Link was a man who was able to look at a problem and solve it by incorporating ideas and techniques from totally unrelated disciplines. Herein lay his genius. At his death he had over 30 patents credited to his name. He was a man who was able to get and keep a team working together though, I gather, he could well have been a slave driver and tyrant at times. He had unbounding energy and a great capacity for work with little requirement for sleep. Link was at the forefront of developmental diving for three decades and was instrumental in the development of many of the techniques that are now taken for granted.

This book could have been a wonderful history of this man's work. The author has used the diaries written by Link's wife as the source material so that a lot of the really interesting information is glossed over. She spends more time telling us who visited and looked over the ship or what they had for dinner, than she does about what Link was doing with each of the hurdles he was facing, how he was tackling them, and what his thought processes were in overcoming these problems. I was very disappointed with this book. Its prose is dull, its narrative forever interrupted with barely relevant excerpts from the wifely diaries and it glosses over the important features and developments in his life. In its defence however, it did whet my appetite for further research and discovery about this man's life and achievements.

Since reading this book I have gone on to read excerpts of one of his wife's books and it seemed that she is a much more interesting author to read than van Hoek. The problem of this book is just that it was written by the wrong person. Disappointing!

David E. Davies

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THE PRINCIPLES OF HEALTH SURVEILLANCE

Des Gorman,

Introduction

Health surveillance can either be an exercise in primary health care (e.g. measurement of blood lipids to identify people who should change their diet) or an activity-related exercise (e.g. assessment of fitness for diving). In general, the principles are common. The only possible exception is that primary health care surveillance should be prefaced by the "condition" to be screened being shown to be amenable to modification. This is not a necessary preface in activity-based surveillance. For example, it may be worth screening potential blood donors (an activity based surveillance) for antibodies to HIV, but given the resistance of this virus to current treatment, in most communities this would not be cost effective primary health care surveillance.

This review of the principles of health surveillance is biased to activity oriented assessment and fitness for diving, in the context of asthma, will be used as an illustration.

Principles of health surveillance

It is important to examine critically the potential of a "health condition" (a disease, treatment regimen, state of aerobic fitness etc.) for surveillance, as once introduced most screening procedures are very difficult to withdraw. This is due to the population being screened coming to accept the screen as an important part of their health care (often seen as a warrant of fitness). Individuals (and their medical attendants) will always have trouble accepting population-based rationales for allocation and withdrawal of health care. It follows that any health surveillance program, once introduced, must itself be surveyed for efficacy.

The first step in the process of health surveillance is to decide if the condition is worth screening. To justify screening a condition must be:

a important (to the activity or to long-term health);
b prevalent in the subject community;
c (in the context of a primary health care screen only) modifiable (i.e. treatable);
d able to be detected qualitatively and quantitatively by sensitive and specific tests (such sensitivity and specificity will be influenced by prevalence).

On this basis, few of the health screens introduced in the last 20 years in Australasia could be justified. The Armed Forces in both Australia and New Zealand demonstrate many classic examples of poorly focussed and consequently ineffective health surveillance.

If a condition "survives" this review, it must then be decided if the surveillance is cross-sectional or longitudinal. In the context of an activity-based survey, this equates to either a preplacement or ongoing assessment. Often, screens will be able to be justified both

before an activity and as an ongoing screen, however the latter should be reserved for those conditions that are affected by the activity itself or by coincident events or by age. For example, it is worth screening diving candidates for the size of their lungs (FVC) before they undertake any training (as a screen for risk of pulmonary barotrauma). However, the FVC is neither affected by diving nor by age, such that unless the diver has some other form of lung injury or illness, there is no value in periodic reassessment of lung size.

The next step in health surveillance is to decide if the process is to be prescribed or discretionary. The prescribed format is that usually used by the military, occupational diving regulatory authorities, fire and police services and insurance companies. The assessment is based on a prescription (e.g. to be fit for service the candidate must have uncorrected vision in both eyes of at least 6/9). The strength of such assessments is that the medical practitioner or other health professional conducting the review does not require any special training (i.e. they only need to be able to read the prescription) and the outcome of the assessment is unequivocal (pass or fail). The weaknesses of this type of survey is that many candidates will "fall on the thresh-hold" and for many conditions (e.g. asthma) the diagnostic criteria are controversial, such that some form of central arbitration is needed to ensure consistent application of the prescription. Also, the individual being assessed is excluded from the risk assessment. This often results in people who have "failed" such a prescriptive survey "shopping around" for another medical assessment and if aware, avoiding the history that invoked the original negative response (e.g. not describing a history of recurrent shortness of breath and wheezing). Finally, the prescribed format requires a medical practitioner to engage in "policeman-like" behaviour, a role that is not well suited to most doctors.

The discretionary assessment is based on the practitioner evaluating and explaining to an individual the risks (e.g. in the context of an intended activity) and the individual deciding the merit of undertaking the activity. The strength of this process is that the individual is central to the risk acceptance and the medical practitioner is engaging in "physician-like" behaviour. The weaknesses are that the practitioner requires insight (e.g. knowledge of the physics and physiology of underwater exposures for a diving candidate), other risk acceptors are potentially excluded (e.g. dive instructors and dive buddies) and the outcome of the assessment is often uncertain (e.g. the diving candidate may decide to take the risk of diving in the context of active asthma). Many practitioners who use a discretionary approach do have a prescribed threshold as a base (e.g. a diving candidate with phenytoin (Dilantin) controlled epilepsy would not be given the opportunity for discretion, whereas a candidate with a history of asthma in childhood would be consulted).

Any health surveillance then requires careful examination of purpose and efficacy; and also is dependent on the assessing practitioner being aware of the nature of the process.

Asthma and diving fitness

Asthma and fitness for diving can be used to illustrate these principles of health surveillance, particularly in the context of a pre-placement assessment.

Firstly, does asthma warrant screening in a population of diving candidates? The answer is clearly yes, given that:

a asthma is important in diving (Exercise, breathing a dry cold gas or alternatively a salt water aerosol, anxiety etc. may all precipitate asthma. Active asthma will limit a diver's cardiorespiratory fitness in the water and may cause them to drown. Air trapping in an asthmatic lung may cause pulmonary barotrauma during a decompression. Some bronchodilators will reduce the ability of the lungs to filter venous bubbles during and after a decompression);

b asthma is common in Australasia (perhaps 20 to 30% of the population wheeze at some time of their lives);

c tests of bronchial reactivity do exist and there are claims of reasonable sensitivity and specificity for salt water provocations (the same cannot be said for histamine and methacholine challenges).

The review can be prescribed or discretionary, or a mixture of both. A variety of approaches are used. They vary from considering that any candidate who has asthma is fit to dive providing they do not dive when they have active asthma (this is a common stance in the UK and is based on some of the worst epidemiological data ever published, and ignores the potential for diving to provoke asthma), to considering those who have had no recent (3 to 5 years) history of asthma (or of using asthma medication) as being fit to dive, to only considering those with any history of asthma at any time as being fit to dive if they have demonstrably normal bronchial reactivity (a problem here is that some viral URTIs can cause temporary bronchial hyperreactivity), and finally to the stance that any history of asthma is incompatible with diving. Any of the former approaches do require some ongoing health surveillance.

Summary

Health surveillance is potentially useful, but often expensive, ineffective, time consuming and distracting. This is usually a direct result of a health surveillance program that is inappropriate and or the practitioner involved not being aware of the nature of the process. The principles of

health surveillance should be understood by those who intend to engage in such screening.

Key words
Pre-placement, discretionary assessment, prescribed assessment, asthma.

Dr Des Gorman, FAFOM, PhD, is a consultant to the Royal New Zealand Navy, the Royal Adelaide Hospital and Head, Occupational Medicine, School of Medicine, the University of Auckland. His address is Private Bag 92 019, Auckland, New Zealand.

OBSERVATIONS ON ASTHMA IN THE RECREATIONAL DIVING POPULATION

A Bove

I will review a little bit about the pathophysiology of asthma. Some of the data that we collected for DAN in an attempt to make a statement about what to do with asthmatics in diving. Asthma is a common disease. Some people estimate about 10% of the US population are asthmatics. I was in the desert for several months during the Gulf War and a large number of the young American marines, who went into the desert, came to our hospital wheezing with significant asthma because of the organic dust that is in the air there. Our surveys in the US indicate that the incidence of asthmatic divers is the same as the incidence of asthma in the general population which means there is no effective screening. Asthmatics are getting into diving, probably by not revealing their past history. So, generally, asthma comes under the list of pulmonary disorders in diving, and I do not want to dwell on the other ones, although they are there. The history of pneumothorax, the history of any other chronic lung disease, pneumoconiosis, all would eliminate somebody from diving. The question about what we do with previous barotrauma is also unanswered.

If one looks up the text book definition of asthma it is usually stated as "generalised airway obstruction due to the contraction of bronchial smooth muscle". It has a series of clinical characteristics. Often it is associated with a cough, dyspnoea (shortness of breath) with mild exertion, wheezing, the over inflation syndrome, that is the lungs are over inflated, and often the auscultatory finding of wheezing and crackles throughout the lungs because of secretions retained in the airways. I do want to make light of the cough because many people who have very mild asthma, develop a cough and do not understand what it is about. People are sent to me with a cough thought to be heart failure, it often turns out they are asthmatics and a bronchodilator gets rid of the cough. The cough was related to airway reactivity, so there are a number of different presentations. The severe obstructive airway disease which causes wheezing and dyspnoea is only one end of the spectrum.

Allergy and infection are the two most common trigger mechanisms. Most asthmatics have a family history, in parents, siblings or children, of other allergies. Infection of the upper airways is often a trigger in the person with hyper-reactive airways. Adult bronchiolitis, when a viral infection of the airways causes wheezing, is a truly transient phenomenon and it is not related to reactive airways. There is a small number of patients who wheeze with bronchitis, but if that is the case one should not classify that patient as an asthmatic. In these cases one needs to wait several months to allow the airways to settle down before doing any testing. Acute anxiety will do this and I think it is probably because of the change in hormone that stimulates the airways. Parasympathetic stimulation will cause reactive airway disease, and of course the catecholamines usually cause relaxation of the airways so we use epinephrine (adrenalin) to relax the airways. Exercise will induce wheezing, and cold will induce wheezing. Cold and exercise are somehow irritants to the airways which can cause bronchospasm under those conditions. So there is a number of trigger mechanisms.

In a chronic asthmatic the process goes beyond just pure smooth muscle activation and bronchial constriction. There ultimately becomes hypertrophy or overgrowth of the bronchial smooth muscle so there is thickening of the bronchial walls. There is mucosal oedema and secretions in addition to bronchial hyperaemia. All these things will cause airway obstruction. In particular the retention of secretions in the small airways is a common complication in asthmatics because with bronchial relaxation, the airways do not always completely clear. Often one must use inhalation therapy with mucolytic agents to clear the bronchial secretions. This is an important part of the chronicity of asthma.

Fishman[1] is a well respected pulmonary physiologist who studied asthma for a long time and classified severity in a range of one (most) to five (least). I think the single most useful measure of an asthmatic is the alteration in airway conductance. The normal person, or the minimal asthmatic, has essentially normal airway conductance. As one goes through the spectrum of severity to what essentially is chronic obstructive lung disease, there is a progressive decline in the airway conductance, that is there is more and more resistance to the motion of air through the airways.

This is manifest by a number of different measurements. The forced expiratory flow, between twenty five percent and seventy five percent (FEV_{25-75}), or any of