The 10-Year Experience of an Academically Affiliated Occupational and Environmental Medicine Clinic

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Occupational and environmental diseases are underrecognized. Among the barriers to the successful diagnosis, treatment, and prevention of these conditions are inadequate consultative and information resources. We describe the 10-year clinical and training experiences of an academically affiliated referral center that has as its primary goal the identification of work-related and other environmental diseases. The University of Washington Occupational and Environmental Medicine Program has evaluated 6,048 patients in its diagnostic and screening clinics. Among the 2,841 seen in the diagnostic clinics, 1,553 (55%) had a work-related condition. The most prevalent diagnoses included asbestos-related lung disease (n=603), toxic encephalopathy (n=160), asthma (n=119), other specific respiratory conditions (n=197), carpal tunnel syndrome (n=86), and dermatitis (n=82). The clinics serve as a training site for fellows in the specialty training program, primary care internal medicine residents, residents from other medical specialties, and students in industrial hygiene, toxicology, and occupational health nursing. The program serves two additional important functions: providing consultative services to community physicians and training specialists and other physicians in this underserved area of medicine.

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Occupational diseases pose a considerable health burden to current and former workers in the United States,[1-4] but occupational health services have historically been isolated from the mainstream of medical education and clinical practice.[5] It is only in the past decade that a clinical specialty in occupational medicine has gained even a limited presence in American medical schools and teaching hospitals.[6-9] From just a handful in the early 1980s, there are now about 40 hospital-based, academically affiliated occupational medicine clinics in the United States. These clinics are involved in providing services aimed at the diagnosis, treatment, and prevention of work-related diseases. More recently several of these clinics have expanded their activities to include the evaluation of nonoccupational environmental exposures and conditions.

We describe here the clinical and training experiences of the first ten years of the University of Washington (Seattle) Occupational Medicine Clinic. The clinic was founded in July 1981 at Harborview Medical Center and focused on serving the Pacific Northwest. Goals defined at the outset were to assess the work-relatedness of disease, to train clinicians, and to screen for disease in selected worker populations.

Methods

The Occupational Medicine Clinic is based at Harborview Medical Center, one of the two University of Washington Health Sciences Center hospitals. The clinic is part of the Occupational and Environmental Medicine Program. Patients are referred by a variety of sources and screened to meet appointment criteria, which have varied over time. Before 1990, patients with possible nonoccupational environmental exposures or conditions were largely excluded from evaluation. Because of increasing demand for consultations about nonwork exposures, this exclusion criterion was eliminated. Beginning in 1989, when an occupational musculoskeletal clinic was started, patients with back pain who had previously been excluded from evaluation were seen routinely. Other exclusion criteria that persist to the present are patients who seek evaluation of Agent Orange exposures and those who identify workplace stress as the primary concern.

From the beginning, patient records have been maintained and housed in the Occupational and Environmental Medicine Program offices, separate from hospital records. A computerized patient data base has been in existence since the clinic began operation; this data base has evolved over time to optimize patient management functions and research needs. In addition to routine demographic data, the following coded information has been available for each patient throughout the ten-year period from July 1981 to July 1991:

- Referral source;
- Occupation and industry (3-digit codes from the Classified Index of Industries and Occupations, developed by the Bureau of Census and based on the Standard Industrial Classification and the Standard Occupational Classification systems) and employer name (coded only for those employed by 102 selected regional and local employers);
- Exposures: one or two possibly hazardous exposures per person in current or past employment, using a predetermined list of about 70 exposures grouped in nine categories—fumes, dusts, metals, solvents, pesticides, miscellaneous

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chemicals, physical factors, ergonomic factors, and other factors; and

- Work-related diagnoses: one or two diagnoses for possible and diagnosed occupational diseases, using a slightly modified version of the *International Classification of Diseases, 9th Revision.*

Each diagnosis is linked to one specific exposure (using the exposure list described) and to a determination of the likelihood of work-relatedness of the condition (none, possible, probable, definite). Conditions thought readily attributable to nonoccupational causes were generally not coded.

The coding of patient information from the diagnostic clinics was done by attending physicians only (to increase inter-rater reliability) with assistance by the clinic industrial hygienist for general exposure codes (including N.J.H.). Seven physicians (including L.R., W.D., S.B., J.C., and J.D.K.) have served as attending physicians in the clinic during the period covered. Coding forms are regularly entered into the clinic's microcomputer, and the data base is maintained and quality controls assured by the clinic's research scientist (currently B.S.).

Results

Demographic Characteristics

The Occupational and Environmental Medicine Program maintains two primary clinical activities: diagnostic clinics, including a general diagnostic clinic that was started in 1981 and a musculoskeletal clinic started in 1989, and screening clinics—arranged by contractual agreements to serve defined populations of workers—started in 1983. Overall, in the ten years of clinic operation, 6,048 persons have been evaluated; 2,841 have been evaluated in the diagnostic clinics and 3,207 in 1 of 18 screening programs arranged for a wide range of occupational groups, including workers with exposure to asbestos, firefighters, and hazardous waste workers (see Table 1).

TABLE 1.—*Occupational Cohorts Evaluated in Occupational and Environmental Screening Clinics (n=3,207)*

Workers	Persons Evaluated No.	(%)
Asbestos-exposed		
Plumbers and pipe fitters	777	(24)
Ship scalers	83	(3)
Sheet metal workers	402	(12)
Elevator workers	66	(2)
Shipyard painters	61	(2)
Others	20	(1)
Firefighters		
Seattle, Wash.	796	(25)
Other	73	(2)
Hazardous waste workers	467	(15)
Others	462	(14)

The demographic characteristics of patients evaluated in the diagnostic clinics are shown in Table 2. The clinic population is largely men of working age. The racial distribution of the clinic population is roughly comparable to that of the metropolitan area in which it is located. Physicians are the single largest of the varied referral sources. The program's screening clinics generate a sizable number (n = 196, 7%) of diagnostic clinic evaluations. Figure 1 shows the location of the residence of patients evaluated, with 56% (n = 1,518) of all patients at the time of evaluation residing in Seattle and King County, an additional 40% (n = 1,081) from elsewhere in Washington State, and 4% from out of state.

TABLE 2.—*Characteristics of Patients Seen in Diagnostic Occupational Medicine Clinics (n=2,841)*

Characteristic	Patients No.	(%)
Sex*		
Men	2,175	(76)
Women	652	(23)
Age, years		
Range	18-87	
Mean (±SD)	49	(±14)
Race		
White	2,177	(77)
African American	334	(12)
Other	164	(6)
Unstated	166	(6)
Referral source		
Physician	734	(26)
Self-referred	722	(25)
Legal	359	(13)
Union	286	(10)
Workers' compensation	148	(5)
Screening clinic	196	(7)
Employer	51	(2)
Other/unknown	345	(12)

*Information not available for 14 persons.

TABLE 3.—*10 Leading Work-Related Conditions Identified in the Diagnostic Occupational Medicine Clinics**

Condition	Patients No.	(%)
Asbestosis	389	(21)
Asbestos-related pleural disease	214	(12)
Specified respiratory conditions (excluding asthma and asbestos-related)	197	(11)
Acute or chronic encephalopathy	160	(9)
Specified musculoskeletal (excluding carpal tunnel syndrome)	142	(8)
Hearing loss	125	(7)
Asthma	119	(6)
Carpal tunnel syndrome	86	(5)
Dermatitis	82	(4)
Other specified intoxication	26	(1)
Total	1,540	(84)

*In all, 1,824 conditions were noted in 1,553 patients; only diagnoses deemed "probably" or "definitely" related to work are included.

Job Characteristics and Work-Related Diagnosis

Among the 2,841 patients evaluated in the diagnostic clinics, 1,553 (55%) were identified as probably or definitely having a work-related condition. The age and sex distribution of those with a work-related diagnosis is similar to those of the overall population (mean age, 50 ± 15, and 78% men). Referral sources of those diagnosed with an occupational disease are, however, somewhat different from those of the overall diagnostic clinic population; they are less likely to be

referred by a physician (15% versus 26%) and more likely to be referred by their union (32% versus 10%).

The ten leading work-related diagnoses are shown in Table 3. These ten categories account for 84% of all work-related diagnoses. Asbestos-related conditions are the most prevalent and reflect in part follow-up of screening activities focused on high-risk workers, with 121 (20%) of those found to have an asbestos-related disease referred from this source. The geographic distribution of the residence of patients with an asbestos-related condition is shown in Figure 2.

Secular trends in work-related diagnoses are displayed in Figure 3. The peak of new asbestos-related diagnoses in 1986 followed a large screening effort. The number of cases of carpal tunnel syndrome increased considerably after the opening of a clinic activity dedicated to musculoskeletal disorders. The number of asthma diagnoses has remained relatively constant over time.

Several medical conditions attributable to workplace factors were diagnosed infrequently, including toxic hepatitis (n = 7), vibration-induced peripheral vascular disease (n = 6), hard-metal lung disease (n =4), urticaria (n = 3), lymphohematopoietic cancer (n = 3), chemical conjunctivitis (n = 5), myopathy or rhabdomyolysis (n = 3), and glomerulonephritis (n = 2). In all, 26 cases of multiple chemical sensitivity syndrome could be identified through the data base, of which 16 (62%) were thought to be probably work-related. This underrepresents the total number of patients diagnosed with this disorder and is likely due to physician discretion to code only those conditions deemed probably related to work.

In addition to characterizing clinic patients by diagnosis, all patients were assigned up to two types of possibly hazardous exposure on the job(s) of concern—either the current or most recent job or the one related to the problem under evaluation. The ten leading workplace exposures are shown in Table 4. Diagnostic clinic patients were employed in a wide variety of occupations and industrial settings, as shown in Tables 5 and 6.

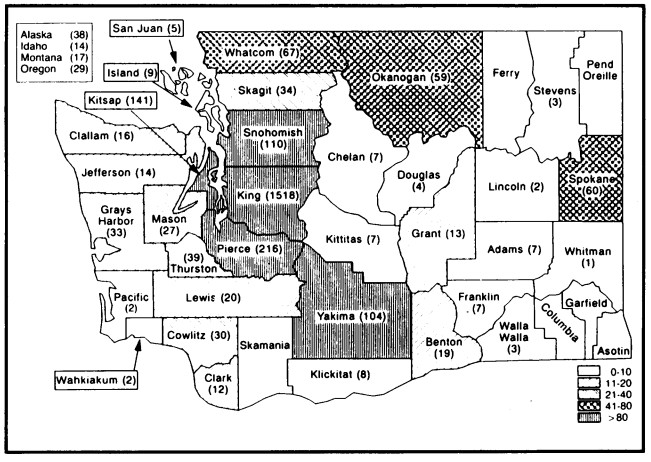

Figure 1.—The distribution of patients evaluated in the occupational medicine diagnostic clinics is shown by county in Washington State (n = 2,599) and those from Alaska, Idaho, Montana, and Oregon (n = 98). Not shown are 144 patients from other states or with unknown county of residence.

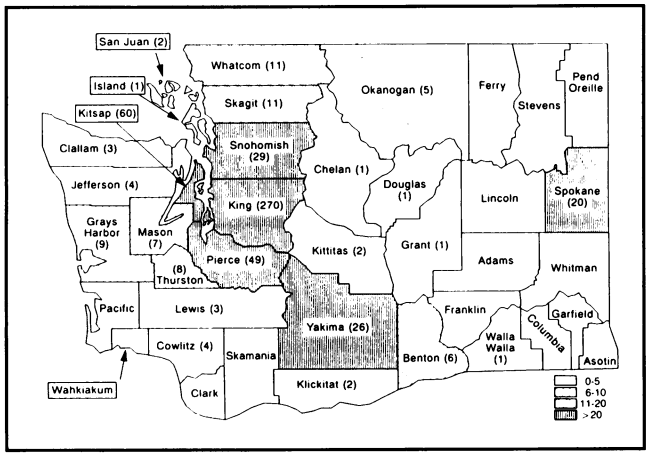

Figure 2.—The geographic distribution of the residence of patients diagnosed with an asbestos-related condition is shown. Not included are 67 patients not from Washington State or with unknown county of residence.

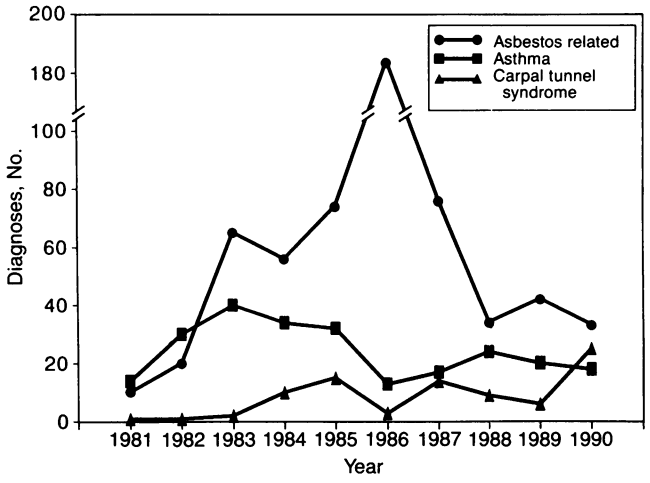

Figure 3.—The graph depicts time trends for the diagnosis of selected occupational diseases.

Training

The occupational medicine clinic is the major site for clinical training in occupational and environmental medicine at the University of Washington. Since 1987 specialty training in occupational medicine has been offered as a joint effort by the School of Medicine and School of Public Health and Community Medicine. At any one time about six fellows participate in the two-year training program. The program seeks to train physicians who have completed residency training in a primary care specialty (usually internal medicine) and are interested in academic or related careers. All fellows participate regularly in diagnostic clinic activities and to a limited extent in the screening clinic. Joint specialty training with the pulmonary disease and critical care medicine program has become formalized, and occupational and environmental medicine is an identified special emphasis area for the University of Washington Robert Wood Johnson Clinical Scholars Program.

In addition to training specialists in the field, the Occupational Medicine Clinic is a required rotation for all Seattle-based primary care internal medicine residents at the University of Washington. Other physicians in training (mostly internal medicine and family practice residents) elect on a regular basis to spend one or more months in the diagnostic clinic. About one to two medical students per year—from the University of Washington or elsewhere—do an

elective with the program combining clinical and research experiences.

Nonphysician training is also integrated into clinical activities. On an elective basis each year, several students in industrial hygiene, toxicology, occupational health nursing, and nurse practitioner programs have worked side by side with clinic staff—which, in addition to physicians, includes a full-time industrial hygienist and nurse practitioner.

Clinical teaching is predominantly patient-based in the ambulatory setting. An inpatient consultation service augments clinical experiences for fellows. In addition, a weekly clinic conference, which is open to all interested persons, is a regular forum for multidisciplinary discussion about the medical, legal, and social aspects of all cases evaluated in the diagnostic clinics. On a monthly basis, the conference is organized to include faculty and students in the graduate programs of industrial hygiene and occupational health nursing.

TABLE 4.—*Leading Potentially Hazardous Exposures Identified Among Diagnostic Clinic Patients*

Hazardous Exposure	Patients* No.	(%)
Asbestos	1,069	(38)
Solvents	588	(21)
Welding fumes	364	(13)
Vibration	260	(9)
Other chemicals	195	(7)
Metals, excluding welding and lead	95	(3)
Pesticides	74	(3)
Repetitive motion	54	(2)
Lead	53	(2)

*Each of 2,841 patients can be assigned up to 2 exposures.

Discussion

We have provided an overview of patients seen during a ten-year period at an academically affiliated occupational and environmental medicine clinic. The workplace diversity of clinic patients reflects that seen in Washington State and particularly the greater Seattle area, but it also reflects interest in certain conditions by clinic faculty. For example, asbestos-related lung disease has been an area of research activity for several faculty and trainees, and the large number of patients seen with this condition is due in large part to a selective referral of such patients and follow-up of possible case identification from numerous screening programs.

Our own evolving triage criteria, particular research interests, and subsequent referrals all contribute to limiting the generalizability of this experience to the overall pattern of occupational disease in the local area, let alone the state and region. Moreover, even without the biases introduced by our selection criteria and interests, the same forces leading to the underrecognition and underreporting of occupational diseases in general[10-12] are likely to result in our clinic's experience both underrepresenting and skewing the actual distribution of these conditions in the community. The most prevalent conditions we have diagnosed, however, are remarkably similar to those of another academic referral center in a different geographic region.[9]

Despite limitations in our clinical data base, our descriptive data are nonetheless instructive. Referral patterns indicate that the clinic has been able to respond to diverse sectors in the community, particularly physicians, who sought consultation. The initiation of an occupational musculoskeletal clinic is an example of responding to a perceived need in this area, as identified by patient and physician inquiries. In addition to providing direct patient consultations, the clinic staff responds to countless phone inquiries from physicians and others about hazards and medical effects of exposures.

A substantial proportion of our patients were deemed to have a work-related condition. Although the most common diagnosis, asbestosis, reflects work conditions of many years

TABLE 5.—*Most Common Occupations of Patients in the Diagnostic Occupational Medicine Clinic*

Occupation	Patients No.	(%)
Plumber, welder	251	(9)
Hazardous waste worker	144	(5)
Painter	128	(4)
Sheet metal, furnace installer	122	(4)
Laborer, sandblaster	94	(3)
Precision metal worker	93	(3)
Insulator, asbestos worker	80	(3)
Accountant, clerk	82	(3)
Sales	68	(2)
Machinist	62	(2)
Boilermaker	60	(2)
Janitor	47	(2)
Truck, bus driver	45	(2)
Carpenter	40	(1)
Electrician, technician	37	(1)
Pot operator	33	(1)
Machine operators	31	(1)
Auto mechanic	26	(1)
Ship fitter	26	(1)
Fabricators, assemblers	26	(1)
Total	1,495	(51)

TABLE 6.—*Most Common Industries Employing Patients of the Diagnostic Occupational Medicine Clinic*

Industry	Patients No.	(%)
Shipbuilding	555	(19)
Construction	485	(17)
Airplane manufacturing	130	(5)
Grocery store	81	(3)
Hospitals, medical care	65	(2)
Shipping, maritime services	51	(2)
Aluminum smelting	46	(2)
Auto repair	46	(2)
Railroad	43	(1)
Lumber manufacturing	42	(1)
Agricultural production crops	33	(1)
Trucking	31	(1)
Fabrication, metal manufacture	27	(1)
Military, national security	27	(1)
Printing, publishing	24	(1)
Federal government	24	(1)
Firefighting station	23	(1)
Hydraulics plant	22	(1)
Logging camp	21	(1)
Colleges and universities	20	(1)
Total	1,796	(64)

past, many identified work-related diseases—such as asthma, acute chemical pneumonitis, and lead poisoning—reflect current hazards. These cases nearly always result in our own efforts at initiating prevention, but they also suggest the potential advantages of linking clinic findings with organized feedback response systems, as suggested by Rutstein and colleagues in describing the benefits of defining and reporting occupational sentinel health events.[13]

Our clinical experiences not only reflect our a priori research interests but have also driven numerous investigations. For example, the evaluation of a patient with chronic encephalopathy that appeared to follow an acute pesticide intoxication was the impetus for ongoing research into chronic neurologic sequelae of pesticide exposures.[14,15] The identification of a cluster of carpal tunnel syndrome in seven grocery checkers spurred epidemiologic studies in grocery checkers and other populations.[16] The clinic has indeed served as a laboratory and has been the basis for numerous faculty and trainee scholarly endeavors.

Clinics such as the one described here also need to be put into the broader context of occupational and environmental disease detection and prevention. There have been important advances in the past several decades in our understanding of the causes and mechanisms of occupational disease. Several approaches are needed, however, to reduce further the incidence and severity of these conditions. In addition to a need for broader surveillance, prevention, and control programs, physicians can play a major role in this effort by diagnosing, treating, and initiating appropriate follow-up of conditions in individual patients. Academically based clinics can fulfill multiple purposes by facilitating the identification of local exposure and disease patterns and by serving as a consultative resource to community physicians. Finally, these clinics can play an important additional role in providing a clinical base for training physicians and other health care professionals in this underserved area of medicine.

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