

## Consequences of U.S. Navy diving mishaps: decompression sickness

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Hoiberg A. Consequences of U.S. Navy diving mishaps: decompression sickness. *Undersea Biomed Res* 1986; 13(3):383-394.—This study identified the short- and long-term health effects among U.S. Navy divers ( $n = 328$ ) who suffered decompression sickness (DCS) between January 1968 and December 1979 and compared their post-DCS hospitalization rates with a matched sample of divers ( $n = 1,086$ ) who had no recorded diving accidents. Results identified 251 individuals (76.5%) whose records contained no diving-related medical events after the DCS incident; the other divers (23.5%) had records of a subsequent hospital admission and/or a physical disability separation. Only three physical disabilities were attributed to DCS or diving, and there were no DCS-related deaths. DCS divers had significantly higher rates than controls for total hospitalizations, symptoms and headache, and diseases of the arteries and veins. These two clusters, which included such conditions as pain in the joint, abnormal involuntary movement, pain in the limb, and arterial embolism, were identified as potential risks for divers who suffer a DCS mishap. Previous hospitalizations and age were not associated with DCS; however, divers in the DCS group were significantly heavier than all other divers.

longitudinal study

U.S. Navy divers

decompression sickness (DCS)

diseases of the arteries and veins

physical disabilities

hospitalization rates

symptoms and headache

The risk of experiencing a diving mishap among U.S. Navy divers has been determined to be quite low; of more than 700,000 dives recorded from January 1968 through May 1981, the proportion of mishaps reported was 0.17% (1). The most frequently occurring mishap was decompression sickness (DCS), which accounted for 41.1% ( $F = 426$ ) of the total number of accidents. Of the dives requiring some form of decompression, 0.70% resulted in a DCS incident. Using data analyzed in Rivera's comprehensive study of DCS (2), Strauss (3) reported a comparable incidence rate of 0.69% among 722 U.S. Navy divers for the 1946-1961 time period.

The symptomatology of DCS, which includes Type I and Type II manifestations, has been described in numerous texts and journal articles (4-8). Kidd and Elliott (5) indicated that differentiating between the two types can be difficult because Type I

symptoms may mask or precede the more serious Type II manifestations. The Type I category consists of DCS cases in which (a) pain is the only symptom, (b) joint pain is experienced in conjunction with cutaneous or lymphatic implications, and (c) incidents are manifested by cutaneous or lymphatic involvement without pain. Type II cases are of a more serious nature, with central nervous system, peripheral neuropathy, or respiratory involvement. Of the 22 symptoms listed on the U.S. Navy diving accident log, the highest percentages of the most "significant sign" associated with a DCS mishap were localized pain (74.9%), numbness (9.4%), muscular weakness (3.1%), dizziness (3.1%), and rash (2.8%).

If treated immediately, the symptoms of Type I DCS would be expected to disappear without residua (3). In their study of 3 DCS cases occurring after deep excursion dives, Greene and Lambertsen (9) reported that complete relief with no aftereffects was accomplished as a result of prompt treatment. Other researchers (6) have shown that approximately 24% of the DCS cases among scuba divers "have some neurological consequence involving the spinal cord and the potential to render a victim permanently paraplegic." In Rivera's study of 935 DCS cases (2), a total of 51 divers (5.4%) suffered residual effects and 3 divers died (0.3%) because of DCS. Although follow-up data were not available on all cases, Rivera reviewed almost all cases and reported a remarkably high recovery rate after several days or weeks for those divers who received immediate physical therapy. Similarly, Berghage (10) determined that the subsequent recompression treatment of 27 saturation DCS cases resulted in full relief after 2 h for 35% of the divers; the rest of the sample (65%) completed the therapy and decompression with residual pain that diminished over a period of weeks.

Although those investigators determined that the aftereffects of DCS tended to disappear within weeks of initial treatment, little is known of the subsequent health consequences of DCS. Manifestations may not be apparent until years later when dysbaric osteonecrosis or malignant fibrous histiocytoma is discovered (6, 11). A significant relationship between these rarely occurring disorders and DCS has been described by several researchers (11-13). The purpose of this longitudinal study was to identify the short- and long-term health effects among U.S. Navy divers who suffered DCS during a time period of more than a decade and to compare their rates of morbidity (hospitalizations and medical board appearances) with rates for a matched sample of divers who had no recorded diving accidents. The influence of previous hospitalizations, age, and weight on the incidence of DCS also was examined.

## METHOD

Subjects for this study included 304 U.S. Navy enlistees and 24 diving officers who were identified as having experienced DCS during the period January 1968 through December 1979; these divers represented 2.4% of the total Navy diving population of 11,664 enlistees and 2,027 officers. The mean age at the time of the DCS mishap was 27.9 with a range from 17 to 44. Among enlistees the median pay grade was E-6, and among officers the median rank was lieutenant. Of the 130 women divers on the diving log file, 1 suffered a DCS incident.

To determine whether members of the DCS sample had elevated hospitalization rates after the initial DCS incident, their rates were compared with those for a sample of divers who had no recorded diving accident. Selection of this sample was accom-

plished by matching the birth years of individuals in the DCS sample with those of all other divers. Birth year was used as a controlling variable because increasing age was shown in previous research (14) to be significantly related to higher rates for several musculoskeletal and circulatory disorders as well as to alcohol and drug abuse, diabetes mellitus, and diseases of the respiratory tract. The control sample consisted of 1014 enlistees and 72 officers.

### Procedure

Information for this study was obtained from three data bases maintained at the Naval Health Research Center in San Diego (Naval Medical Inpatient, Naval Officer Career History, and Naval Enlisted Service History files) and the computerized file of Diving Log-Accident/Injury Reports (OPNAV 9940/1), which was provided by the Naval Safety Center in Norfolk, VA. Data extracted from the diving file included birth year, height, and weight as well as age, pay grade, and date of each DCS accident. Data selected from the Naval Medical Inpatient file consisted of date and diagnoses for each hospitalization, medical board action, and physical evaluation board appearance as well as the underlying cause and date of death. The diagnostic nomenclature used was the *Eighth Revision of the International Classification of Diseases Adapted for Use in the United States* (ICDA-8). Information on the dates of entry and separation from naval service was obtained from the officer career or enlisted service history files.

For the first phase of the study, frequency and percentage distributions were performed to identify divers in the DCS sample who were separated from service and/or who had been hospitalized or reviewed by a medical board subsequent to the DCS incident. For those who had a recorded medical event, each of the diagnoses and the numbers of days, months, and years after the mishap date were listed in a tabular chronology. These entries represented the diagnoses for all physical disabilities, medical boards, and hospitalizations that occurred in conjunction with the mishap and during each subsequent year after the DCS incident. A similar frequency distribution of hospitalizations and board actions was compiled for all diagnoses recorded before the DCS incident.

For the second phase, the frequencies of hospitalizations and medical board actions for DCS divers were compiled into 9 diagnostic clusters (symptoms and headache; disorders of the joint, knee, and connective tissue; osteoarthritis, arthritis, and rheumatism; diseases of the circulatory system; disorders of the arteries and veins; disorders of the back; diseases of the respiratory system; alcoholism and drug abuse; and benign and unspecified bone neoplasms). Person-years at risk for DCS divers were determined by summing the number of individuals on active duty for each year subsequent to the initial DCS incident. Using these person-years, annual rates per 10,000 strength were computed for the 9 post-DCS diagnostic categories. Comparisons with the control sample were conducted after calculating the control divers' hospitalization rates per 10,000 strength for the 9 categories. Person-years at risk for the control sample were obtained by summing the number of these divers on active duty year by year throughout the 1968 to 1979 time period. Ninety-five percent confidence limits, based on the Poisson distribution (for rarely occurring events), were calculated to establish whether rate differences between divers and controls were significant for any of the diagnostic categories.

Because increasing age and obesity have been implicated as risk factors of DCS (2, 6, 15–16), comparisons of mean values for age and a weight-height index (kilogram/meter<sup>2</sup>) were conducted between the DCS sample and all other members of the diving community ( $n = 13,329$ ). The  $t$ -test technique was performed to ascertain the level of statistical significance between samples for these two variables.

## RESULTS

In examining the post-DCS events, as summarized in Table 1, 216 divers (65.8%) had no records of a hospitalization, board action, or medical separation after the initial incident, and 35 divers (10.7%) were observed as having had a hospital admission or board action for reasons unrelated to diving, such as motorcycle and automobile accidental injuries, assault injuries, and cellulitis. The remaining 77 cases (23.5%) included 1 death and divers who had had an immediate hospitalization, a subsequent hospitalization, and/or a physical disability separation. No information was recorded on the cause of death for the diver who died.

### Immediate hospitalization

Of these 77 divers, 34 were hospitalized immediately as a result of the mishap: 32 were diagnosed with DCS and 2 were admitted for air embolism. No post-DCS medical events were recorded for the 2 divers hospitalized for air embolism. Two other divers of the 34 were diagnosed with a spinal cord lesion as an additional

**TABLE 1**  
FREQUENCY AND PERCENTAGE DISTRIBUTION OF OUTCOME VARIABLES AMONG  
U.S. NAVY DIVERS WITH DECOMPRESSION SICKNESS (DCS), 1968–1979

Outcome Variable	DCS Divers	
	No.	%
Death		
Related to diving	0	0
Not specifically related to diving	1	0.3
Physical disability		
Related to diving	3	0.9
Not specifically related to diving	11	3.4
Immediate hospitalization		
With no subsequent medical event	26	7.9
With subsequent hospitalization	4	1.2
Subsequent hospitalization		
Less than 1 yr	8	2.4
More than 1 yr	24	7.3
No post-DCS medical event	216	65.8
Post-DCS hospitalization—unrelated to diving	35	10.7
Total	328	99.9

diagnosis with DCS. One of these 2 divers had no subsequent hospitalization but was retired with a DCS physical disability less than 2 yr later. The other diver was listed on active duty at the end of the follow-up period, 1.5 yr after the incident. Other secondary diagnoses included emphysema, alcoholism, symptoms of the nervous system (disturbances of sensation), other diseases of the ear, and other diseases of the muscle, tendon, and fascia. In Tables 2 and 3, the sequence of events is presented for divers who were hospitalized or separated subsequent to the DCS incident ( $n = 50$ ).

**TABLE 2**  
DIAGNOSES FOR SUBSEQUENT HOSPITALIZATIONS AND PHYSICAL DISABILITY  
SEPARATIONS (< 1 YR) AMONG U.S. NAVY DIVERS WITH DECOMPRESSION  
SICKNESS (DCS), 1968-1979

Diver	Diagnosis (ICDA-8 Rubrics)	Time Period Since DCS
1	Symptoms referable to the abdomen and lower gastrointestinal tract (abdominal pain)*	5 d
2	Spinal cord lesion without evidence of spinal bone injury (cervical, without mention of open wound) and spinal cord lesion (dorsal and lumbar, without mention of open wound) (diving related)	12 d
3	Chronic enteritis and ulcerative colitis (first admission)	46 d
	Arthritis, unspecified (second admission)*	70 d
4	Anomalies of lumbosacral joint and vertebrogenic pain syndrome	54 d
5	Certain symptoms referable to nervous system and special senses (vertigo) and special symptoms (cephalgia)*	75 d
6	Transient situational disturbances	100 d
7	Phlebitis and thrombophlebitis	7 mo.
8	Symptoms referable to limbs and joints (pain in limb)	8 mo.
	Physical disability retirement for malignant neoplasm of testis	18 mo.
9	Other diseases of respiratory system (pulmonary collapse) and chronic sinusitis (first admission)	9 mo.
	Chronic sinusitis (second admission)	16 mo.
	Sprains and strains of knee and leg (unknown cause) (third admission)	45 mo.
10	Physical disability retirement for DCS*	10 mo.
11	Headache, unspecified cause	10 mo.
12	Essential benign hypertension and symptoms referable to respiratory system (pain in chest) (first admission)	11 mo.
	Symptoms referable to respiratory system (pain in chest) and essential benign hypertension (second admission)	32 mo.
13	Essential benign hypertension and ulcer of duodenum	11 mo.

\*Subsequent hospitalization(s) and physical disability separations for divers hospitalized immediately for DCS.



**TABLE 3**  
**DIAGNOSES FOR SUBSEQUENT HOSPITALIZATIONS AND PHYSICAL DISABILITY**  
**SEPARATIONS (> 1 YR) AMONG U.S. NAVY DIVERS WITH DECOMPRESSION**  
**SICKNESS (DCS), 1968-1979**

Diver	Diagnosis (ICDA-8 Rubrics)	Time Period Since DCS, yr, mo.
1	Physical disability retirement with no diagnosis available	1, 1
2	Phlebitis and thrombophlebitis (other, unspecified sites)	1, 2
3	Effects of air pressure (other and unspecified effects of high altitude), other aneurysm, and essential benign hypertension	1, 3
4	Deflected nasal septum*	1, 4
5	Alcoholism (other and unspecified)	1, 4
6	Osteoarthritis and allied conditions and arthritis, unspecified	1, 6
7	Symptoms referable to limbs and joint (pain in joint)	1, 7
8	Other muscular rheumatism, fibrositis, and myalgia	1, 8
9	Sprains and strains of sacroiliac region and neurosis (depressive) (first admission)	1, 8
	Vertebrogenic pain syndrome (lumbalgia) (second admission)	6, 2
	Vertebrogenic pain syndrome (lumbalgia) (third admission)	6, 5
	Vertebrogenic pain syndrome (other and unspecified) (fourth admission)	6, 11
	Physical disability retirement for vertebrogenic pain syndrome (on-duty diving)	7, 5
10	Other diseases of joint/chondromalacia of knee (first admission)	1, 10
	Other deformities of leg, dislocation of knee, and osteoarthritis (second admission)	3, 7
	Physical disability separation for other deformities of leg*	5, 6
11	Physical disability retirement for DCS*	1, 11
12	Symptoms referable to limbs and joints (pain in joint—arthralgia) and other unspecified infective-parasitic diseases (first admission)	2, 1
	Other and unspecified infective-parasitic diseases (second admission)	2, 8
	Physical disability separation for other and unspecified infective-parasitic diseases	2, 11
13	Other ill-defined and unknown causes of morbidity and mortality	2, 2
14	Physical disability separation for osteoarthritis and allied conditions (spondylitis osteoarthritica)	2, 2
15	Physical disability retirement with no diagnosis available	2, 3
16	Internal derangement of joint (other knee derangement)	2, 4
17	Deflected nasal septum (first admission)	3, 2
	Deflected nasal septum (second admission)	4

TABLE 3 (continued)

Diver	Diagnosis (ICDA-8 Rubrics)	Time Period Since DCS, yr, mo.
18	Sprains and strains of other and unspecified parts of back and anomalies of lumbosacral joint (first admission)	3, 5
	Vertebrogenic pain syndrome (lumbalgia) and sprains and strains of other unspecified parts of back (second admission)	3, 11
	Displacement of intervertebral disc (lumbar and lumbosacral) and unspecified site (third admission)	4, 8
	Other anomalies of larynx, trachea, and bronchus (fourth admission)	6, 9
19	Transient situational disturbances (first admission)	3, 6
	Transient situational disturbances (second admission)	3, 8
20	Internal derangement of joint (other knee derangement)	3, 7
21	Physical disability retirement for dislocation of hip (automobile accident)**	3, 3
22	Diseases of the intestines and peritoneum	3, 10
23	Neoplasm of unspecified nature of skin and musculoskeletal system (bone and cartilage) (first admission)	4, 1
	Neoplasm of unspecified nature of eye, brain, and other parts of nervous system (spinal cord) (second admission)	4, 3
	Other diseases of spinal cord (third admission)	4, 7
	Certain symptoms referable to nervous system and special senses (abnormal involuntary movement) (fourth admission)	4, 10
	Other diseases of joint (fifth admission)	5, 1
24	Alcoholism (alcoholic addiction) (first admission)	4, 1
	Alcoholism (alcoholic addiction) (second admission)	4, 9
25	Symptoms referable to cardiovascular and lymphatic system (syncope or collapse) and injury, other and unspecified (trunk)	4, 8
26	Chronic ischemic heart disease, gangrene, and benign neoplasm of bone and cartilage	5, 1
	Physical disability retirement for chronic ischemic heart disease	5, 5
27	Alcoholism (alcoholic addiction)	5, 3
28	Diseases of the pancreas (acute pancreatitis) and symptoms referable to abdomen and lower gastrointestinal tract (abdominal pain) (first admission)	5, 5
	Dislocation of knee (second admission)	6
	Internal derangement of joint (other knee derangement) (third admission)	7, 9
	Other diseases of muscle, tendon, and fascia (residual foreign body in tissue or bone) (fourth admission)	8
	Other diseases of joint (fifth admission)	10, 7
29	Alcoholism, improper use of drugs, and essential benign hypertension	5, 5

TABLE 3 (continued)

Diver	Diagnosis (ICDA-8 Rubrics)	Time Period Since DCS, yr, mo.
30	Vertebrogenic pain syndrome (lumbalgia)	5, 11
31	Osteoarthritis (spondylitis osteoarthritis) (first admission)	6, 2
	Osteoarthritis (spondylitis osteoarthritis) (second admission)	6, 5
	Osteoarthritis, other congenital anomaly of musculoskeletal system (abnormality of spine), personality disorder (other), and arthritis (unspecified) (third admission)	7, 11
	Physical disability separation for arthritis*	8, 10
32	Arterial embolism and thrombosis (of mesenteric artery)	6, 10
33	Occlusion of precerebral arteries (without mention of hypertension) (first admission)	7, 10
	Arterial embolism and thrombosis (of other and unspecified arteries) (second admission)	7, 10
34	Essential benign hypertension	Unknown
	Physical disability retirement for diabetes mellitus	7, 11
35	Diseases of the pancreas (chronic pancreatitis)	8, 7
	Physical disability retirement for diseases of the pancreas (chronic pancreatitis)	8, 7
36	Other diseases of the gallbladder	8, 7
37	Sprains and strains of knee and leg (first admission)	8, 9
	Internal derangement of joint (other knee derangement) (second admission)	9

\*Subsequent hospitalization(s) and physical disability separations for divers hospitalized immediately for DCS. \*\*This diver had six automobile accident-related hospitalizations and medical boards which are not presented.

### Subsequent hospitalizations during the first year

During the first year after the DCS incident, 13 divers were hospitalized and/or retired for various reasons, as can be seen in Table 2. The number of days or months since the initial DCS incident also is indicated. One diver was retired 10 mo. later with a DCS physical disability. Six divers were hospitalized for such diving-related disorders as a spinal cord lesion, which was recorded 12 d after the DCS incident; symptoms referable to the abdomen and lower gastrointestinal tract (abdominal pain); pain in the limb; pain in the chest; vertigo; and headache. As shown in Table 2, 2 of these 6 divers had been hospitalized immediately after the DCS incident.

### Subsequent hospitalizations after one year

During a period from 13 mo. to almost 11 yr, 37 DCS divers were hospitalized and/or separated from active duty. As shown in Table 3, reasons for these medical events consisted primarily of joint, knee, back, arthritic, respiratory, and circulatory dis-



orders as well as pain symptomatology. Two of these divers, 1 of whom had been hospitalized immediately after the DCS incident, were retired with physical disabilities: 1 for DCS and the other for a diving-related vertebroprogenic pain syndrome. The latter diver had a history of four hospitalizations and medical boards.

### **Hospitalization rates for DCS divers and controls**

The diagnoses for the hospital admissions listed in Tables 2 and 3 were clustered into such diagnostic categories as symptoms and headache ( $n = 10$ ); disorders of the joint, knee, and connective tissue ( $n = 7$ ); osteoarthritis, arthritis, and rheumatism ( $n = 6$ ); diseases of the circulatory system ( $n = 6$ ); and disorders of the arteries and veins ( $n = 5$ ). Frequencies of four were observed for disorders of the back, diseases of the respiratory system, and alcohol and drug abuse. Only 2 divers were hospitalized for disorders of the bone, 1 for benign and the other for unspecified neoplasm of the bone and cartilage.

Annual hospitalization rates per 10,000 strength were computed for these categories in both the DCS and control samples. In examining the 95% confidence limits between samples, three comparisons yielded significantly higher rates for the DCS sample than the control group: symptoms and headache; disorders of the arteries and veins; and total hospitalizations. Three other clusters, which were concentrated in the musculoskeletal system, accounted for almost one-half of all post-DCS admissions: disorders of the joint, knee, and connective tissue; disorders of the back; and arthritic conditions. Rates for these three categories failed to significantly differentiate the DCS sample from the control group.

### **Pre- and post-DCS hospitalizations**

No specific disorder was observed to have an elevated number of hospitalizations before the DCS incident. Of the 328 DCS divers, 96 (29.3%) had been hospitalized one or more times before the DCS mishap; the leading reason for an admission was for an accidental injury ( $n = 25$ ). Other diagnostic categories and specific disorders with the highest number of admissions included diseases of the respiratory system ( $n = 17$ ); infective and parasitic diseases ( $n = 8$ ); disorders of the back ( $n = 7$ ); cellulitis ( $n = 6$ ); hernias ( $n = 5$ ); and disorders of the joint, knee, and connective tissue ( $n = 5$ ). In examining the frequencies for the clusters of symptoms and backache and disorders of the arteries and veins, only two admissions for these reasons were noted before the DCS incident, as contrasted with 15 for the post-DCS follow-up period. Two divers were observed as having had a hospitalization that occurred as close as 16 d before the DCS incident, 1 for a migraine and the other for a concussion and cerebral contusion. Nineteen other divers were hospitalized within a time period of 12 mo. or less before the DCS mishap.

### **Influence of age and weight on DCS incidence**

In comparisons of mean ages, the DCS sample had a somewhat higher, albeit not significant ( $t = 1.88$ ) mean age than all other members of the diving community (27.9 vs. 27.3). DCS divers, however, were significantly heavier than other divers, with a mean weight:height ratio of 25.0 vs. 24.3 ( $t = 5.3$ ;  $P < 0.001$ ).

## DISCUSSION

Of the 328 divers who experienced a DCS incident, results of this study identified 251 individuals (76.5%) whose records contained no medical events related to diving after the initial DCS incident. Three physical disabilities (one with a spinal cord lesion) were specifically attributed to DCS or diving; there was no diving-related death among the 328 DCS divers. Other serious health consequences were observed for 2 divers hospitalized with air embolism and 2 admitted with a spinal cord lesion, none of whom were subsequently hospitalized or medically separated. For these and the rest of the sample, analyses of their post-DCS hospitalization records revealed three significantly higher rates than controls, which were evaluated as possible consequences of DCS.

The total hospitalization rate for DCS divers was significantly higher than that for the control group. In comparisons of rates by diagnostic category, DCS divers had higher rates than controls for all 9 clusters, 2 of which were significantly higher (symptoms and headache and diseases of the arteries and veins). All of the diagnoses included in the cluster of symptoms and headache have been identified in the literature as diving related: vertigo, abnormal involuntary movement, pain in the limb, pain in the joint, chest pain, abdominal pain, syncope, and headache (4). Disorders of the arteries and veins were comprised of arterial embolism and thrombosis, phlebitis and thrombophlebitis, occlusion of precerebral arteries, and other aneurysm, which seemed to reflect conditions possibly associated with bubble nucleation and growth. Such findings provided support for the interpretation that these conditions might have occurred as a consequence of the DCS incident.

Before concluding that these conditions were causally related to DCS, however, two major issues need to be addressed. First, the number of divers hospitalized for each of the 12 diagnoses in these two categories was very low, which would temper any conclusion attributing incidence of these disorders to the DCS mishap. For example, only the three disorders of pain in the joint, abdominal pain, and phlebitis had a frequency of 2 hospitalized divers whereas the other 9 diagnoses were recorded for only 1 diver each.

Second, the factor of time should be considered in discussing these significant results. For the cluster of symptoms and headache, only one hospitalization (for abdominal pain) occurred sufficiently close in time to the accident to be attributed to DCS. The other admissions in this category were recorded during a time period from 2.5 to 65 mo. subsequent to the DCS accident. Incidence of the disorders subsumed under the other category was observed from 7 mo. to almost 8 yr after the DCS incident, with no specific time evidenced as a period of increased risk. On the basis of the low frequencies and variable latency periods, it would be impossible to pinpoint a specific illness or time period of increased vulnerability for a subsequent DCS-related health problem.

Although there was no clear-cut evidence in support of a causal relationship, the higher rates observed for the two diagnostic clusters among DCS divers may be a manifestation of an increased susceptibility for these disorders as a result of the DCS incident. The higher incidence of these disorders also may have occurred as a consequence not only of the DCS incident but also as a result of the accumulating effects of hyperbaric exposures. Thus, a diver who suffers DCS and continues to work as a diver might expect to be at increased risk for these conditions. Moreover, an exam-

ination of the reasons for being hospitalized before the DCS incident determined that none of the divers who had been admitted for the diagnoses included in the two clusters had previously been hospitalized for those reasons. The post-DCS hospitalizations, therefore, probably were not instances of continuing treatment for an underlying condition.

Other results of this study showed that DCS divers were not on the average older than all other divers, which suggested that their mean age could not be considered a risk factor of DCS. Similar to findings reported elsewhere (15, 16), divers in the DCS sample were significantly heavier than all other divers.

In conclusion, this longitudinal study examined all illnesses requiring a hospital admission or board appearance in a sample of DCS divers as well as those disorders that differentiated these divers from controls. Other findings revealed that no hospitalization recorded before the DCS incident served as a precursor of the mishap. Two clusters of 12 diagnoses, which included such symptoms as pain in the joint, abnormal involuntary movement, and pain in the limb, were identified as potential subsequent health risks for divers who suffer a DCS mishap.

Hoiberg A. Conséquences des accidents de plongée de la Marine américaine: maladie de décompression. *Undersea Biomed Res* 1986; 13(3):383-394.— Cette étude identifia les effets à court et à long termes sur la santé chez des plongeurs de la Marine américaine ( $n = 328$ ) qui souffrirent de la maladie de décompression (DCS) entre janvier 1968 et décembre 1979 et compara leurs taux d'hospitalisation postérieurs à la DCS avec un échantillon pairé de plongeurs ( $n = 1,086$ ) qui n'avaient rapporté aucun accident de plongée. Les résultats identifièrent 251 individus (76.5%) dont les documents ne contenaient aucun événement médical relié à la plongée après l'incident de DCS. Les autres plongeurs (23.5%) avaient des documents d'une admission hospitalière subséquente et/ou d'une séparation pour cause d'invalidité physique. Seulement trois invalidités physiques furent attribuées à la DCS ou à la plongée, et il n'y eut aucune mort reliée à la DCS. Les plongeurs qui éprouvèrent une DCS eurent des taux significativement plus élevés que les témoins en ce qui concerne le nombre total d'hospitalisations, symptômes et maux de tête, et maladies des artères et des veines. Ces deux groupements, qui comprirent des conditions telles que la douleur articulaire, mouvement involontaire anormal, douleur dans les membres, et embolie artérielle, furent identifiés comme risques potentiels pour les plongeurs qui subissent un accident de la DCS. Les hospitalisations préalables et l'âge ne furent pas associés avec la DCS. Toutefois, des plongeurs du groupe de la DCS étaient significativement plus lourds que tous les autres plongeurs.

étude longitudinale	invalidités
plongeurs de la Marine américaine	taux d'hospitalisation
maladie de décompression (DCS)	symptômes et maux de tête
maladies des artères et des veines	

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