INTERNAL MEDICINE JOURNAL

Internal Medicine Journal **39** (2009) 763–770

BRIEF COMMUNICATIONS

Utility of regular medical examinations of occupational divers

C. Sames,[1,2] D. Gorman,[2,3] S. J. Mitchell[2,3] and G. Gamble[3]

[1]Naval Health Services, Royal New Zealand Navy, [2]Diving Medical Directorate to the New Zealand Department of Labour, and [3]School of Medicine of the University of Auckland, Auckland, New Zealand

Key words
occupational diving, health surveillance, fitness for diving.

Correspondence
Des Gorman, School of Medicine, Level 12, Support Bldg, Auckland City Hospital, Faculty of Medical and Health Sciences, University of Auckland, Private Bag 92019, Auckland, New Zealand. Email: d.gorman@auckland.ac.nz

Received 15 October 2008; accepted 23 November 2008.

doi:10.1111/j.1445-5994.2009.02055.x

Abstract

The utility of regular medical fitness-for-diving examinations of occupational divers is unknown. The aim of this audit was to investigate the impact on the employment of occupational divers of a 5-yearly medical examination and an annual health surveillance questionnaire administered in intervening years. The medical records of all New Zealand occupational divers registered with the Department of Labour for at least 5 years were audited ($n = 336$). Each record included at least two full medical examinations (mean spacing of 5.6 years). An impact on career was defined as the diver being issued with either a conditional certificate of fitness or being graded as temporarily or permanently unfit for diving. The means by which the relevant medical issue was identified was recorded. Ten (3%) of 336 divers had an assessment outcome, which had a career impact. One was considered permanently unfit, four were temporarily unfit, and five were issued with conditional certification. Two were identified by respiratory function testing and eight by way of their responses to the questionnaire; none was found by the medical interview and examination process. The questionnaire system did not 'miss' any divers who developed a critically important health problem, and detected most of those with less important problems. Five yearly medical examinations have a low detection rate for important health problems, but remain useful for discussion of risk understanding, acceptance and mitigation.

Occupational health surveillance is undertaken for many different reasons and should be tailored to the specific occupational setting.[1] Thus, fitness for work assessments need to predict actual work fitness and identify health problems that might be exacerbated by the work situation, might be a safety concern at work, or might predispose the candidate to work-related injuries and illnesses. There are some occupations that are subject to relevant regulation, including public transport drivers, dangerous goods drivers, pilots and occupational divers.

In many jurisdictions, occupational divers are required to undergo an annual medical assessment that includes a history and comprehensive medical examination by an appropriately trained doctor. Required or recommended investigations may include lung function tests, audiology, various blood tests, resting and exercise electrocardiograms (ECG), chest radiographs (CXR), long bone radiographs, and even psychometric testing and magnetic resonance imaging (MRI) scans.[2] There is no evidence for this practice from occupational cohort studies or from evaluations of the routine medical examination of recreational divers.[3,4]

In New Zealand and Australia, regulations have been based on the relevant Australian and New Zealand Standard,[5] which prescribes a comprehensive medical examination and investigations both at entry to the industry and then annually. We have previously shown that this comprehensive approach is of doubtful validity at even the initial evaluation,[6] let alone when repeated annually. As a consequence, the nature of the initial assessment for occupational diving in New Zealand was modified, and the need for ongoing assessment was relaxed to a

Funding: None
Conflict of interest: None

5-yearly comprehensive interview and examination by a doctor trained in diving medical fitness assessment. In the intervening years, the only regular requirement is for the diver to complete an annual health status questionnaire. This is reviewed by expert diving physicians on behalf of the New Zealand Department of Labour. Where the questionnaire reveals any potentially significant health issues, defined in the relevant guidelines as 'an accident, illness, a change of medication, or any medical circumstance which is likely to affect their medical fitness to dive', a new comprehensive interview and examination is required prior to recommencing work. In the past 5 years 12 (<1%) such additional assessments have been required.

This audit was undertaken to determine the validity of the revised process. The major concern is whether the reduced frequency of comprehensive assessment results in divers who have health problems working inappropriately. Consequently, we reviewed the records of those divers who had completed a full 5-year cycle leading to a second comprehensive evaluation to determine whether any important health problems had been 'missed' by the intervening questionnaire approach.

The revised system was introduced in 2002 and by early 2008, 336 divers (23% of the total population of 1475 registered occupational divers in New Zealand) had undergone a full 5-year cycle; in particular, they had been comprehensively assessed for the second time after completing 4 years of questionnaire-based assessment only. *A priori* consent was obtained from the divers at the time of each assessment and an anonymous clinical file audit was conducted on this subgroup of 336 divers. Regional Ethics Committee approval was sought, but not required for this audit. We identified all subjects who had passed the first of the two comprehensive medical assessments, and in whom an impact on career was subsequently detected from either the questionnaire or the second comprehensive assessment and investigations approximately 5 years later. An impact on career was defined as the diver being issued with either a conditional certificate of fitness or being graded as temporarily or permanently unfit for diving. We then noted how the health issue precipitating the impact was first identified (questionnaire, oral history, examination or investigation). Data were recorded into a purpose-designed database (Microsoft Access).

The demography of the 336 diver cohort is summarized in Table 1. The mean period between the comprehensive assessments for this group was 5.6 years. The self-assigned occupational subgrouping of this cohort was 148 commercial divers, 122 scientific divers, 30 recreational dive instructors and 15 military divers. For 326 divers (97%), no important health problems were identified by questionnaire, interview, examination or investigation.

Table 1 Demographic characteristics of a cohort of 336 New Zealand occupational divers at initial assessment of medical fitness for diving

	No. or Mean (standard deviation)	Range
Male	311	
Female	25	
Height (cm)	177.9 (7.1)	158–196
Weight (kg)	82.3 (12.8)	50–116
Body mass index	26 (3.4)	20–36
Age (years)	35.6 (8.6)	18–65
Smoker (past but not current)	25	
Smoker (current)	33	
Non-smoker (ever)	278	
Years of occupational diving	13.8 (8.8)	0–42
No. dives in past year ($n = 52$)	97 (117)	0–600
No. dives >30 mm in past year ($n = 25$)	5 (14)	0–50
Time to second examination (years)	5.6	4.8–12

Over the 5-year period, one diver only was determined to be medically unfit for occupational diving on the basis of a spinal injury, which was declared by the diver on an annual questionnaire. Another four divers were considered temporarily unfit while further assessments were undertaken. Three of these situations arose because of questionnaire responses (see Table 2). One arose because of abnormal spirometric lung function testing, which was performed as part of the 5-year assessment. Finally, a group of five divers had conditions imposed on their diving practice (see Table 2). Again, all but one of these were identified on the basis of questionnaire responses. The exception similarly arose because of abnormal spirometric lung function testing at the 5-yearly comprehensive assessment.

Ten of 336 divers (3%) who completed a full 5-year cycle of the revised assessment system for medical fitness for occupational diving in New Zealand were found to have a health problem that impacted on their employment. Eight divers (including the only one who was unable to resume work as a diver) declared their problem on an annual questionnaire and two were identified by lung function testing at the 5-yearly medical. Although it can be argued that the two lung function abnormalities might have been detected earlier by annual comprehensive evaluations (including spirometry), it must be noted that neither diver was made permanently unfit to dive. Neither case challenged our belief that a diver with previously normal spirometry who developed a new lung problem serious enough to warrant disqualification from diving would be detected by a properly designed questionnaire.

Table 2 Details of 10 New Zealand occupational divers whose employment was affected by the outcome of a regular medical examination or questionnaire

Category	Sex/age	Method of identification	Medical problem
Permanently unfit for diving	M/35	Questionnaire	Spinal injury
Temporarily unfit for diving	M/33	Spirometry	Impaired lung function
	M/55	Questionnaire	Heart surgery
	M/36	Questionnaire	Deafness and tinnitus
	M/36	Questionnaire	Deafness and head injury
Conditional certification for diving	F/45	Spirometry	Impaired lung function
	M/34	Questionnaire	Otic barotrauma
	M/49	Questionnaire	Heart surgery
	M/58	Questionnaire	Asthma
	M/53	Questionnaire	Atrial fibrillation

Two conclusions are possible on the basis of this audit. First, despite the obvious reliance on honesty by responding divers, the questionnaire system does not seem to 'miss' any divers who have developed a critically important health problem that would subsequently be detected by a comprehensive assessment. Second, there needs to be some other justification for ongoing comprehensive assessments, even at 5-year intervals, as the detection rate for important health problems approaches zero.

We are not aware of any data that challenge the first of these conclusions. The authors of a study of 480 German Navy divers concluded that the annual routine medical examination, which included ECG, bicycle ergometry, CXR, spirometry or plethysmography, blood and urine testing, specialist eye, ENT and dental examinations, and a pressure test in the hyperbaric chamber (as well as a hyperbaric oxygen tolerance test for those divers who use nitrox or oxygen re-breather devices), contributed to minimizing the risk of accidents in military diving operations.[7] However, no relevant supportive data were presented. By contrast, our earlier audit showed little utility for any element of the initial assessment process used in Australasia,[6] and our present study suggests that comprehensive annual assessments of the type described by Weiss[7] are an over-inclusive and unnecessarily expensive approach to ongoing health surveillance. Although not strictly relevant to occupational divers, routine medical examinations were also shown to be of little value in Scottish recreational divers,[3] and a follow-up analysis undertaken 3 years after instituting a system of self-reporting questionnaires and clinical examination only in those recording a positive response, confirmed that the questionnaire is an effective screening tool.[4]

It is relevant to our first conclusion that our system employs central arbitration by an expert who has access to the records of all divers' previous comprehensive examinations and questionnaires. This allows contextualizing of questionnaire results and detection of inconsistencies over time, which almost certainly contributes to the sensitivity of the method in detecting significant problems. An added benefit is the prevention of inconsistent decision-making between different practitioners at the initial and 5-yearly medical evaluations. This can be problematic, as demonstrated by an Australian postal survey, which showed that there was little consensus about what constitutes diving fitness among 52 Queensland doctors who perform diving medical examinations.[8] This finding concurs with our own experience that only about half of all important health problems revealed on interview and/or examination of divers by 'trained' doctors are identified as such (also, unpublished audit data).[6] The low rate of reporting by these doctors can be variously explained by a lack of knowledge at one extreme to 'client advocacy' at the other.[1]

Our second conclusion relates to the broader principles of occupational health surveillance.[1] On the basis of this and our earlier audit,[6] it is difficult to justify the present method of health surveillance in occupational divers with respect to work capacity assessment,[9] or for reducing the absolute risk of illness and injury.[1] However, work as a diver does involve the management of risk. The broader purpose of occupational diving health surveillance then is to enable divers and their employers, and the wider community of interest, to make informed decisions in the context of risk understanding, acceptance and mitigation. This is increasingly important as the long-term effects of a career as a working diver become apparent.[10]

On this basis, we are not recommending any further changes to the New Zealand system. We believe there is value in a diver seeing an appropriately trained doctor every 5 years to discuss their health and work practices. It also provides an opportunity for monitoring the status of hearing, which is known to deteriorate over time in occupational divers,[11] but sufficiently slowly that an impact on career might not be detected by this audit. However, these audit data do enable us to argue that annual

comprehensive assessments are unnecessary. Finally, our reliance on a central expert panel to determine the medical fitness for occupational diving in New Zealand is reinforced by this audit, as is the value of a central register in executing such analyses.

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Pulmonary hypertension in pregnancy: two cases and review of the literature

A. M. Higton, C. Whale, M. Musk and E. Gabbay

Advanced Lung Disease and Lung Transplant Unit, Royal Perth Hospital, Perth Western Australia, Australia

Key words
pulmonary hypertension, pregnancy, management, prognosis.

Correspondence
Alexandra M. Higton, Advanced Lung Disease and Lung Transplant Unit, Royal Perth Hospital, Ainslee House, Murray St, Perth, WA 6000, Australia. Email: alexhigton@yahoo.co.uk

Received 4 August 2008; accepted 6 October 2008.

doi:10.1111/j.1445-5994.2009.02051.x

Abstract

Pulmonary arterial hypertension (PAH) in pregnancy carries a mortality of 30–56%. There are few published data to guide clinicians in its management. Two pregnant women with severe PAH have been treated at Royal Perth Hospital with a successful result in both. Their presentation and management are described. We review the physiological changes in pregnancy, pathophysiology in PAH, and review the literature describing treatment of PAH in pregnancy.

Funding: None
Conflict of interest: Eli Gabbay is on the advisory board and received travel expenses, research funding and honoraria from Actelion and is on the advisory board of CSL and GSK.

Pulmonary hypertension in pregnancy carries a mortality of 30–56%.[1] There are few published data to guide clinicians in its management.

A 23-year-old aboriginal woman presented at 33 weeks gestation, in her first pregnancy, with frank