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## CHAPTER 4

### EPIDEMIOLOGY AND TREND ANALYSIS

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#### Introduction

One of the greatest challenges to occupational health (OH) clinical providers is to develop meaningful public health interventions based on their clinical and laboratory observations. This requires interaction with many other disciplines including industrial hygienists, safety professionals, radiation health officers and preventive medicine technicians. Only with a multi-disciplinary approach can the clinical workload of the occupational health clinic result in improvements to the health and safety of the work force as a population.

The use of epidemiology as a public health tool is required in several areas of OPNAVINST 5100.23 series including:

1. The development of an occupational exposure registry and data bank - this is the product of identification of hazards by the industrial hygiene (IH) program and the results of medical surveillance examinations (section 0802.5).
2. The review of worker medical data in aggregate to "detect unrecognized occupational hazards and assess the effectiveness of the occupational medicine program" (section 0803.1(b)(9)).

In most Navy and Marine Corps settings, the opportunity to review and collect medical data has not been fully realized. Large, centrally managed Occupational Health Management Information Systems have proved too cumbersome to be useful to the resource sponsor, functional managers or individual OH clinics. This chapter will discuss options available to occupational health care professionals who wish to develop an epidemiological approach to improve both the health of the work force and the quality of services provided.

### **Epidemiological Approach to Prevention**

Prevention of illness and injury should be the underlying goal of all OH clinical efforts. If this goal is not attempted, what is referred to as a medical surveillance program results in only a screening process without the evaluation and intervention steps. Population-based epidemiological analyses may be used at any of the three levels of prevention:

1. **Primary prevention** - the modification of the workplace to prevent disease prior to exposure. This is the underlying goal of industrial hygiene (IH) surveys. Primary prevention requires an active interaction between the IH and OH programs. IH surveys and walk-throughs should drive the medical screening program. Use of OH demographic data and information obtained from the following questions can be useful to the IH and safety professional:

(a) Who is being referred for OH services by command and workplace?

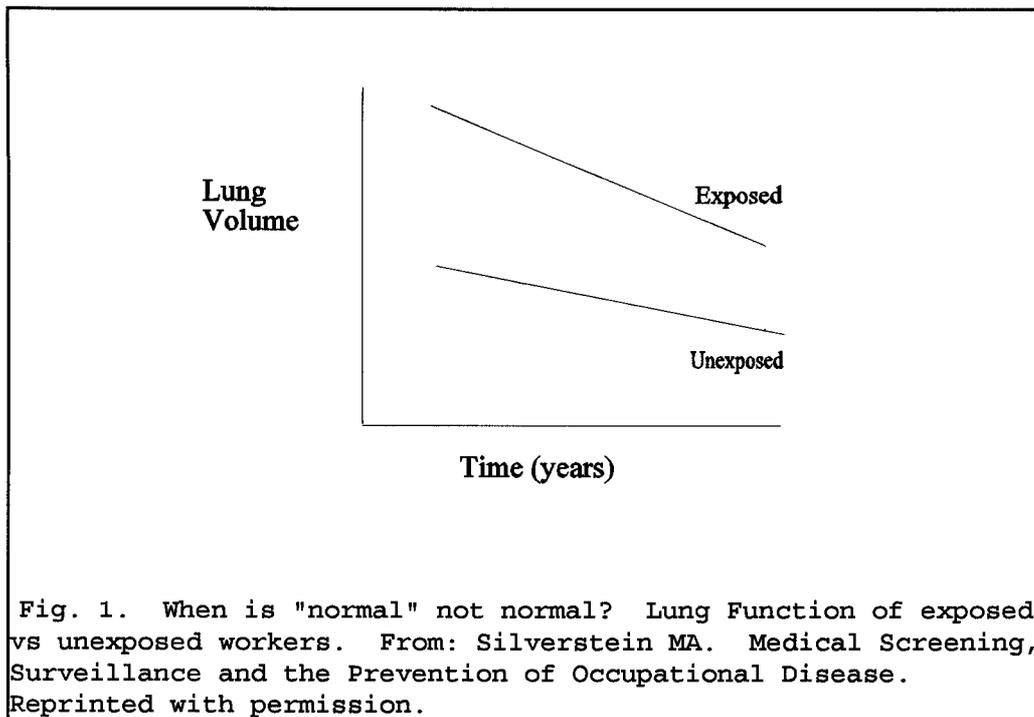
(b) Have there been changes in OH patient patterns that might indicate a change in work process or production level which may require an IH re-evaluation? This may also be the first indication of a change in command emphasis on NAVOSH programs or assignment of a different safety officer.

(c) Are there changes to occupational injury or illness patterns that reflect a degradation of primary prevention strategies such as proper use of engineering controls, administrative practices, or personal protective equipment?

2. **Secondary prevention** - the detection of a disease state at a point where it can be reversed. Secondary prevention can occur at several levels:

(a) Evaluation of the individual worker - based on the potential chemical, biological and physical hazards to which the worker may be exposed, physical examinations and laboratory tests may indicate a potential disease. It is important to compare the worker's results to established normal values and the worker's last evaluation. The majority of workers will have "normal" results. This is commonly referred to as the "the healthy worker effect". The observed decline in laboratory studies may be more pronounced in an exposed worker than the expected change over time in a non-exposed worker, although the values may still be "normal". This is demonstrated in figure (1). In this way, each worker is used as his own control for comparison over time, in addition to the published normal values. An example is tracking spirometry test results for change over time to look for reduced lung function.

(b) A similar problem is how to approach an asymptomatic worker with mildly "abnormal" laboratory values. Specific algorithms have been developed, as in figure (2), to evaluate workers with laboratory tests outside the published normal values.



(c) Another area that has the potential for epidemiological investigation of screening results is biological monitoring. Workers' exposures are assessed by collecting samples (most commonly blood or urine) which are then measured for a hazardous agent or a metabolite. This has the advantage over IH air sampling because it takes into account the workers' exposures, not only through inhalation, but also across the skin or by ingestion (due to poor work practices). The data can easily be analyzed by workplace to determine any overexposures or changes over time. The OSHA cadmium standard (29 CFR 1910.1027) specifically outlines this approach with threshold values for either urine or blood cadmium results. Within two weeks of obtaining an elevated cadmium result, a reassessment of the worker and workplace is required. Although not required by OSHA, a similar occupational health and industrial hygiene biological monitoring threshold approach could be used with blood leads or other heavy metal determinations. This can be a useful tool for the IH department with multiple taskings and limited resources to identify workplaces that should be prioritized for evaluation.

(d) The next step in secondary prevention is the collection of individual worker data, either from medical surveillance examinations or biological monitoring. This information is then evaluated by both specific worksite and by areas of similar potential hazard exposure, asking these types of questions:

(1) Are there collections of "abnormal" results among workers in a specific workplace?

(2) Are there differences among workers with similar potential exposures compared to other work sites?

(3) Are there any changes over time in the number or location of these abnormalities?

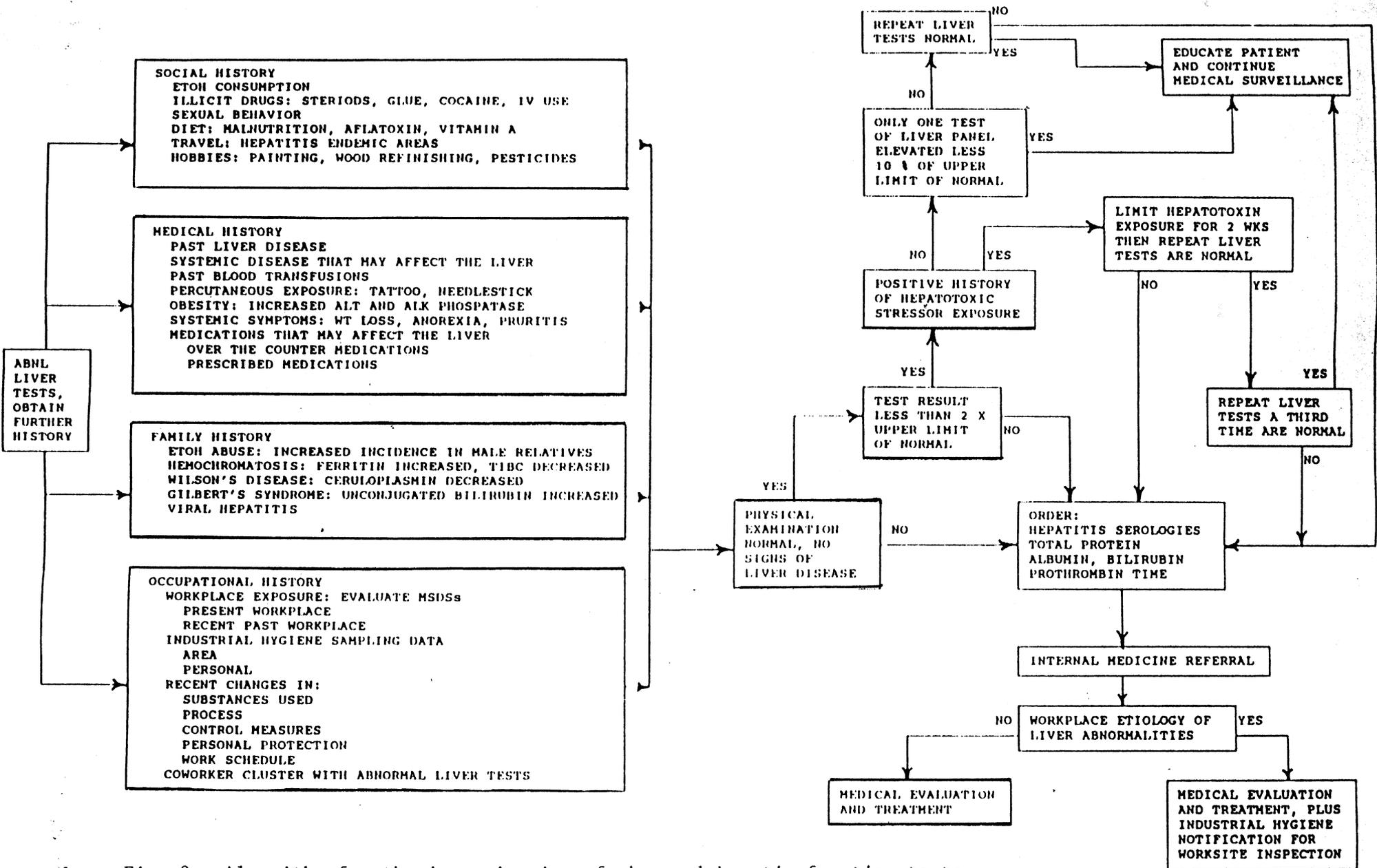


Fig. 2. Algorithm for the investigation of abnormal hepatic function tests in asymptomatic workers.

From: Herip DS. Recommendations for the Investigation of Abnormal Hepatic Function in Asymptomatic Workers. Am J Ind Med. 1992;21:331-339.

(4) How do any of these observations compare to the IH data?

3. **Tertiary prevention:** the improvement of the disease or disability condition. Although tertiary prevention is the least advantageous approach to the individual worker, important information for the development of workplace preventive strategies can be obtained. Examples of this approach include:

(a) The development of occupational health sentinel events that require a reevaluation of hazards, exposures, and work practices. Examples are a list of 64 occupational events, such as hepatitis A in a day care center worker, or contact or allergic dermatitis in a boat building or repair worker (Mullen and Muthy).

(b) Another tertiary preventive approach is the expansion of potential sites to look for occupational injuries and illness treated by primary care providers (including afloat and ashore military sick calls). Patients treated at these sites may not be recognized as having an "occupational" illness or injury, or may not be referred to an OH clinic. Personal interaction with safety professionals, emergency room staff, and physical and occupational therapists may allow the OH provider to define better the scope of occupational illness and injury seen by medical care providers.

(c) The results of large Navy or civilian work evaluations, released as government reports or published articles, may provide clues to evaluate local workplaces and populations. An example is a study from the Navy Health Research Center (White and McNally) which identified that 1371 hospitalizations and 136 deaths occurred from 1974 to 1985 as a result of exposure to hazardous materials. Specific Navy enlisted rates and ages were identified as being high-risk. While this information cannot be considered current, it might provide a meaningful place to look for potential hazards and opportunities for training in safe work practices.

### Sources of Epidemiological Data

Personnel assigned to operational units or military treatment facilities often do not have the manpower, time, or computer resources to perform extensive analyses of the entire universe of potential patients for whom their facility provides OH services. As mentioned previously, service-wide databases have proved too cumbersome to provide meaningful data. Smaller resources do exist including the following:

1. The computerized version of reference NEHC6260 TM96-1, the Medical Surveillance Procedures Manual, is used widely to generate SF-600 facsimile forms for Navy OH medical surveillance programs. This program generates a dBase III Plus (Borland International Inc.) database file (filename employee.dbf) which can be used to produce summary medical surveillance reports for industrial hygienists and command safety officers.

A working knowledge of dBase III Plus is required to use this feature. Information on this program is available by contacting the Navy Environmental Health Center (NAVENVIRHLTHCEN) Occupational Medicine directorate or any Navy Environmental and Preventive Medicine Unit NAVOSH department.

2. NAVENVIRHLTHCEN maintains on computer files data from NAVMED 6260/5 and NAVMED 6260/7 of the Navy Asbestos Medical Surveillance Program.

3. A free computer program called Epi-info has been developed by the US Public Health Service Centers for Disease Control and Prevention (CDC). This program was specifically designed for epidemiological analysis and is relatively simple to use. This program reads and can analyze dBase III Plus files generated by the medical matrix computer program. Ordering information can be obtained at (404) 469-4098 or FAX (404) 469-0681.

4. Data on IH samples sent to the regional Navy Consolidated Industrial Hygiene Laboratories are collated by NAVENVIRHLTHCEN and can be requested for a specific location or command.

5. OPNAVINST 5100.23 series lists the mishap and occupational illness and injury reporting requirements that can provide another source of information. This also can produce the side benefit of closer interaction between safety professionals and OH providers.

### **Conclusion**

The use of epidemiological methods affords the OH professional the opportunity to better understand OH customers. From this approach, meaningful public health interventions can be recommended to another set of our customers - the commands that refer us our patients and who are ultimately responsible for the maintenance of a safe and healthy workplace.