when entering unfamiliar territory. The book is intended for the use of occupational health care providers - physicians in solo or group practice, plant physicians, occupational health nurses, medical directors of corporations - and, especially, for managers responsible for occupational health services for work places of any enterprise, large or small, public agencies and health care facilities, such as hospitals. This book sets forth the elements of occupational health delivery by tracing the structure and regulation of occupational health care systems, identifying standards of practice and performance of all such services, explaining the administration of programs, from staffing and facilities requirements to office procedures and insurance liability, defining the types and extent of services and delineating the standards to evaluate programs and services.

The book is arranged into major sections:

1. The Occupational Health Care System (with chapters on the Role of Workers' Compensation, Occupational Safety and Health Regulations and Ethics in Occupational Medicine);
2. Occupational Health Care Delivery (with chapters on The Business Context, Contract Services, Preparing for an Occupational Medicine Practice and Marketing Services);
3. Office Administration (with chapters on Staffing and Personnel Needs, Facilities and Equipment, Office Procedures and Recordkeeping);
4. Program Management (with chapters on Service Selection and Implementation, Program Evaluation, Cost/Benefit Analysis and Research Management, Fitness-to-work and Impairment Evaluations, Equal Access and Opportunity, Health Monitoring and Surveillance, AIDS in the Workplace, Absence Monitoring, Hazard Evaluation and Control, Industrial Emergencies Involving Hazardous Substances, Alcohol and Drug Testing, Employee Assistance Programs and Health Promotion).

Each chapter is a rich source of practical information. There are several appendices, with an exceptionally noteworthy format for an on-site occupational health audit. This book is an essential addition to the field of occupational health and will gain wide-spread acceptance through out North America and will be of equally great value in other countries, as well. I recommend this book, most highly!

*(by Tee L. Guidotti, John W.F. Cowell and Geoffrey G. Jamieson. Chicago, IL: American Medical Association, 1989, 369 pp. hardcover)

Editor's Note:

Readers may obtain a complete Index to Occupational Health Services-A Practical Approach, free of charge, by writing to the Editor, Alberta Occupational Medicine Newsletter, Dept. of Community Health Sciences, Faculty of Medicine, The University of Calgary, 3350 - Hospital Drive N.W., Calgary, Alberta, T2N 4N1, Canada.

Tee L. Guidotti, M.D., M.P.H., F.R.C.P.(C), C.C.B.O.M.*

Repetitive strain injury (RSI) is a class of musculoskeletal disorders in which chronic discomfort, pain, and functional impairment may result from numerous repeated movements of the upper extremity. There are many synonyms for repetitive strain injury, including "overuse syndrome" and "cumulative trauma disorder." Although there are several specific conditions within the general RSI category, all have in common the association of repetitive movement, rather than a single initiating event, and a subjective nature in the presenting complaints that makes diagnosis difficult and claims for compensation problematic.

The frequency of reported repetitive strain injuries has increased dramatically in recent years, most obviously in Australia where it has emerged as virtually the leading issue in occupational health studies. In Japan and the United States, as well, there are indications of a dramatic increase in reports of RSI. This may be due to increased recognition and attention to the disorders but the strong impression of many occupational health authorities is that the increase is real and relates to the increasing number of jobs in the economy that relate to paced or work-driven execution of a limited number of relatively fine motor movements of the hands and arms, such as keystrokes, assembling small parts, cutting fabric, and packaging small items. It is probable that in the past many RSIs were simply ignored or overlooked. However, it is also true that jobs requiring such actions have proliferated in recent years and that workloads and pacing have increased.

Occupational factors associated with RSI include a sustained and awkward posture, excessive manual force, use of intrinsically weak body parts in unusual or forceful movements, and high rates of repetition of movements. Load factors are important in producing RSI and additional occupational hazards, specifically cold working conditions and vibration, may make the condition worse.

There are many specific injuries that fall under the rubric of RSI. The more common ones are listed in Table 1. A more detailed description of these RSI conditions will appear in Part 2.

*Professor of Occupational Medicine, Director, Environmental and Occupational Health Programs, Faculty of Medicine, The University of Alberta.

Table 1

Repetitive Strain Injury: Common Conditions and Diagnostic Features

Condition	Diagnostic Maneuver
Neck and Shoulder Girdle	
Tension neck syndrome	None
Cervical syndrome	Pain with flexion/extension of neck radiating down arm
Thoracic outlet syndrome	Variation in pulse strength with hyperextension at shoulder (Adson's maneuver)
Shoulder and Upper Extremity	
Tendonitis, tenosynovitis, bursitis	Local pain, swelling
Supraspinatus tendonitis (rotator cuff tendonitis)	Pain on abducting beyond 70 percent at shoulder
Bicipital tendonitis	Pain over bicipital tendon
Frozen shoulder syndrome	Reduced range of motion after injury
Acromioclavicular syndrome	Pain over acromioclavicular joint when clavicle is percussed while patient is pushing downward against resistance
Upper Extremity and Hand, Wrist	
Lateral or medial epicondylitis	Local pain and pain with resisted hand motion
de Quervain's tenosynovitis	"Trigger thumb", may also be idiopathic
Carpal tunnel syndrome	Nerve conduction studies, Tinnel's sign, Phalen's test
Ulnar nerve entrapment	Nerve conduction studies, Tinnel's sign

UPCOMING CONFERENCES

Sampling and Evaluating Airborne Asbestos Dust
Seattle, Washington
June 5-8, 1990
Contact:
Northwest Centre for Occupational Health and Safety,
Department of Environmental Health, SC-34,
University of Washington,
Seattle, Washington 98195

The 5th International Conference on Indoor Air Quality and Climate
Toronto, Ontario
July 29 - August 3, 1990
Contact:
Indoor Air '90
Centre for Indoor Air Quality Research,
University of Toronto
223 College Street,
Toronto, Ontario M5T 1R4

C.P.H.A. 81st Annual Conference
CULTURES - The Relationship Between Culture and Health
Toronto, Ontario
June 25 - 29, 1990
Contact:
Dr. Peter Cole/Dr. Trevor Hancock
Co-Chairs, Program Committee
Canadian Public Health Association
1565 Carling Avenue, Suite 400
Ottawa, Ontario K1Z 8R1

Comprehensive Industrial Hygiene Review Course
St. Paul, Minnesota
August 13-17, 1990
Contact:
Angela Molenaar or Sheryl Hayward-Beagle,
Midwest Center for Occupational Health and Safety
640 Jackson Street,
St. Paul, Minnesota 55101