

# A review of 17 years of telephone calls to the Australian Diver Emergency Service (DES)

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## Abstract

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**Introduction:** The Diver Emergency Service (DES) in Australia provides specialised medical advice on diving incidents 24 hours a day to divers, dive operators, families and health professionals. It is operated from the Hyperbaric Medicine Unit of the Royal Adelaide Hospital where the physician-on-call also carries the DES phone (1800-088200 or +61-8-8212-9242).

**Methods:** Data from calls to the service have been compiled into a computer database since 1991. Calls for the 17 years from 1991 through 2007 were analysed.

**Results:** A total of 6,083 calls were logged, an average of 358 calls a year. Calls from Queensland and New South Wales each accounted for 25% of calls. Calls originating from outside Australia have been increasing and now make up 25% of calls. The diver themselves initiated the call 50% of the time and 66% of the calls were about male divers. The age range of divers was 12 to 95 years old. The mean age has increased from 30 to 36 years, with a greater proportion of calls from divers aged 50 years or older (from 2% to 14%). The largest group of calls (37%) related to whether symptoms might be the result of decompression illness (DCI). DCI was considered to be the probable diagnosis in 17% of calls, and possible in a further 12%. Other common findings were barotrauma (11%) and questions regarding fitness to dive (15%). Older divers were more likely to call in relation to a medical problem.

**Conclusion:** Interpretation of these data is qualitative but the prolonged collection period of 17 years allows some consideration of trends as to who calls the DES and why.

## Key words

DES - Diver Emergency Service, incidents, injuries, fitness to dive, decompression illness, numbers, safety

## Introduction

The Divers Emergency Service (DES) in Australia is a dedicated telephone number (1800-088200 or +61-8-8212-9242) offering specialised diving medicine advice 24 hours a day. It has operated since 1986 from the Hyperbaric Medicine Unit (HMU) of the Royal Adelaide Hospital. There has been a perception that the medical training of doctors in Australia does not adequately equip them to assess and manage many dive-related problems, and that this may have led to the compromised care of some divers. The mission of DES is to provide relevant and timely advice which will allow formulation of a management plan for an injury or health concern in a diver. Anyone can call DES; however, it is specifically targeted to the diving community and the medical field.

The financial costs have been kept to a minimum with the medical advice provided by the hyperbaric physician-on-call at the Royal Adelaide Hospital. However, there has always been a requirement to pay for the dedicated telephone handset and associated call costs. Initially, this money came from a government grant, various donations and from fund-raising activities undertaken by HMU staff. In 1993, the non-profit, dive safety organisation Divers Alert Network Asia-Pacific (DAN AP) offered to fund the service while maintaining access for the entire diving community.

The current system utilises a free-call number for calls made within Australia and a user-pays number for international calls. Calls are answered by the Communications Room of the South Australian Ambulance Service where basic details are gathered and any immediate advice provided. A pager alerts the physician on call to an incoming call, which is transferred to the phone held by the physician. A printed data sheet is used to record the information and any advice provided. This review is an analysis of 17 years of information recorded from 01 January 1991 to 31 December 2007.

## Methods

On completion of the DES call, the data sheets are stored securely in the HMU. Monthly transcripts are received from the Ambulance Communication Room, which are reconciled with the information on the data sheets. Since 1991, this information has been entered into a database (Office Access 2003®; Microsoft Corporation, Redmond, Washington) and stored on a secure computer within the HMU.

Trends in the data were assessed for significance by linear regression and have been reported as scatter plots with regression line, the coefficient of determination ( $r^2$ ) and probability value. Trend analysis and chi-squared test were performed using statistical software (Statistica version 6; Statsoft, Tulsa, Oklahoma). It was not possible to

**Table 1**Origin of DES calls 1991 through 2007 (*n* = 6,083)

Origin of call	No of calls	%
Queensland	1647	27
New South Wales	1500	25
Victoria	685	11
South Australia	660	11
Western Australia	367	6
Tasmania	85	1
ACT	83	1
Northern Territory	80	1
Overseas	896	15
Unidentified	80	1

obtain specific consent from each caller for the use of this information; however, the reporting of de-identified DES data has been approved by the Research Ethics Committee of the Royal Adelaide Hospital.

## Results

There were 6,083 logged telephone calls handled, an average of 358 calls per year (Figure 1). Figure 1 also shows the time of the day that the call was received (Australian central time). The total number of calls received from each state of Australia and from overseas is listed in Table 1. The decline in the number of DES calls over the review period can be attributed to a significant trend of fewer calls from Australia (Figure 2) with the numbers symmetrically reduced across all of the Australian states. In spite of this, there has been an increasing trend in calls from overseas (Figure 2) such that they now constitute about 25% of the annual total. A further 25% of calls currently originate from each of Queensland and New South Wales with the remaining 25% from the other Australian States and Territories. There were a total of 896 calls from outside of Australia. The bulk of these calls came from the very popular band of tropical dive locations to the north of Australia, stretching from Thailand in the west to Fiji in the east (Table 2). However, calls have come from almost every imaginable location including the Red Sea, Korea, Galapagos Islands and the Australian

**Table 2**Most frequent locations of overseas calls to DES (*n* = 896)

Origin of call	No of calls	%
Papua New Guinea	216	24
Indonesia	140	16
Thailand	89	10
Solomon Islands	73	8
Vanuatu	55	6
Fiji	52	6
Malaysia	52	6
All other locations	224	25

Antarctic Territory, and from commercial aircraft while in flight. Although the data are not illustrated, the southern states of Australia made fewer calls over the months of June to August, which corresponds to the winter months in the Southern Hemisphere. The overseas calls showed no variation over the course of the year and calls from Queensland showed only a mild dip over winter.

The caller is categorised in Table 3. Consistently about 50% of the calls originated from the diver themselves and about 2% of calls from the buddy. While a call from an instructor or divemaster usually indicates someone who had been in the water with the diver, a non-diving supervisor is considered to be someone with a responsibility for the activity but who had not been in the water at the time of the incident. This category includes dive shop owners, dive boat skippers and supervisors of commercial dive operations. There has been an increasing trend in calls from instructors and divemasters (Figure 3) and they currently make up about 20% of annual calls. There has been a decreasing trend in calls from physicians (Figure 3). In the early years over 30% of calls came from physicians but more recently they make up about 10%.

**Table 3**Who called the DES phone line? (*n* = 6,083)

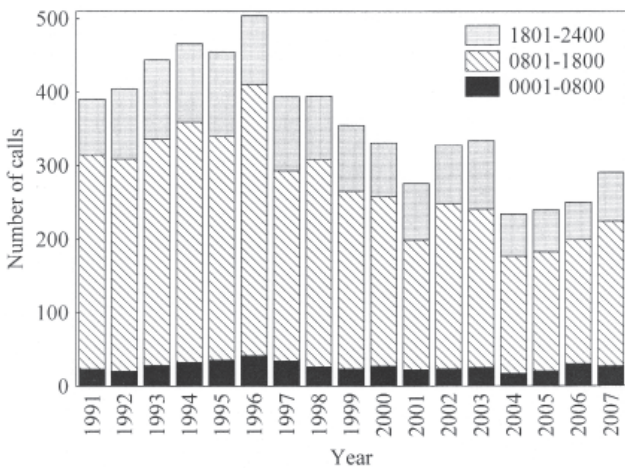
Caller	No. of calls	%
Diver	3029	50
Buddy	134	2
Physician	1177	19
Instructor/divemaster	499	8
Non-diving supervisor	200	3
Family/friend	321	5
Nurse	86	1
Other	637	10

**Table 4**Summary of calls to DES about children ≤ 15 years (*n* = 77); DCI – decompression illness

Diagnosis	No of calls	Age range (yr)
Probable DCI	1	15
Possible DCI	13	12–15
Unlikely DCI	6	12–15
Ear barotrauma	7	13–15
Sinus barotrauma	3	12–15
Pulmonary barotrauma	1	14
Fitness-to-dive enquiry	22	7–15
Medical problem	9	2–15
Marine envenomation	7	3–14
Musculoskeletal/trauma	2	12, 13
Altitude post-dive	2	14, 15
Other	4	14–15

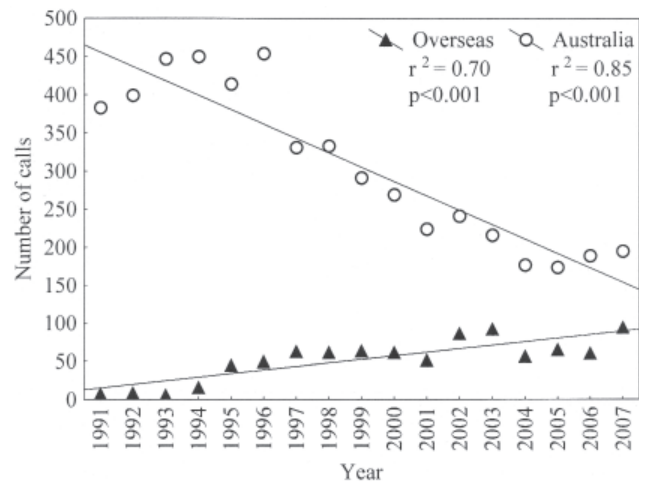
**Figure 1**

Number of DES calls and time received (Australian central time)



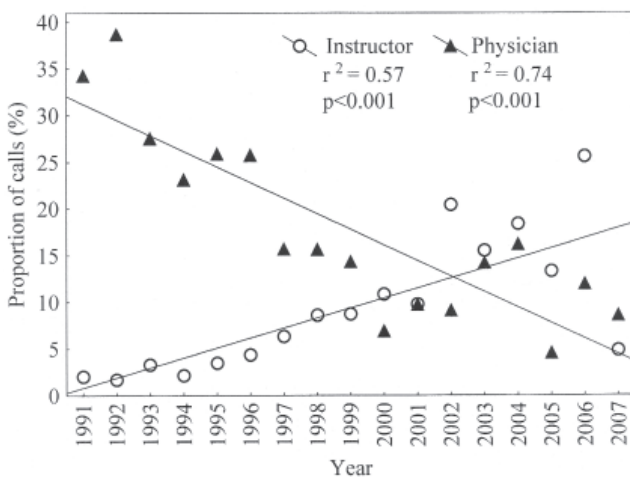
**Figure 2**

Trend in DES calls from Australia and overseas



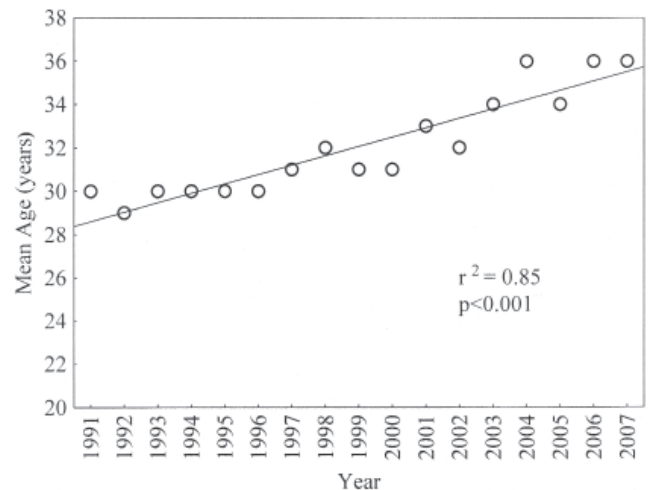
**Figure 3**

Trend in calls from instructors and physicians



**Figure 4**

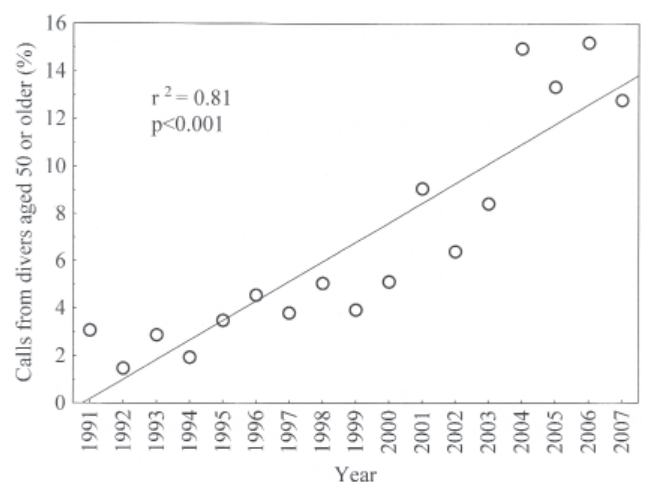
Age of divers calling the DES line, by year



The diver was male in 66% of calls, with a wide age range, from 2 to 95 years old. Some of the calls about children did not actually involve diving, such as the three-year-old with a marine envenomation while wading in water or the physician with a nine-year-old prospective scuba diver and a fitness-to-dive question. The youngest person with a diving problem was 12 years old; the 95-year-old was a scuba diver. Calls relating to children (15 years and younger) are summarised in Table 4. There has been a trend of increasing mean age of the diver (Figure 4), from 30 to 36 years. Also, the proportion of calls from divers aged 50 years or older has shown an increasing trend (Figure 5) from 2% to 14%. A total of 359 calls were from divers aged 50 years or older (6% of total).

**Figure 5**

Percentage of DES calls from divers ≤50 years, by year



The provisional diagnosis or reason to call is summarised in Table 5. There was a declining trend for fitness-to-dive questions (Figure 6) from over 30% to 15% currently. There was also an increasing trend in enquiries regarding

**Table 5**

Diagnosis/reason for call to DES; DCI – decompression illness (n = 6,083)

Diagnosis	No of calls	%
Probable DCI	1026	17
Possible DCI	732	12
Unlikely DCI	466	8
Barotraumas	664	11
Fitness to dive	844	14
Information	528	9
Follow up	267	4
Musculoskeletal	249	4
Medical	333	5
Marine envenomation	143	2
Dive related	242	4
Other	589	10

**Table 6**

Common symptoms and signs reported to DES line with probable decompression illness (n = 1,026)

Symptom	Number	%
Pain	595	58
Paraesthesia	551	54
Fatigue	295	29
Headache	200	19
Dizziness	177	17
Weakness	164	16
Nausea	147	14
Poor concentration	119	12
Skin rash	80	8
Visual disturbance	54	5
Loss of consciousness	39	4

**Table 7**

Calls to DES diagnosed as barotrauma (n = 664)

Site of barotrauma	No of calls	%
Middle ear	298	44.9
Inner ear	99	14.9
Sinus	147	22.1
Pulmonary	86	13.0
Mask	25	3.8
Dental	7	1
Suit	2	0.3

medical problems unrelated or incidental to diving (Figure 6), currently almost 10% of calls. Probable decompression illness (DCI) was diagnosed in 1,026 calls (17%), 689 males and 337 females. Cerebral arterial gas embolism (CAGE) was suspected in 70 calls (7% of probable DCI calls). The reported signs and symptoms of DCI are shown in Table 6. Multiple symptoms and/or signs were common. Skin rash was reported in 80 calls (51 males, 29 females; 8%) with an increasing trend to reporting a rash with probable DCI (Figure 7). Loss of consciousness was reported in 39 calls, with CAGE believed likely in 32. A rapid ascent was reported in 14 of the 32 calls. Barotrauma was diagnosed in 664 calls (11%) (Table 7).

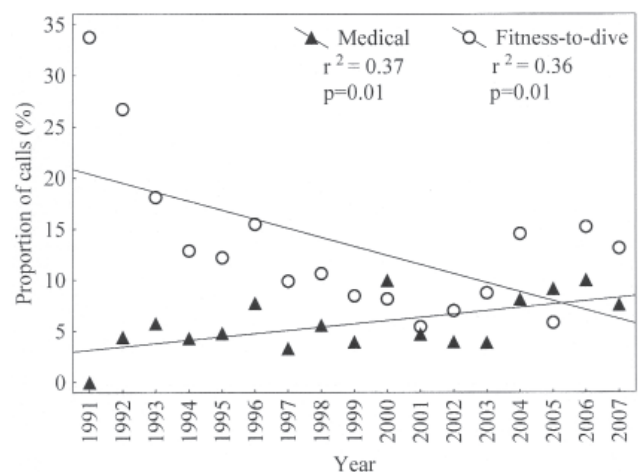
The diagnosis or reason to call was compared for divers aged 50 or older to those younger than 50 years (data not displayed). There were very few differences in the diagnoses; however, there was a significantly higher proportion of calls related to a medical or non-diving issue in the older group of divers (13%) compared to the younger cohort (5%) ( $\chi^2 (1, n = 6,083) = 31.00, P < 0.001$ ).

**Discussion**

The primary role of DES has always been telemedicine. Telemedicine involves the use of information and communication technologies to deliver health care services,

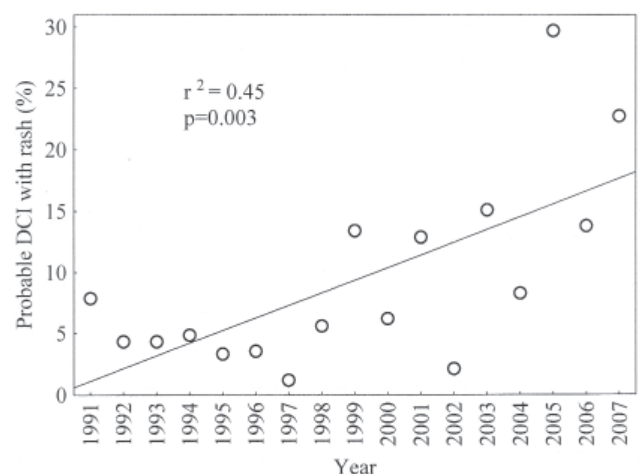
**Figure 6**

Trend in calls to DES about fitness to dive and medical issues



**Figure 7**

Trend of probable decompression illness (DCI) causes reporting skin rash to DES line



usually over a distance. While telemedicine is becoming increasingly sophisticated, with use of video facilities and even robotic surgery, DES provides a telephone-based service only. The advantage of this, however, is that anyone with a mobile phone can now access specialised medical advice in underwater medicine.

Independent of the telemedicine aspects, it was recognised early in the life of DES that there would be value in collating and analysing the information derived from these calls. This information creates a database of diving incidents that relates to the (usually immediate) health concerns in divers. Other diving incident databases do exist, and different methods of data collection will influence the information reported. For instance, the British Sub-Aqua Club (BSAC) publishes an annual diving incidents report.<sup>1</sup> Incidents are any unexpected dive events, not just medical problems. Divers are invited to complete a web-based form sometime after the incident with further contextual information sought, from which precipitating and contributing factors might be identified. The Divers Alert Network (DAN) publishes an annual report which describes the emergency calls made to their Medical Call Services Centre (DAN 'Hotline').<sup>2</sup> The Hotline operates as a telephone-based medical help service similar to DES, and the data from both more closely reflect the "*perspective of the first responder to an emergency*".<sup>2</sup>

As with any database of incidents, DES data are qualitative, not quantitative. Only data from those incidents that get reported will be collected. Also, there is no record of the denominator, or total number of dives taking place. Analysis of the data, therefore, will not allow calculation of the incidence or prevalence of specific events. However, it will highlight common problems and identify areas that might require further consideration. With 17 years of data to call on, consideration of trends into who calls the DES and why is possible.

#### CALLS – WHEN AND WHERE FROM?

Notwithstanding the qualitative nature of the DES data, the pattern of these calls does conform to what would be expected of a cross-section of diving activity. Two-thirds of the divers were male. Also, most of the calls came from Queensland and New South Wales, two states traditionally expected to account for a large proportion of the diving activity. On an annual basis, there was a consistent dip in calls from the southern states over winter months, when the cooler water temperature attracts fewer divers. This seasonal variation in calls can also be seen in the BSAC reports, given that the diving is in the United Kingdom.<sup>1</sup> BSAC found that, in 2010, 74% of the reports occurred during the summer months. If DES is accurately reflecting dive activity, then two trends in the origin of calls warrant discussion.

Firstly, a decreasing number of calls were made from within Australia over the period of the review (Figure 2). While the analysis does show a prominent decreasing trend (using

linear regression admittedly), the scatter plot also suggests that the numbers may have reached a plateau in the last couple of years. This raises the often-debated consideration that fewer people are actively diving. Estimating how many dives have actually taken place is very difficult as one must rely on many assumptions. One paper suggested that the training agencies in Australia certified 54,153 new scuba divers in 1994 but only about 48,000 in 2007.<sup>3</sup> Other interpretations for the decline might be that fewer divers suffered injuries, whether through better training, safer dive practice, or that fewer people chose to use the service.

The other trend is the significant increase in overseas calls (Figure 2). The initial increase may be attributable to DAN AP's participation in 1993 and subsequently better advertising of the DES throughout the broader Asia-Pacific region. The steady rise since may be due to an increased awareness of DES (even though there were fewer calls from Australia at the same time) or an increase in the overall number of divers visiting these regions together with an increase in diving activity of the local population. Remote areas in the Asia-Pacific region offer divers the opportunity to dive in pristine, undeveloped environments. An increase in tourism trade and improved transport infrastructure within these countries now allows more divers to reach these locations. Unfortunately the improved access for tourists has not been matched by a commensurate improvement in the medical facilities available to them. This, in turn, highlights some of the difficulties DES has encountered when dealing with a problem in a remote location; the advising physician is heavily reliant on the quality of the telecommunication contact when attempting to collect accurate information, usually in the absence of examination findings and any knowledge of the medical support that is available locally and regionally. It seems that divers give more thought to the dive site when planning their trip than to the availability of appropriate medical services or to anticipating and preparing for the problems a dive trip might entail.

One change in recent years is the improved network of recompression chambers now available in the Asia-Pacific region, making consideration of aeromedical retrieval less common. Details of the location of regional recompression chambers are kept on file with the DES telephone. The increasing load of calls from divers looking for medical assistance while diving overseas, together with the sometimes limited medical options they have available to them, suggests this issue deserves more attention.

The catchment area served by the DES is large, stretching across Asia and much of the Pacific, encompassing many time zones. Calls have come from all corners of the world. Little can be interpreted from the time of the call and it usually bears no relationship to the severity of the problem. Some problems lead to immediate contact while other problems may be observed and contemplated for a period of hours, sometimes weeks.

## WHO CALLS?

The diver made the call half of the time; however, it was surprising how few calls were made by the buddy: only 2%. While the sport always promotes 'buddy diving', the DES data suggest any involvement of the buddy evaporates once divers are out of the water. The role of the buddy certainly becomes less important with any delay in onset of symptoms and with the common recreational practice of diving as a group under the supervision of a dive instructor or divemaster. Although the divers may be 'buddied up', it is the instructor or divemaster who has overall responsibility for the group, prompting them to initiate contact with DES. Certainly there has been an increasing trend of calls from instructors and divemasters (Figure 3); on the other hand calls from the buddy have been consistently low throughout.

Many calls from an instructor or divemaster were made in the immediate post-dive period while still on board the dive boat, and usually indicated a problem with a rapid onset. A delay in onset or recognition of a problem may then lead to a call from a non-diving supervisor, such as the shop owner who learns of a problem only once the diver has returned to shore. Calls from a dive boat skipper were often from live-aboard vessels in far-flung locations using a radio telephone.

Calls from physicians have fallen over time (Figure 3). When you consider the similar reduction in calls about fitness-to-dive (Figure 6), especially from the earlier years when fitness questions made up 30% of calls, it can be understood that many of the calls from physicians were requesting help in determining whether a person was fit to dive. It is not within the capacity of the DES to determine fitness over a telephone consultation and this service is not encouraged. If the physician has had no experience with diving medicine, DES may be able to suggest where the diving candidate could be referred, based on the Diving Doctor List compiled by the South Pacific Underwater Medicine Society. However, for the physician with training in underwater medicine who is seeking specific advice, DES can be a useful resource to help develop a management strategy for a diver with a complicated medical issue.

In 2005, DES collaborated with DAN AP to publish a poster warning of the symptoms and signs of DCI and advertising the DES phone number. This was mailed to as many emergency departments as possible that were near coastal regions of Australia. It was intended to be displayed in the staff areas to prompt physicians to consider the possibility of a dive-related medical problem. Consequently, the nature of the calls from physicians has changed over time, with fewer fitness-to-dive questions and more calls from doctors working in emergency departments wishing to discuss the significance of a problem in a diver they are assessing.

A small but intriguing number of calls have come from the spouse, partner, family member or friend of the diver.

Most of these were people who were not present when the diving took place but became aware of a problem later on, sometimes not until the diver returned home. Their concern about the well-being of their loved one prompted them to call, seeking guidance. This group was not evident in early years but currently make up about 10% of calls. It is unclear how they became aware of the DES; perhaps the diver suggested it while being reluctant to call himself? More than one call has been initiated by a concerned partner searching through the diver's paperwork to find DAN AP documents with the DES number displayed (personal communication). Regardless of who initiates the call, experience has demonstrated that there is no substitute for talking directly to the diver and this has become standard DES practice. The story of the incident can change dramatically once it becomes second- or third-hand.

## WHAT WAS THE PROBLEM?

Based on the information gathered over the telephone, a diagnosis was proposed in most cases. This diagnosis must be considered provisional as it is usually made based only on the history, sometimes second-hand and often without access to any physical examination. However, a good history has generally been very reliable in diagnosing many dive-related problems. It should also be remembered that DES is an advisory service only and is not in a position to accept responsibility for ongoing medical management or to demand that those at the scene take a particular course of action. As a consequence, DES may not be informed of the final diagnosis if medical review is obtained. While these considerations could question the reliability of the DES diagnosis, feedback has been received in many cases and this has confirmed that the provisional diagnosis has generally been accurate or appropriate. Assessment of the reliability of a diving telemedicine service was described recently by the Swiss chapter of DAN, who run their own hotline.<sup>4</sup> They compared the severity of the hotline assessment of DCI with clinical assessment and found the consistency to be good.

Prudence and common sense are required in recommending a medical review. The margin for error in making a diagnosis over the telephone means that the threshold for recommending a review must be set low, but will be influenced by many factors. These factors include: likelihood of the diagnosis, clinical significance of the diagnosis, what local medical services are available and the distance to more comprehensive medical services. Whether the diver actually proceeds to the review depends on another set of factors including geographical location and insurance status.

The provisional diagnosis for the DES call (Table 5) is comparable to the dive injury data in the DAN Annual Diving Report.<sup>2</sup> For the calendar year of 2007, DAN received a total of 2,505 emergency calls (most of which came through the DAN Hotline). They report a working diagnosis of DCI in 26%, barotrauma in 26%, non-diving related problem in 14%, envenomation in 6% and trauma in 2%.

### *Decompression illness*

The most frequent reason to call the DES was a concern that symptoms could be indicative of DCI. If symptoms could be confidently attributed to another diagnosis, such as musculoskeletal injury, the call was listed under that category. Otherwise, the calls were stratified into three groups based on likelihood of the DCI diagnosis: probable, possible and unlikely DCI. Unlike the Swiss approach,<sup>4</sup> there were no set criteria for making the distinction between these; all aspects of the information provided were used to make a determination, and this ultimately relied on the clinical impression of the DES physician taking the call and recording the information. Collectively these groups accounted for 37% of all calls.

Not surprisingly, the most common symptoms reported in DCI cases were pain and paraesthesia (Table 6). The 2008 DAN report from the USA described 53 cases of skin decompression sickness (12% of 424 DCI cases) and interestingly found a gender bias – 60% of these were female.<sup>2</sup> The DES data does not accord with this; the probable DCI category was male in 67% and skin rash with DCI was male in 71%, suggesting no gender bias. While the true incidence of rash is unknown, it is interesting to speculate on why the DES data suggest an increasing trend in skin rash. This period of time has seen a dramatic shift towards the use of dive computers rather than tables (anecdotal). Computers allow a change in dive pattern away from the square dive profile, towards multi-level diving, which permits multiple ascents and descents, longer periods underwater and shorter surface intervals. The dive activity may be influencing the way the body handles an inert gas load and its distribution in body tissues.

DAN reported that 5% of the DCI group were thought to have CAGE.<sup>2</sup> This is comparable to data from DES calls (7%) and cases presented both with and without loss of consciousness. The classic presentation of CAGE involves a rapid ascent by the diver and loss of consciousness on surfacing. Loss of consciousness is a dangerous event; if it occurs while the diver is still in the water there is a high likelihood of drowning. About half of the cases diagnosed as CAGE presented with loss of consciousness, and only half of these reported a rapid ascent. This means that the classic presentation for CAGE was found in only one quarter of calls thought to be CAGE and serves as a reminder that CAGE may present in other ways and, importantly, may not present with loss of consciousness.

### *Barotrauma*

Almost half of the barotraumas reported were thought to be of the middle ear, while sinus barotrauma was also very common. Several calls each year described mask barotrauma, typically in the less experienced diver for whom the startling appearance of subconjunctival haemorrhage was quite alarming even though it was usually not uncomfortable.

Pulmonary barotrauma involves alveolar gas finding its way into other anatomical sites. If the gas passes into local tissues, then symptoms may reflect pneumothorax or pneumomediastinum, and it will likely be diagnosed as pulmonary barotrauma. If the gas passes into the blood stream, the ensuing neurological manifestations will mean a diagnosis of CAGE (with or without pulmonary barotrauma).

DAN made the observation that their data of several years ago were provided by hyperbaric facilities describing the divers that presented to them.<sup>2</sup> Not surprisingly, hyperbaric facilities were seeing many more cases of CAGE than pulmonary barotraumas; this led to a public perception that CAGE was far more common. The DAN report, which now draws its data from the emergency calls made to the DAN Hotline, lists more calls diagnosed as pulmonary barotrauma (52 calls) than CAGE (23 calls). The DES data reveals a similar experience, with 86 calls diagnosed as pulmonary barotrauma and 70 calls as CAGE. Of course, neither of these data sources will provide an incidence of the problem; however, the numbers suggest that we should be thinking more about pulmonary barotrauma. This also highlights how data can be biased by how, where and when they are collected.

### *Fitness to dive*

Fewer calls have come from physicians seeking an answer to their fitness-to-dive questions. More recently, calls were initiated by the diver when confronted by a change in their own health status. Examples of the sort of questions encountered include how long to lay off diving after surgery for a hernia operation or the consequence of a change in antihypertensive medication. DES may not be able to provide a clear answer but would suggest how to achieve it. This may include a recommendation to seek a formal dive medical examination from a suitable physician. Fitness calls currently make up almost 15% of the annual total and indicate a demand by divers for medical advice specific to their own situation.

### *Information*

Information calls (9%) often related to requests for directions to diving medical services or questions of a general nature about DCI. Many calls related specifically to the recommended time between diving and flying. This can then become problematic (for the diver) when a public address announcement in the background of the phone call indicates that the diver has already arrived at the airport but had then become anxious about the interval between their last dive and the impending flight.

### *Follow up*

Follow-up calls included a diver reporting what had happened since the last call (such as response to normobaric oxygen in someone with suspected DCI), and a courtesy call

to inform us of the progress of a diver handed over to other medical services (such as retrieval).

#### *Musculoskeletal injury*

Diving is a physically demanding activity, even when out of the water. Lifting and carrying heavy tanks on a moving boat will inevitably lead to soft-tissue and bony injuries. While some cases of trauma were obvious, in others the pain came on after a dive with no obvious precipitant and presented with a query whether the pain could be from DCI. This can be difficult to assess over a telephone consultation and soft-tissue injury was diagnosed only when the physician was confident of such. Features that might be helpful in discriminating between a soft-tissue injury and pain due to DCI include other symptoms of DCI, a recognised event leading to injury, localised tenderness to palpation and any features that make the pain better or worse.

#### *Medical*

There was a modest upwards trend in calls about medical conditions that were independent or incidental to the dive (Figure 6), which may be attributable to the increasing proportion of calls from older divers (see below). Medical calls included many viral illnesses and gastrointestinal problems; ischaemic heart disease was also common.

#### *Envenomation*

Some years ago, the DES number was regularly published in first-aid books as the Marine Stinger Hotline, and DES still receives a number of calls each year related to marine envenomation. Jellyfish injuries were common and ciguatera was considered likely in a number of calls from the Pacific Islands. Several calls have come from people who keep bullrouts at home and should be more careful of their spines when cleaning the aquarium. Immersion of fish-spine injuries in hot water has been spectacularly successful in relieving pain, especially in remote locations where no medical services are available. For expert advice, the Australian Venom Research Unit offers emergency telephone consultation to physicians and paramedics only (1300-760-451).

#### *Other dive-related problems*

Other dive- or marine-related calls included headache, rapid ascent without symptoms, salt-water aspiration and drowning, skin rash (not DCI), sea sickness and gas contamination.

#### *The young diver*

The minimum age for scuba diving is a controversial topic with dive physicians holding conflicting opinions. DES does not determine fitness to dive; however, we do believe better injury data are required in this area. There appears to be less

controversy about divers 16 years or older, so this review will only look at the 77 calls regarding children aged 15 years or younger (Table 4). Six calls (including the infants) involved non-divers with five marine envenomations while wading in water and one carbon monoxide exposure. There were 22 fitness-to-dive calls, usually from physicians. The majority of these involved a history of asthma; however, there were several calls about attention deficit hyperactivity disorder. For calls about actual scuba divers, ear barotrauma was a common event as were other medical conditions (usually infections and illnesses, but included one caller with acute asthma post-dive). Of concern are the 13 cases of possible DCI and one probable DCI. The outcome of these calls is not known to DES but would be of great interest.

#### *The ageing diver*

Anecdotally many dive clubs and people in the dive industry have observed that the active dive population appears to be getting older. The DES data reveals that the average age of the diver has increased by six years over the 17 years of this review, with an increasing numbers of calls from divers aged 50 years or older. DAN reported that the mean age of the DAN membership base increased by six months for every year between 2000 and 2006.<sup>2</sup> With increasing age comes the risk of age-related medical illness and potentially an increase in risk with activities like scuba diving. The BSAC report notes that 47% of the 2010 fatalities involved divers over the age of 50 while this age group only represented 16% of the diving population.<sup>1</sup> DES has found that this older diver group is two-and-a-half times more likely than other age groups to call about a medical problem. The increasing influence of this older group is most likely the reason for the modest, increasing trend in medical calls in the overall data. This issue is becoming more prominent and, perhaps, calling the DES phone is leaving it a bit late.

Many of these calls were diagnosed as myocardial problems; a number were actual cardiac arrests requiring resuscitation. Not all of them occurred at the same time as the dive. Three important observations to be made are:

- There is a need for action on fitness to dive in the older diver. It has been difficult to persuade recreational divers of the importance of a medical review of fitness beyond their original dive medical, with a general reliance on personal motivation or family pressure to achieve this. Peer pressure could be applied by a pro-active response from dive training agencies, dive shops and dive clubs to promote the message that a dive medical should be revisited as the diver ages. Legislation requiring a fitness-to-dive review would be very complicated to enforce; it would be better for the dive community to own the problem.
- The older diver should prepare in advance for the increased chance of having to deal with a medical emergency on a dive trip. Ensure personnel at the destination are appropriately trained and any equipment



and medications are checked and permitted on an aeroplane and to enter a foreign country, if required. Consideration should also be given to the availability of local medical services. Everyone should have insurance that covers evacuation and dive injury treatment.

- The medical emergency may not happen during the dive and may occur at any time. Personnel and equipment need to be readily accessible.

### Conclusions

DES offers diving medicine advice 24 hours a day by telephone. The collected data over a 17-year review are qualitative, but do reflect diving activity with a preponderance of male divers, most calls from Queensland and New South Wales and a seasonal variation in calls from southern Australian states. Increasing numbers of calls came from overseas, pointing to a need for divers to consider the appropriateness of medical services in remote locations.

The most common reason to call was to ask if symptoms could be the result of DCI (37%). Barotrauma was also common (11%). Divers have shown a desire for specialised medical advice that is specific to their needs and this has accounted for many of the calls about fitness to dive (14%) and information (9%). DCI can manifest with myriad symptoms and signs but the increasing trend of skin rash in probable DCI cases is unexplained.

There was an increase in the average age of divers calling DES, along with an increase in calls from divers aged 50 years or older. While they do report a largely similar range of problems, the older divers were more likely to report a medical problem unrelated or incidental to their diving activity. In junior scuba divers, commonly reported issues related to asthma and ear barotrauma. The outcome of several potential DCI cases is unknown.

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