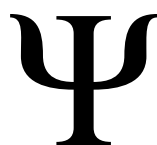**DET PSYKOLOGISKE FAKULTET**

Ψ

Potentially Traumatic Events and Posttraumatic Stress Among North Sea Divers

HOVEDOPPGAVE

profesjonsstudiet i psykologi

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Abstract

North Sea divers have worked in a high-risk environment for 45 years. Little is known about the psychological consequences of deep sea diving. One third of the entire population of 375 male North Sea divers was thoroughly assessed as part of a health examination requested by the Norwegian government. As many as 96% had experienced at least one potentially traumatic event (PTE). The pressurized environment causes PTEs to be particularly dangerous, increasing likelihood of diagnostic criteria for Posttraumatic Stress Disorder (PTSD) to be fulfilled. High rates of possible PTSD were found; 48% - 70% measured with the symptom measure Impact of Event Scale – Revised (IES-R), and 8% - 35% measured with the Keane PTSD scale, a part of the personality measure Minnesota Multiphasic Personality Inventory-2 (MMPI-2). This indicates that North Sea divers are at severe risk for PTSD, and that this is probably due to the conditions they work under. The related litigation and economic compensation arrangement spurred suspicion of malingering, but we found no differences in symptoms or personality in those tested before or after the compensation arrangement was established. More research on the mental health of active North Sea divers, as well as properties of the PTEs are of interest and can be useful in developing better safety interventions.

Sammendrag

Nordsjødykkerne har arbeidet i et risikofylt yrke i 45 år. Det finnes lite forskning på

psykologiske konsekvenser av dykk på store dyp. En tredjedel av hele populasjonen på 375

mannlige nordsjødykkere ble grundig undersøkt som en del av en helseundersøkelse utført på

oppdrag fra Helse og Sosialdepartementet. Hele 96% hadde opplevd minst en potensielt

traumatisk hendelse (PTE). I et trykksatt miljø blir PTE-ene spesielt farlige, og øker slik

sannsynligheten for at de diagnostiske kravene til Posttraumatic Stress Disorder (PTSD) blir

oppfylt. Det ble funnet høye andeler av mulig PTSD, med 48% - 70% målt med

symptommålet Impact of Event Scale – Revised (IES-R), og 8% - 35% målt med Keane

PTSD skala, en del av personlighetsmålet Minnesota Multiphasic Personality Inventory – 2

(MMPI-2). Dette tyder på at nordsjødykkere har høy risiko for PTSD og at dette sannsynligvis

er grunnet arbeidsforholdene deres. Søksmålene og den økonomiske erstatningsordningen

bidro til mistanke om overrapportering, men vi fant ingen forskjeller verken i symptomer eller

personlighet på dykkerne testet før og etter at erstatningsordningen trådte i kraft. Det er

ønskelig med mer forskning på den mentale helsen hos aktive nordsjødykkere, samt

egenskaper ved PTE-ene. Dette kan være nyttig i utviklingen av nødvendige sikkerhetstiltak.

Ikaros was a hero in Greek mythology, known for his youthful boldness and overconfidence. To render flight possible, his father made them wings of feather and wax, and upon releasing his son into flight, the father warns him not to fly too high. However, Ikaros listens only with half an ear, and flies higher and higher towards the sun. The wax on his wings cannot withstand the heat from the sun, and melts. He plunges uncontrollable towards the face of the earth - turning his hunger for exploring into fatal defeat.

Scientists, entrepreneurs and professionals in diverse fields of exploration always try to find the balance between safety and risk. Some occupations are more dangerous than others and Statistics Norway lists primary industries as the most dangerous with 29% of the respective workers experiencing absence from work after accidents. Driving and operating machinery was number two (17%) and crafts was number three (11%) on this list of occupational hazards (SSB, 2006). Forestry and fishing make up for 5,7% of the total number of sick days (SSB, 2001-2008), but these statistics do not separate between the various reasons for absence, whether it is an accident or illness.

There can be found little research aimed at comparing different occupations in order to find how they differ in psychological load. One study examined prevalence of anxiety and depression, and found that farming and crafts were among the occupations with highest scores, at least for depression (Sanne, Mykletun, Dahl, Moen, & Tell, 2003). However, the studies in this field are few and they tend to suffer low statistical power due to small samples. In a search on the ISI Web of Knowledge database using the search words: "work-related" AND "traumatic stress"; Policemen, fire-fighters and ambulance personnel, yielded far more hits (14 out of 52) than any other occupational groups.

The risk involved in performing a task is defined as a product of the likelihood of an accident to occur, and the magnitude of the possible damage. However, this definition allows for much variation. For example will an occupation with more and smaller accidents have an approximately equal risk to it as an occupation with fewer but larger accidents. The highest risk will be in occupations where the workers more frequently are exposed to larger accidents. This calculation of risk becomes very important when investments are considered. Money is the main incentive on the market, and companies in high-risk industry must balance the resources spent on selection, training and safety up against the profit they get out of it. Poorly educated staff is less efficient and more likely to be involved in accidents – which costs in publicity, reduced production, sick leaves, disability benefits, lack of applicants, and loss of trained workers. Workers are one of the resources distributed. They are pushed further and further, alongside the technological development. Many value the challenges this creates, historically exemplified by the well-known picture of men lunching on a crossbeam 69 floors (850feet) above New York in 1932.

Figure 1. "Lunch Atop a Skyscraper", 1932, by Charles C. Ebbets.

Despite all effort to reduce risk, selection, training and safety measures, accidents still happen: Drivers crash, policemen get shot, fire fighters get trapped, and constructors get hit by falling objects. The physical consequences may be obvious and immediate, the psychological are not. Posttraumatic Stress Disorder (PTSD) is a complex anxiety disorder and the most researched upon psychological sequelae after traumatic events (Thomas, 2006).

PTSD

Posttraumatic Stress Disorder is a severe and often chronic disorder following traumatic events and it is "one of the psychiatric disorders leading to the widest use of health care systems" (Darves-Bornoz et al., 2008). According to the DSM – IV (American Psychiatric Association, 1994), PTSD include six main criteria; objective exposure to a potentially traumatic event (PTE) (A1), a subjective appraisal of intense fear, helplessness or horror when confronted with it (A2), and the three symptom clusters intrusion (B), avoidance (C) and hyperarousal (D), duration of the symptoms more than 1 month (E), and social or occupational functional impairment (F). The fulfilment of the A criterion demands a thorough discussion due to its complex nature. The A criterion demands that both the A1 (PTE), and the A2 criteria are present. The A1 states "The person experience, witness, or confront an event(s) that involve actual or threatened death or serious injury, or a threat to the physical integrity to self or others". The A2 criterion is: "the response involved a subjective appraisal of intense fear, helplessness, or horror". When both criteria are fulfilled, the potentially traumatic event has become a traumatic event. The A criterion is the primary focus in this study, and criteria B through F will not be thoroughly discussed.

The main criterion for PTSD concerns a psychological stressor. During the lifespan, most people experience situations that are appraised as stressful and dramatic to that specific

individual. Prevalence of potentially traumatic events (PTE) varies across different types of events and across cultures. For instance will relatively few people in our part of the world experience torture and military combat, but many experience the sudden loss off a loved one, or a traffic accident (Breslau et al., 1998).

The prevalence of PTEs is higher than the prevalence of actual PTSD. A general population study in USA reported a lifetime prevalence of 89,6% for one or more of a number of specific traumatic events (Breslau et al., 1998). This sample included both genders between 18 and 45 years of age. Prevalence and likelihood of experiencing different potentially traumatic events differs across gender. Men are more likely to experience events like accidents, nonsexual assault, witnessing death and injury, disaster, and combat (Tolin & Foa, 2006). Because our study has an all male sample, it is relevant to look at studies with male informants. In Germany less than 1% of male subjects aged 14-24 from the general population qualified for PTSD diagnosis, but 25% of them reported having experienced at least one potentially traumatic event in their lifetime. However, only 18,6% of all males also qualified for the A2 entry criterion for PTSD, which means that not all experienced a potentially traumatic event involving intense fear, horror or helplessness (Perkonigg, Kessler, Storz, & Wittchen, 2000). In Sweden almost 85% of a general population male sample between 18 and 70 years of age reported having experienced at least one potentially traumatic event (Frans, Rimmo, Aberg, & Fredrikson, 2005). The authors do not specify whether these events qualify for traumatic events according to the A2 criterion. The level of reported experiences is still in contrast to 3,6% of the same Swedish sample meeting all the DSM-4 criteria for PTSD. One study reports a general lifetime PTSD prevalence of 6,8%, in an American general population of both genders older than 18 years (Kessler et al., 2005). A study comprising samples from 6 different European countries, reported prevalence of a PTSD diagnosis of 0,5% in a male

sample aged 18 or above. This was based on the symptom severity the last 12 months prior to the interview (Darves-Bornoz et al., 2008). In general male populations, literature indicates mostly low (< 5%) prevalence rates of PTSD across age and culture.

The research on PTSD since the DSM-III introduced the diagnosis in 1980 has been massive. A search on the database ISI Web of Knowledge for scientific papers with PTSD in the title yields more than two thousand hits, and more than eight thousand with PTSD in the topic. There have been both broad-based epidemiological studies in general populations, and studies focused on specific types of trauma. Several aspects have been studied; risk factors for developing PTSD (Breslau, Davis, & Andreski, 1995; Brewin, Andrews, & Valentine, 2000), PTSD prevention (Rose, Bisson, Churchill, & Wessely, 2002) and treatment methods of psychological difficulties associated with trauma (Herbert & Sageman, 2004; Van Etten & Taylor, 1998).

Exposure to psychological trauma in specific settings has also been studied, including workplace and work related PTSD. The occupations most frequently studied have been emergency response personnel. Studies on certain risk groups, like fire-fighters, show considerable higher PTSD prevalence estimates than the general population. In a Canadian male group of professional fire-fighters 85% had at least one potentially traumatic event exposure the past year, and 17,3% qualified for PTSD (Beaton, Murphy, Johnson, Pike, & Corneil, 1999). Professional fire-fighters resemble in many ways the occupational group we want to study, namely professional deep sea (> 60 meters) divers. Both perform specialized work, are exposed to the forces of nature, poisonous gases and substances, depend on heavy personal equipment, breathing apparatus, and have to work in extreme temperature and with low visibility. Both groups are mostly male with physically demanding jobs that involve

frequent exposure to PTEs. Unlike fire-fighters, professional deep sea divers have been given

little attention in research on psychological trauma (Thorsen et al., 2004). However, the

psychological impact of accidents on recreational SCUBA (Self Contained Underwater

Breathing Apparatus) divers has been investigated in a recent study (Trevett, Peck, & Forbes,

2009). The victims had been involved in different dive accidents, 80% were male, and age

ranged from 22 to 72 years. After exposure to one diving accident, the majority of victims

suffered psychological post trauma difficulties after 3 months, and between 25% and 50%

continued to suffer 12 months after. The effect of diving on somatic health was not

investigated.

Due to little available research literature focusing on North Sea divers and posttraumatic

stress, we will rely on three Norwegian reports. These reports include an investigation on the

pioneer divers in the North Sea, carried out on behalf of the Norwegian Government (Lossius,

Andersen, Høilund, Nicolaysen, & Holand, 2003); a report on examinations of potential

health consequences from diving in the North Sea, carried out by Haukeland University

Hospital (Thorsen et al., 2004); and an analysis of risk in manned underwater operations,

delivered by a consulting services company for Statoil, Norsk Hydro and Esso (Scandpower,

2005).

Diving

Figure 2. Saturation diver holding his umbilical cable in the North Sea at 89 meters depth.

Petroleum related diving in the Norwegian sector of the North Sea started in 1966. Over 2300 divers operated in the North Sea between 1965 and 1990, with the majority in British sector. Several different diving methods were used and the most common has been saturation diving. This method utilizes that body tissue becomes saturated with gas when diving. The time needed to eliminate the gas from the tissue and return to surface pressure is independent of how long the diver has been exposed to the given pressure (Scandpower, 2005). Gases found in air, have qualities that make them toxic to humans at different depth and must therefore be replaced. Helium is a common replacement gas but transports heat five times better than air. This causes additional heat loss through the respiratory system and increases the risk of hypothermia (Lossius et al., 2003). The mixture of gases is regulated by the depth, and divers depend on receiving the correct mixture from the surface through an umbilical cable. The umbilical typically supplies heat, communication, power and acts as the only safety line connecting diver and dive bell. Jeopardizing this umbilical is life threatening for the diver.

Saturation diving is effective, in terms of how much out of total dive time is used on working, because divers may live and work under the same atmospheric pressure. The length of the dive has been limited to maximum 16 days by current Norwegian work regulations (Arbeidsmiljøloven, 1991). During this period, divers stay under pressure either in the living quarters or in the subsurface work setting, and cannot leave the pressurized environment. Professional deep sea diving is characterized by exposure to elevated pressure for a given time with a given breathing gas (Thorsen & Troland, 2004). Following this definition diving also includes time out of water, as long as it is a pressurized environment.

The Norwegian government and industry had no experience when it came to petroleum production and processing in the 1960s, and a lot of foreign workers with needed competence were recruited to help the North Sea operators start production. The first systems for saturation diving were developed by the American offshore petroleum industry located in the Gulf of Mexico and on the coast of California. However, most of the offshore drilling in these areas has been done in shallow water, and a mild climate. In contrast, the depth in the North Sea varies from 50 to more than 300 meters, with an average of 94 meters. Common work depth in the 1970 and 80s was between 60 and 180 meters (Thorsen et al., 2004). Depth, along with water temperature as low as 2°C and rough weather make it a challenging task for the divers. Dangers in deep sea diving include, among many others, losing breathing gas, hypothermia, falling objects, sea currents and unstable pressure (Lossius et al., 2003). Additional psychological stressors may be search and recovery of bodies at sea. All these events may qualify for a traumatic event and may induce intense fear, helplessness or horror, as demanded in the A2 criterion.

All dangerous work demand well trained personnel. Training was the most important factor in coping on the job for a group of US Navy divers aged between 20 and 40+ who participated in search and recovery of an aircraft (Leffler & Dembert, 1998). In Norway, all professional divers were rigorously selected and educated by the Norwegian Navy prior to the establishing of The Governmental National Diving School in 1980. There was also some "on the job training" provided by the diving companies (Scandpower, 2005). Competence was developed along the way, in a work which was groundbreaking but unfortunately not without accidents (Lossius et al., 2003). Many divers experienced injuries and the most common was decompression sickness. In one report 83% of the deep sea divers had experienced decompression sickness (DCS) one or more times (Troland & Thorsen, 2004), and there were 176 confirmed and reported cases of DCS during saturation diving in the Norwegian sector between 1978 and 2003 (Scandpower, 2005). This life-threatening condition is caused by insufficient time in decompression after diving, equivalent to too fast surfacing. When the pressure decreases too fast, too much of the inert gas from saturated body tissue is released into the bloodstream. These gas bubbles damage the body tissue and brain cells to different degrees, resulting in minor injuries or death (Lossius et al., 2003). A Norwegian governmental report claims that 83% of deep sea divers has experienced a life threatening situation under water, and between 1967 and 1990, 55 divers died during petroleum related work in the North Sea (Lossius et al., 2003). This report concludes that deep sea divers seem to be at risk in terms of physical illness, use of medication, disability pension, and psychological illness as a result of work strain. It is important to note that these divers are a selected group of young men in good physical and mental health conditions. The latter was verified annually in mandatory medical examinations (Lossius et al., 2003).

There exists a historical parallel to this situation of young men with "unexpected" severe health complaints. It resembles the situation when Norwegian prisoners returned from concentration camps after WWII. During the war, Norwegian members of the resistance movement were typically recruited from sports clubs, cultural and political organizations. They were young people with excellent physical and mental health, resilience and hardiness. When they showed symptoms of posttraumatic stress several years after return from captivity, it was highly unexpected, because they were considered better able than most people to withstand the potentially traumatic events they were exposed to during the war and years in prison camps (Weisæth, 1993). This refers to the notion that good upbringing and background will affect how one deals with potentially traumatic events. In an attempt to explain breakdown during WWI, family pedigrees of patients were collected, due to the notion that some people were genetically predisposed to "shellshock". Such early theories on psychological trauma emphasizing hereditary factors and background in determining breakdown have been repeatedly discredited. Experiences from WWI forced experts to think otherwise when the young upper class men of respectable character returned as mental wrecks, after trench warfare (Stone, 1985).

We know from three reports (Lossius et al., 2003; Scandpower, 2005; Thorsen et al., 2004)) that the deep sea divers in the respective samples were exposed to several PTEs, all supposedly qualifying for the PTSD A1 criteria. However, the diver's subjective experiences of the potentially traumatic events were not assessed; leaving fulfilment of the A2 criterion unknown. But two important studies support that a strong A1 experience most likely will induce intense fear, helplessness and horror (Breslau & Kessler, 2001; Creamer, McFarlane, & Burgess, 2005). This will be especially true when the person is situated under water or in a pressurized environment. Because the surface return is time consuming and no immediate

help is available, safe escape from any danger when diving is complicated and totally dependent on colleagues. Dive operations are extremely expensive if petroleum production is paused for extensive time while divers complete their work. The completion of work in as short time as possible is imperative, and this may influence risk taking and work pressure for divers. Considering the indication that deep sea divers have a high prevalence of PTE, and the potential magnitude of the threat to self and others experienced by them, most likely the A2 criterion is satisfied (Creamer et al., 2005).

Health Consequences and Economic Compensation

    Somatic health.

North Sea divers need certificates in order to perform their work, and good health is necessary to obtain these. The starting health for people in this profession will be better than for the general population (Scandpower, 2005). This is due to health requirements which must be fulfilled at the start of the education. However, examinations of health conditions in a group of North Sea divers indicate several somatic health issues. Divers are more likely than a comparable age group to be disabled (Irgens, Grønning, Troland, & Thorsen, 2004). They report a higher rate of sicknesses, injuries and symptoms than general population at comparable age, and a large part of divers considered their health status to be poor. Physical health issues include among others impaired hearing and balance, reduced lung functioning, impairment of neurological functioning, and often occurring joint pains (Irgens et al., 2004).

    Psychological consequences of offshore diving.

Research on the negative psychological consequences of oil-related deep-sea diving is scarce. A preliminary study of 74 retired North Sea Divers, concluded that 97% of them had been exposed to life-threatening events during work in their diving career (Troland & Thorsen,

2004). A final report for the Ministry of Labour and Administration, was worked out by the

Department of Work Medicine at Haukeland University Hospital (Thorsen et al., 2004). This

report showed more than three times higher prevalence of psychological problems in a sample

of 96 North Sea divers, compared to a sample of other divers and to a sample from the general

population. This sample of 96 is included in our data of 136 North Sea Divers.

Litigation.

The impact of litigation on reported symptoms have been studied many times. PTSD is

especially of interest in litigation cases, since the A1 criterion demands the presence of an

etiological component (Frueh, Elhai, & Kaloupek, 2004). Some studies points towards PTSD

being a neurosis mainly present due to litigation (i.e. Miller, 1961) cited in (Bryant & Harvey,

2003), others that there is an increase in symptoms reported in those involved in litigation

(Bryant & Harvey, 1995), while some have found no impact (Blanchard et al., 1998). There

has also been reported a need for studies on recovery from PTSD while litigations were

unresolved, due to clinical cases suggesting that degree of recovery can be highly reduced or

even reversed in such cases (Kimbrell & Freeman, 2003). It is advised that additional

objective information is gathered when the assessment of PTSD and litigation cases are

connected, especially if there are indications of over-reporting of symptoms (Frueh et al.,

2004).

Law suits are made by former North Sea divers against the Norwegian Government, holding it

accountable for "experimental and dangerous operations in the North Sea" (Sæther, Aas,

Haugsbø, & Vågenes, 2009). The main question is whether the Norwegian State was aware of

the risk the divers were exposed to, and as such was responsible for the negative health

consequences they suffered. The Norwegian parliament established a compensation

arrangement for North Sea divers March 8th, 2004. The law suits on economic compensation started in 2005, encompassing 250 divers. The authors of the report (Thorsen et al., 2004) assumed that this compensation arrangement and the public and political debates regarding North Sea divers and their situation, would affect their expectations for compensation, how they viewed their life situation and how they presented it at the assessment. They also expected the preliminary report in 2003 to have influenced the psychological assessments. Thus, divers' psychological assessments after July 2003, and all data after March 2004 were excluded in the final report on divers' health status published in December 2004 (Thorsen et al., 2004). This study will explore all assessment data from North Sea divers available in November 2007, in order to find what possible effects the compensation arrangement had on reported symptoms at the time of assessment.

Aims of the study

The object of our study is to explore in a sample of North Sea deep divers

1. Percentage of PTEs.

2. Percentage of possible PTSD.

3. Relationship between PTEs and possible PTSD.

4. Possible effects of prospect of economic compensation on psychological symptoms.

Method

Recruitment and Participants

The Norwegian Ministry of Health and Care Services assigned Haukeland University Hospital to offer medical and psychological examination to all former or present deep sea divers who had worked in the Norwegian sector (N=375; all male) with suspicion of diving related health complaints. From February 2000 to November 2007, general practitioners or social security

offices referred 227 divers to health examination at the hospital's Department of Occupational Medicine. Complete data from all three assessments presented in the current study were delivered by 136 divers, representing 60% of the examined divers and 32,3% of the entire population of North Sea Divers. Average age of the present sample was 52,3 years (SD=6,5; range 30-66 years).

Procedure

The divers underwent clinical neurological, neuropsychological, neurophysiological, otoneurological, and medical lung examination, MR-scan of brain and spine, record of medical history and health, assessment of personality patterns and posttraumatic stress symptoms, as well as exposure to potentially traumatic events in the workplace. All tests were performed during three days and scored by trained test-technicians or specialists in the respective fields.

Measures

 Potentially traumatic event (PTE).

The method of collecting information regarding exposure to potentially traumatic events was changed during the data collection period due to the time consuming original procedure. Exposures to PTEs were in the first place measured (n=63) by using a questionnaire and corroborated by using examination of the medical records by two experts in hyperbaric medicine, but later changed to use of questionnaire only (n=73). In the results, the first group will be referred to as the "medical record" group.

Impact of Event Scale – Revised (IES-R).

The Impact of Event Scale (Horowitz, Wilner, & Alvarez, 1979) is the most extensively used

self-report measure in the field of traumatic stress. It measures posttraumatic stress symptoms.

The original IES contain 15 items (7 intrusion, 8 avoidance), and the respondents reported the

frequency (0=not at all, 1= rarely, 3=sometimes, 5=often) the event in question had been true

for them during the last week. To encompass the third symptom cluster of PTSD

(hyperarousal) in the DSM-IV (1994), the Impact of Event Scale – Revised was introduced in

1997 (Weiss, 2004). The IES-R contains 22 items and three subscales (8 intrusion, 8

avoidance and 6 hyperarousal items). The scale used in this study is a combination of the

original IES and the IES-R, assessing the frequency of the 22 items of the IES-R, but with the

4-point (0-1-3-5) scoring of the IES. In the current study the Cronbach alpha coefficient of the

IES-R was .91.

MMPI-2 and Keane PTSD scale.

MMPI is a self-administered test developed for the assessment of personality patterns and

clinical status (Dahlstrom & Dahlstrom, 1980). A subscale of the MMPI, The Keane PTSD

scale, was developed in 1984 (Keane, Malloy, & Fairbank, 1984). It measures personality

variables found to be correlated with PTSD. The scale has been extensively applied (Lyons &

Keane, 1992), and it has demonstrated good discriminative value (Wolf et al., 2008). After a

revision in the 1980s, the MMPI-2 was commercially available in 1989. The Keane PTSD

scale was revised when the MMPI-2 was introduced consisting 46 items, and the new cut-off

for treatment-seeking or traumatized populations was recommended set at 28 (Lyons &

Keane, 1992). The US normative data showed an internal consistency of .75 (van der Heijden,

Egger, & Derksen, 2008). In the current study, the internal reliability coefficient (Cronbach's

alpha) of the MMPI-2 was .86.

The prevalence of possible PTSD in the current study is measured by the personality measure Keane PTSD scale and the symptom measure IES-R. Different cut-offs have been suggested in literature. A balance between high sensitivity; (to what degree a measure will correctly identify positive cases), and high specificity; (to what degree a measure can identify negative cases), is a criterion for the selection of cut-offs. For the Keane PTSD scale, both a T-score of 65 and a raw score of 28 (Lyons & Keane, 1992), have been suggested as cut-offs for identification of possible PTSD. For the IES-R, both item-averages and sum-scores have been suggested. The item averages were: 1.5 (IES-R) as proposed after studies on Vietnam veterans (Creamer, Bell, & Failla, 2003), and 1.3 (IES-15) as proposed as a threshold for clinical concern (Horowitz, 1982). The sum score cut-offs proposed was 35 (IES-15) on a sample consisting of 40% with civilian trauma, and 60% with military trauma (Neal et al., 1994), and 27 (IES-15) after studies on motor vehicle accidents (Coffey, Gudmundsdottir, Beck, Palyo, & Miller, 2006). By transforming sum score cut-offs to item averages, one can compare cut-offs for the IES and the IES-R. Comparison between the original end revised versions is approved in literature (Weiss & Marmar, 1997).

Exaggeration of symptoms was examined through the MMPI-2 validity scales. T-scores on the L-scale (Lie) above 65, F-scale (Correction) above 100, and K-scale (Self-presentation) under 40 or above 71, has been suggested as possible indicators of malingering (Wilson & Moran, 2004). The authors do not say how many scales with scores outside these values are necessary to claim the presence of malingering, but that these scales are three of several that can be applied when evaluating this phenomenon. It should be noted that the malingering term entails not only exaggeration of symptoms, but also faking, which might give different scores.

In the analysis of the possible effects of economic compensation, the sample was divided in those examined before ($n = 74$) and after ($n = 62$) the establishment of the compensation arrangement in March of 2004. Data from the two persons tested in March 2004 were divided and included in the two groups.

Results

Demographic Data

Table 1-2 shows distribution of age and year of testing.

Table 1

Age at Medical and Psychological Assessment.

		Age at assessment		
Age	n	cumulative n	%	cumulative %
30-39	3	3	2.2	2.2
40-49	41	44	30.2	32.4
50-59	76	120	55.8	88.2
60-69	16	136	11.8	100.0

Table 1 shows that the sample is relatively old, $M = 52.4$, $SD = 6.5$, range 30-66.

Table 2

Year of Medical and Psychological Assessment.

	Time of assessment			
Year	*n*	cumulative *n*	%	cumulative %
2000	10.0	10	7.4	7.4
2001	19.0	29	14.0	21.3
2002	28.0	57	20.6	41.9
2003	15.0	72	11.0	52.9
2004	13.0	85	9.6	62.5
2005	19.0	104	14.0	76.5
2006	20.0	124	14.7	91.2
2007	12.0	136	8.8	100.0

Table 2 shows that there was a steady flow of patients during the 8 years of data collection.

Percentage of Potentially Traumatic Events

The entire sample of 136 divers were asked to give "yes" or "no" answers to whether or not they had experienced PTE(s), and number of such events. Ninety-six percent said that they had experienced a PTE and 76% reported how many, with a mean of 4.8 (range 1-20) PTEs. Of these, 92% reported to have experienced more than one PTE. This means that the percentage of experienced PTEs was very high, but there were large variations in number of PTEs among the divers in the current sample.

Further Analyses

In addition to self-reports, the entire medical records were examined for the first 63 divers, in order to find what types of PTEs they had experienced. The distribution of the 15 most frequently reported types of PTEs were as shown in Figure 3. See Appendix A for detailed results.
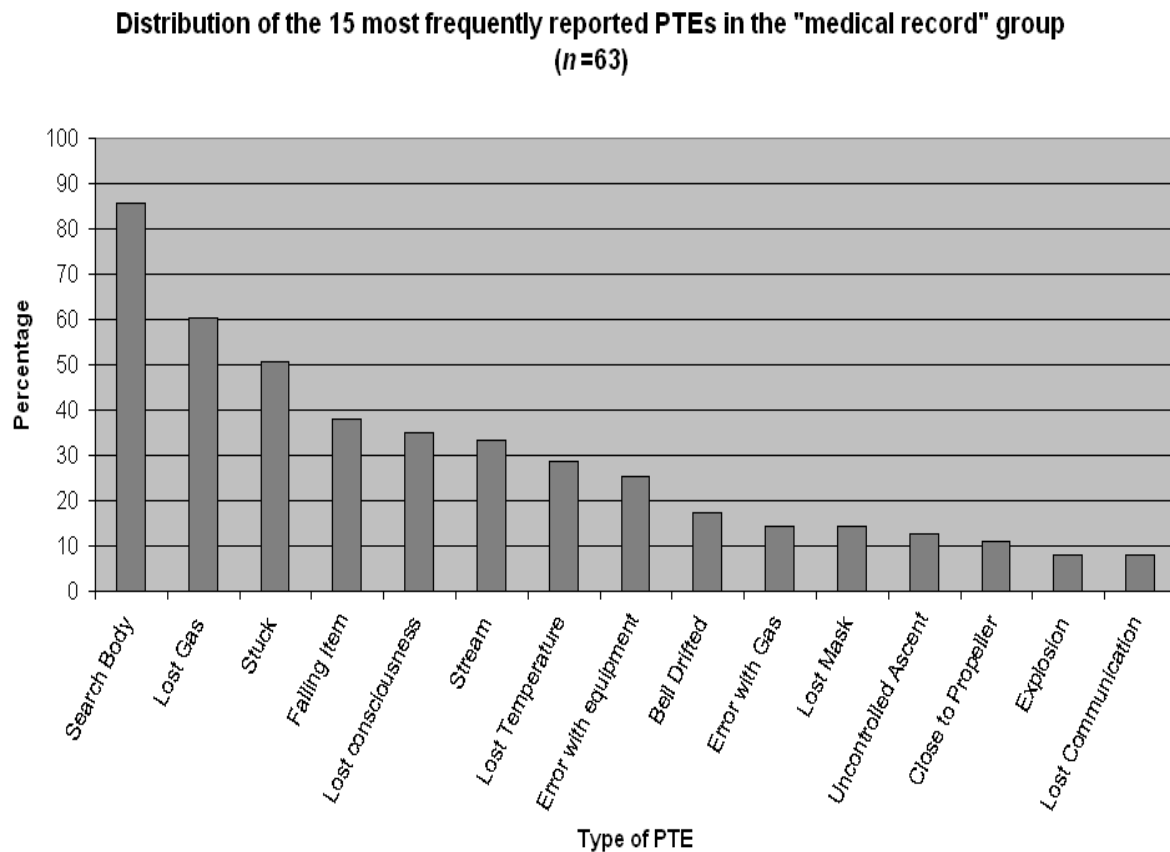
Figure 3. Reported PTEs.

The PTEs most frequently reported were the search for bodies, loss of breathing gas and getting stuck in construction parts, experienced by 51% - 86% of the divers. This shows that many of the divers in the current study experienced a large number of very serious incidents.

Percentage of Possible PTSD

According to the personality scale, the percentage of possible PTSD ranged from 8% - 35%

depending on which cut-offs were applied. Using the symptom measure, the percentage of

possible PTSD varied from 48% - 70% (see Table 3).

Table 3

Percentage of Possible PTSD Measured with IES-R and Keane PTSD scale.

Type of PTSD measure	Measure	Cut-off scores		Percentage of possible PTSD ($N =136$)
		Average item score	Sum score	% (n)
Symptom	IES (0-1-3-5 scale)	1.3	19	70% (95)
	IES-R (0-4 scale)	1.5	.	66% (90)
	IES (0-1-3-5 scale)	1.8	27	59% (80)
	IES (0-1-3-5 scale)	2.3	35	48% (65)
		T-score	Raw score	
Personality	MMPI/MMPI-2	65	17	35% (48)
	MMPI-2	83	28	8% (11)

Note. "." The data is not comparable with other sum scores and omitted.

The results show that the percentage of possible PTSD was high but varied greatly with

respect to whether the personality or symptom measure was used, with the symptom measure

leading to the highest percentages of possible PTSD.

Further Analyses

The high percentages of possible PTSD stimulate further analyses. All IES-R subscales

correlated statistically significant $r=.74$ to $.82$ (all ps $< .01$), which indicates that they are

highly related but measure different aspects of the same phenomenon. Table 4 shows the item

endorsement (non-zero values) of the IES-R, and sample means of each item. For the

intrusion subscale, the highest sample means were for "intrusive images" (2.89) and

"interrupted sleep" (2.80). For the *hyperarousal subscale*, the highest sample means were for

"trouble concentrating" (3.53) and "irritability and anger" (2.79). For the *avoidance subscale*,

the highest sample means were for "avoid thinking about it" (3.01) and "avoiding getting

upset" (2.73).

Table 4

Item Endorsement and Sample Item Means for the IES-R.

	IES-R 22	*n*	Endorsement (%)	Missing data (%)	Sample item mean	*SD*
	Intrusion (I)	126	.	.	18,28[a]	11,08
	Avoidance (A)	124	.	.	18,42[a]	10,20
	Hyperarousal (H)	127	.	.	14,65[a]	8,45
	IES-R (0-1-3-5)	122	.	.	51,25[a]	27,62
I	Pictures popped into mind	134	93,4	1,5	2,89	1,63
I	Trouble staying asleep	134	86,0	1,5	2,80	1,81
I	Reminders caused feelings	132	80,9	2,9	2,44	1,77
I	Thought about it	133	82,4	2,2	2,29	1,69
I	Dreamt about it	130	80,9	4,4	2,14	1,76
I	Waves of feelings	129	80,9	5,2	2,12	1,65
I	Reminders caused thoughts	131	83,8	3,7	1,98	1,56
I	Act or felt like in the event	130	66,9	4,4	1,58	1,67
H	Trouble concentrating	133	88,2	2,2	3,53	1,82
H	Irritable and angry	135	83,8	0,8	2,79	1,85
H	Trouble falling asleep	131	81,6	3,7	2,72	1,94
H	Watchful and on guard	128	69,9	5,9	1,96	1,88
H	Physical reactions	132	67,6	2,9	1,86	1,84
H	Jumpy and easily startled	132	72,1	2,9	1,82	1,75
A	Tried not to think about	132	80,1	2,9	3,01	1,98
A	I avoided getting upset	132	83,1	2,9	2,73	1,80
A	I tried not to talk about it.	128	75,0	5,9	2,61	2,05
A	Tried to forget	126	72,1	7,4	2,56	2,10
A	Kept distance to feelings	128	78,7	5,9	2,30	1,76
A	Kept distance to reminders	133	61,8	2,2	1,90	1,98
A	Feelings were numb	128	65,4	5,9	1,77	1,74
A	I felt as if not real	132	54,4	2,9	1,52	1,78

Note. [a] Sample subscale mean ".". Missing data and endorsement is not relevant for these scales.

In sum these divers struggle especially with trouble concentrating, difficulties sleeping, and irritability. Some PTSD symptoms typical in other samples, such as re-enactment, numbness, and a sense of the event being unreal, seemed to be less typical for our sample, indicating that the divers have a particular way of reacting to psychological trauma.

Relationships Between PTEs and Possible PTSD

The number of PTEs was significantly correlated $r = .23$ ($p < .05$) with the symptom measure (IES-R), but not to the personality measure (Keane PTSD scale) ($p > .05$). The result shows a weak dose-response tendency, meaning that change in effect (here IES-R score) covariates with different levels of exposure (here to PTEs), however the correlation is small.

Impact of Prospect of Economic Compensation

There were most statistically nonsignificant differences in personality scores and symptom score between the groups tested before and after March 2004. The few statistically significant results were differences in MMPI-2 validity scales "Correction" and "Self-presentation", and content scales "cynicism" and "family problems" (see Appendix B). The results indicate little or no impact of litigation on reported symptoms.

Among several scales suggested for indication of malingering are the MMPI-2 validity scales. The average sample scores on these scales, L (54), F (60) and K (48), are well within valid range. However, there are several values on single scales outside those recommended for estimating malingering, with 32% ($n = 43$) scoring outside the limits on one scale, and 1% ($n = 2$) with two such values. For these values, malingering is only one of several different interpretations possible: On the K-scale, 22% had a T-score below 40, with a possible interpretation of exaggeration of symptoms, as well as loss of control, confusion and

impairment of social or occupational functioning. On the L-scale, 8% scored above 65, indicating underachievement or underreporting of negative sides. On the F-scale, 1% scored above 100, indicating a cry for help, confusion, loss of control and social isolation (Havik, 2003). The few differences in symptoms and personality before and after the compensation agreement, as well as the valid average scores on the MMPI-2 validity scales and the many possible interpretations of the extreme scores, points towards low levels of malingering in our sample

Other Analyses

Relationship between Personality and Posttraumatic Stress Symptoms

All the MMPI-2 *clinical* scales correlated positively with the IES-R sum score, with the exception of "Masculinity-Femininity" ($p > .05$) (see Appendix C). Correlations were positive and in the range of $r=.55$ (Psychastenia) to $r=.23$ (Hypomania). All the MMPI-2 *content* scales correlated positively with the IES-R sum score, in the range of $r=.63$ (Anxiety) to $r=.26$ (Family Problems). For the IES-R subscales, the correlations revealed a pattern when marking the highest correlations for each MMPI-2 scale. Fifteen out of 25 MMPI-2 scales correlated the highest with hyperarousal symptoms, while nine scales correlated the highest with intrusion symptoms, and only one correlated the highest with avoidance symptoms (see Appendix C).

Further analyses.

There were high correlations between IES-R items (symptoms) and MMPI-2 clinical and content scales (personality features), with the exception of Masculinity-Femininity scale and the two avoidance items "I avoided letting myself get upset" and "I tried to remove it from my memory" (see Appendix D).

In sum the personality scores are positively correlated with the symptom scores. Generally, the strongest relationships with posttraumatic stress symptoms were found to be with personality scales that measured depression, anxiety, and their ability to work.

Personality Profiles

The mean MMPI-2 profile for this sample is shown in Figure 4.
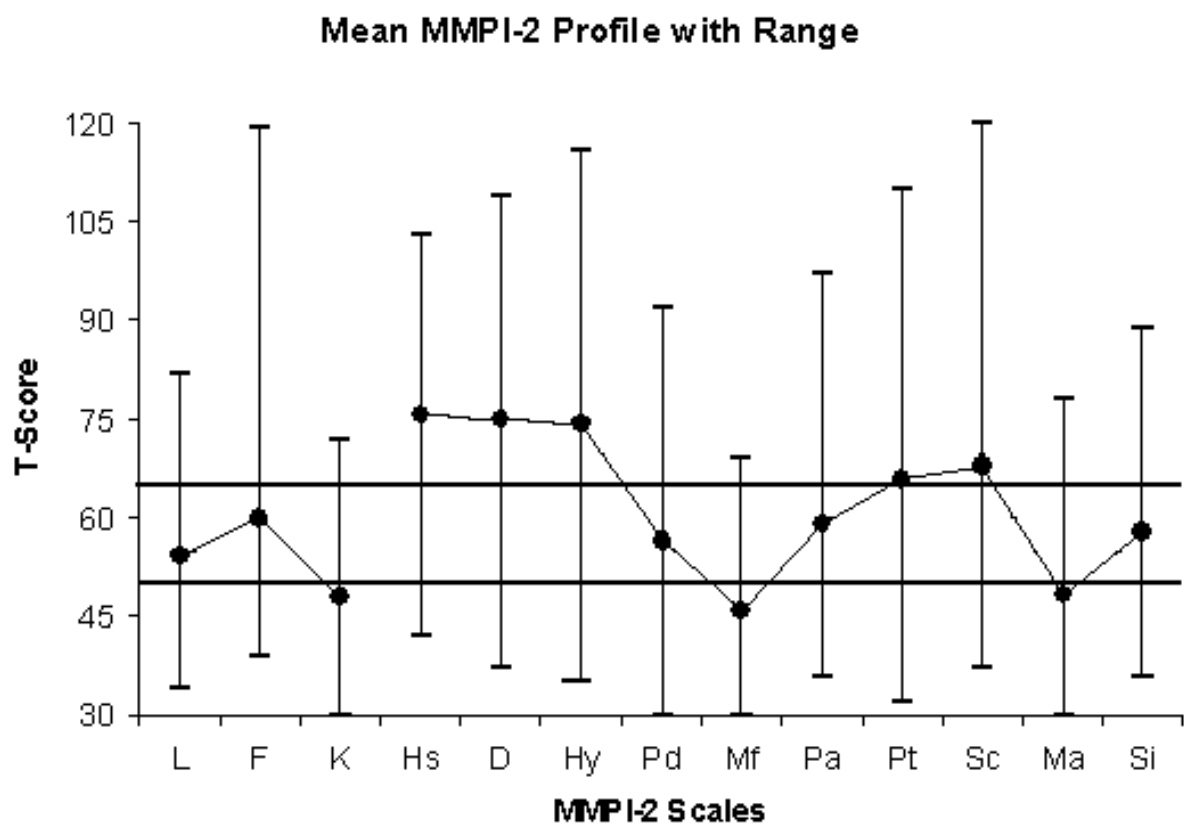
Figure 4. The mean MMPI-2 profile with range, for the total sample ($N = 136$).

The mean MMPI-2 profile for the divers has a 1-2-3 three-point code. This is typical for persons with long lasting problems, characterized by physical symptoms and a feeling of being worn out. With this profile one would expect that the divers have irritability issues that affect their interpersonal relations and it is common with a passive dependency on others to

take initiative and make decisions. The typical 1-2-3 profile is rarely combined with confusion and psychotic features (like intrusions), indicated with the eighth (Schizophrenia, Sc) scale. However, our divers had a heightened Sc scale, which the original Keane PTSD profile also had. This allows for additional expectation of these PTSD-corresponding symptoms. However, there are large variations in scores.

     Further analyses.

Whether there could be detected differences in personality profiles between the groups tested before and after the compensation arrangement was established, or not, was also looked into. The mean MMPI-2 profiles is as shown in Figure 5.
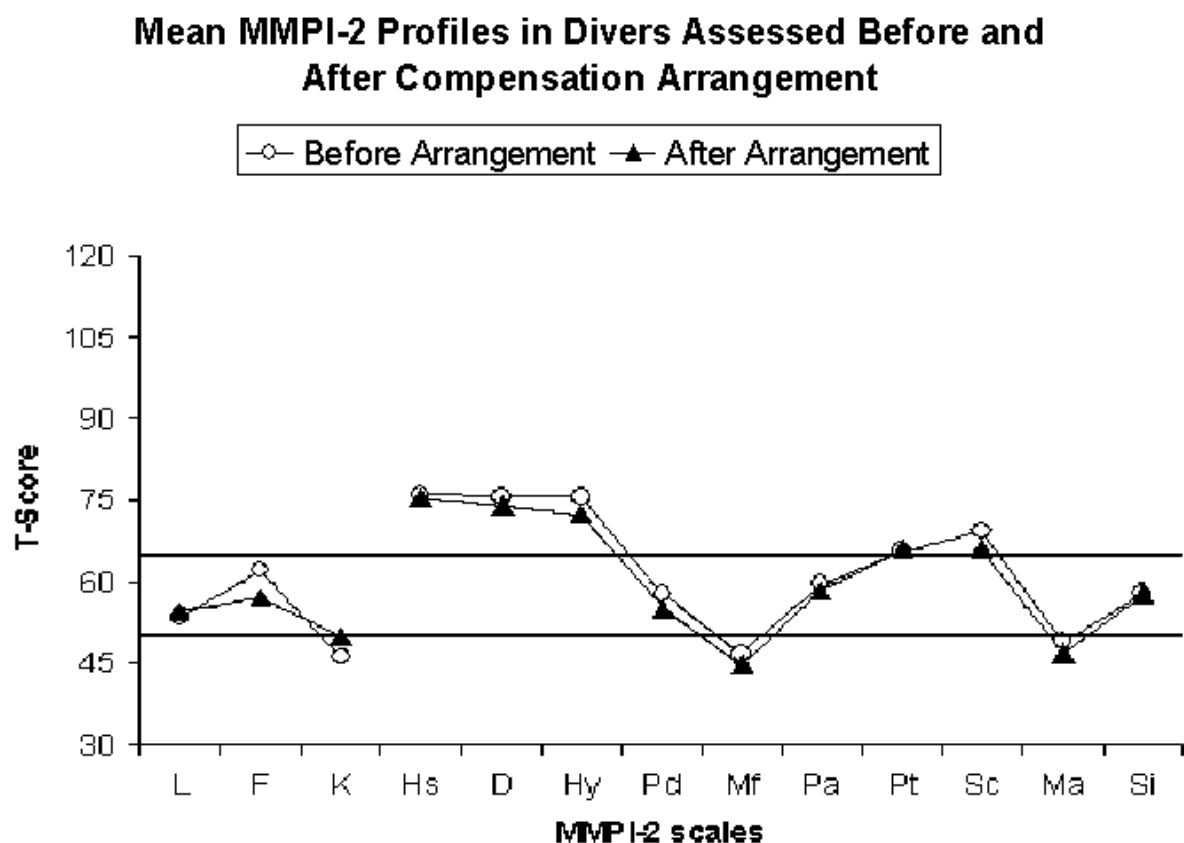
Figure 5. The mean MMPI-2 profiles for the groups tested before and after the establishing of the compensation arrangement in March 2004 (*N* = 136).

The results show identical personality profiles for the divers tested before and after the compensation agreement was established. This indicates no differences in personality for the two groups, and we could not find a particular "claimant personality".

Since the Keane PTSD scale was developed as a scale detecting personality features that correlate highly with PTSD, it is expected that one will find different personality profiles for the groups with or without possible PTSD. The mean MMPI-2 profiles for these groups are shown in Figure 6.
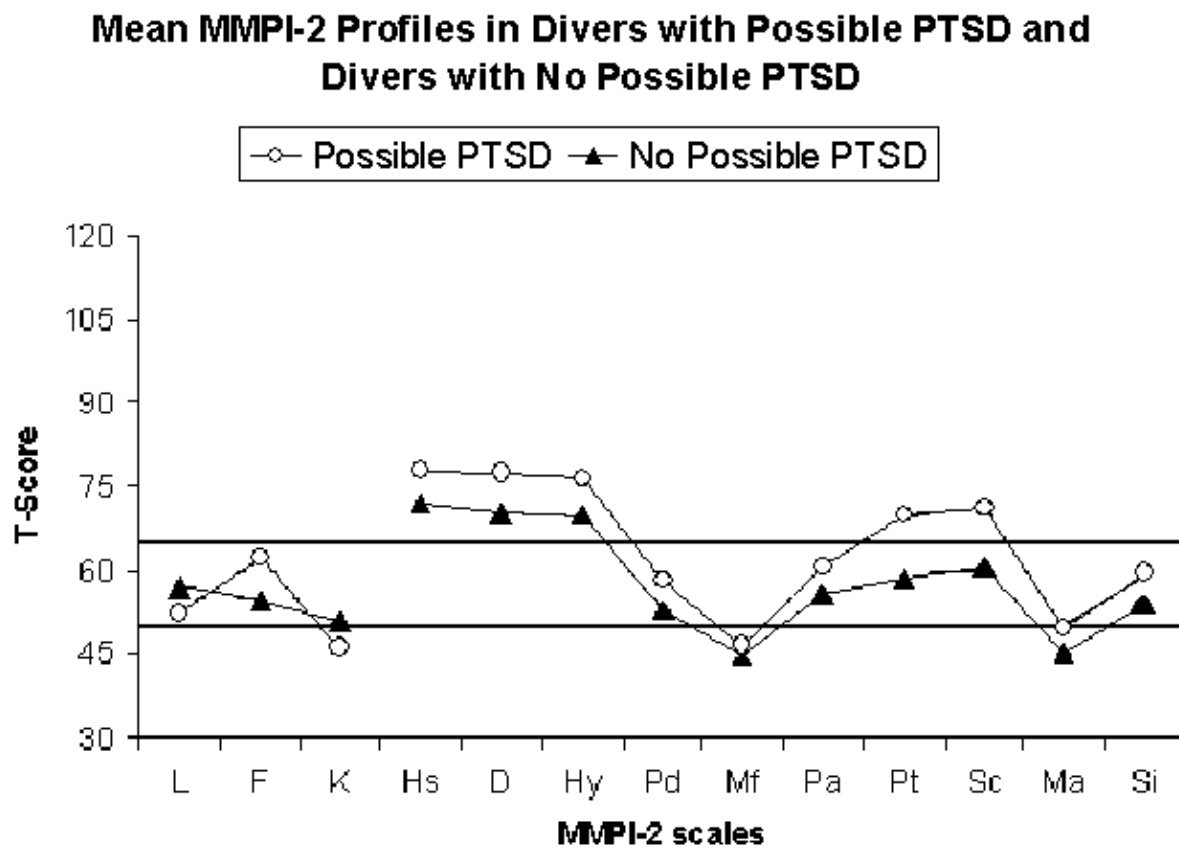
Figure 6. The mean MMPI-2 profiles for the groups with possible PTSD and without possible PTSD (*N* = 136).

The results points towards personality differences between those with and those without possible PTSD. In general, all clinical scales are heightened for those with possible PTSD, in particular the Psychastenia and Schizophrenia scales.

Discussion

Major Findings

Among North Sea divers, almost the entire sample (96%) had experienced at least one potentially traumatic event, and 92% more than one. The number of potentially traumatic events is very high, but still very similar to those experienced by similar occupational groups. However they differ in one very important way – the conditions they occur in. The divers are dependent on their umbilical cable. At the depths they operated in, many different factors can jeopardize the umbilical, and cause the loss of strict essentials such as heating and breathing gas, as well as communication and light. Without artificial light, it is pitch-dark and you are practically blinded. Without communication you cannot ask for assistance. If you lose your breathing gas you will suffocate. Without heating, you will freeze, both on the outside and the inside, as the breathing gas has to be heated, or it draws the heat from your lungs with every breath. All this occurs in a pressurized environment, where only your fellow diver(s) can help you if an accident happens. The only escape is the dive bell, and everyone else can only assist through communication. This means that not only had a vast majority of the divers experienced a PTE; they had experienced *dangerous* PTEs *several* times.

The levels of possible PTSD among these divers were between 10 and 15 times higher than in the general population, when measured with the posttraumatic stress *symptom* measure IES-R. They reported symptoms of intrusion, avoidance and hyperarousal. The most endorsed intrusion symptoms were *intrusive images* and *repetitive awakenings*. For the hyperarousal

symptom cluster, *trouble concentrating, irritability* and *difficulties falling asleep* were the most common, while for the avoidance subscale *trying not to think about the event* and *avoiding getting upset* were the most reported problems. This draws a picture of a typical North Sea diver symptom constellation: They suffer from a variety of symptoms, especially with troubles with concentration, irritability and sleep disturbances. Each symptom is likely to affect both themselves and their surroundings in their everyday life. In addition they try not to feel anything and not to talk about their experiences, leaving them alone with their difficulties. This "traumatized North Sea diver"- constellation also demonstrates what symptoms are less typical for the divers. They seem to less often re-enact the events, experience numbness or feel like the events were unreal. This constellation is not compatible with attention seeking behaviour or typical in persons prone to seek economic compensation.

The presence of possible PTSD was also measured through the *personality* measure Keane PTSD Scale, resulting in 8%-35% with possible PTSD. These rates are high, though lower than with the symptom measure. This taps into an old debate surrounding what leads to posttraumatic stress. Is it the result of *internal dynamic processes* working as vulnerability factors? Or is it decided by the *nature of the PTEs?* The divers were thoroughly selected, but still showed massive responses of posttraumatic stress. It seems unlikely that there was some internal factor in the divers that can explain these responses. However, the nature of the PTEs and the conditions they occurred in can very well account for these strong results. Accordingly; when the event in question is "bad" enough – *anyone* can be traumatized.

The prospect of possible economic compensation was a potential reason to report stronger symptoms of PTSD than were true. The economic compensations arrangement may influence the data in several ways: Stronger or more symptoms reported, an increase in flow of patients, increased number of reported PTEs, and effects on validity scales of the personality measure.

However, there appear to be few differences in personality and symptom scores in the groups assessed before and after the compensation arrangement. This means that the prospect of economic compensation did not affect reported symptom severity or reported personality style. Furthermore, there was no asymmetry in flow of patients for assessment before and after the compensation arrangement in 2004, nor group differences in number of reported PTEs. By assessing the validity scales from the personality measure, very few indicators of malingering on a group level are found. Overall this is interpreted as indications that the prospect of possible economic compensation did not have any effect.

Other Studies

There are few studies on psychological health in divers, and no studies that have investigated PTSD in deep sea divers. Several studies on PTE and PTSD among other samples are relevant to our results. Due to that, the results are related to a number of different studies on general populations, a comparable high-risk group, a group of divers, and to litigation.

Compared to American and Swedish general population studies on PTE prevalence (Breslau et al., 1998; Frans et al., 2005), the results from our study show only slightly higher rates of experienced PTEs. However, our findings present a considerably higher rate of possible PTSD than the general male populations in different countries (Frans et al., 2005; Perkonigg et al., 2000). Relating our results to studies of a demographically comparable group of Canadian fire-fighters shows similar prevalence rates of PTE, but higher rates of possible PTSD in North Sea divers (Beaton et al., 1999). This indicates that it is something specific to deep sea diving, and not the *number* of PTEs that is decisive for the large percentage of possible PTSD.

A recent study on psychological health in recreational divers, reported that they suffered from psychological post-trauma difficulties more than 12 months after the accident (Trevett et al., 2009). The results of the current study are in accordance with these findings, as the North Sea divers also report high level of psychological symptoms long after exposure.

Research on effects of litigation on reported symptoms in victims of accidents have produced various results. Our study reveals no particular effect of litigation and prospect of economic compensation on reported symptoms of posttraumatic stress. This result is in accordance with Blanchard et al. (1998) and their research on motor vehicle accident victims and litigation.

 If all PTSD criteria are not included in assessment of possible PTSD, there is a risk of an inflated prevalence rate (Boals & Hathaway, 2009). The data material we had access to did not include data on the E and F criteria in the DSM-IV PTSD diagnosis. However, considering the E criterion, the participating divers were retired from their occupation. They had to access the study through their general practitioner or social security services, and then be summoned for assessment. This organization is a time-consuming process. It is likely that all participants with posttraumatic stress symptoms had them for at least the required month before assessment. Fulfilment of the F criterion is uncertain, but participating divers did seek help from different sources and were willing to undergo significant testing. This compliance indicates that participants were motivated to receive help, and that they were in need of it. Therefore it is likely that they did experience social or occupational impairment in areas of functioning, and thus fulfil the F criterion.

Alternative Explanations

It is difficult to find plausible alternative explanations for the results, however there are factors that may influence the results. One such factor is PTEs experienced outside the diving

context. Based on demographical prevalence data of PTE, most people will experience at least one such event. Another factor is comorbidity which is unknown in our sample. Comorbid mental disorders could influence scores on the measures used in this study.

Strengths and Limitations

The sample included in this study entails approximately one third of the entire population of North Sea divers who had operated in the Norwegian sector, and it is a rare opportunity to do research on a sample of this proportion. This allows generalizing the results. The sample size, together with the strong findings, tells us that even if assuming no symptoms in the remaining population, the results are still substantial.

Possible PTSD was measured with two different types of instruments, allowing comparisons between personality and symptoms.

The data was collected primarily for health examination, not for research purposes. This natural setting increases the external validity of the study. In addition the divers were assessed in a number of ways by several experts and with advanced technology, causing an unusual wide range of data to be collected. This range allows interpretations of interaction effects and a more holistic view.

This method also leaves highly relevant questions unasked. Time of exposure and time post exposure are two highly relevant variables in trauma research, but with no data available for the current study. Time of exposure can render possible conclusions about their previous experience, age, and what the reigning laws and conditions were at that time. This is important for evaluating protective or risk factors. Time post exposure reveals whether they

have been suffering for a short or a long time. This is relevant for evaluating prognosis, since symptoms following trauma is reported to decline with time.

Data from clinical interviews were not included. This means that comorbidity is unknown for this study. It is also unknown who and how many of the divers are directly involved in the law suits concerning North Sea divers.

Clinical Implications

North Sea divers are chosen men, used to view themselves as persevering, adventurous and tough. Now their life and self-perception has changed drastically, into; disabled, angry, anxious and reserved. They suffer a multitude of symptoms, both physically and psychologically and are a population in desperate need of help. Treatment is important, although in what form it will be most effective must be evaluated. The typical "conversational" psychotherapy is perhaps not best suited for men who avoid talking about their problems. Perhaps it would be more suitable for them to do as Norwegian war veterans in Bæreia (Norway), to meet and be with peers without the necessity of explaining and exploring. As tertiary prevention; the Norwegian Seamen's church started a foundation with divers, priests, a nurse and a social worker, with the goal of helping both North Sea divers and their relatives when they struggle with their health and economy. However, in order to prevent the history from repeating itself it is important to try to avoid these problems and increased safety is necessary.

Suggestions for Further Research

Data on North Sea divers continue to be collected, and more divers have been tested after 2007. Both new and previously collected data should be exhausted for information, and

questions on time of exposure should be added. Active North Sea divers' mental health should be examined, in order to find out if posttraumatic stress is common in this group as well, and if so, allow early prevention. The availability and knowledge of prevention and treatment methods are also of interest, in order to examine if the still active divers – though at less risk than before – know what to do and where to go if accidents happen. It would also be of interest to study the properties of the potentially traumatic events the divers were exposed to. Are there features that make some PTEs more potent in causing posttraumatic stress symptoms than others? Suggestions for features that could be included in such research are helplessness, duration, depth (increasing time necessary to escape from the situation or for help to arrive), and own or colleagues' competence. This could be helpful in the process of deciding how to prioritise safety measures.

Conclusion

This study strongly indicates that a large proportion of deep sea divers who worked in the North Sea from the 1960s an onwards, continue to suffer from the psychological impact of potentially traumatic events experienced at work. For this group, the percentage with possible PTSD is very high compared to exposure to PTEs. This gives us reason to suspect that these divers are at severe risk for PTSD. The findings should lead to increased awareness around the conditions divers worked under, and the extensive implications these had on all aspects of the divers' lives. This could prove useful in clinical practice in order to provide the sorely needed comprehension and treatment.

Appendix A

Percentage of the "Medical Record" Group (n = 63) who have Experienced Different Types

of PTEs. (Graphic presentation in text).

Type of PTE ($N = 63$)	n	%
Search Body	54	86
Lost Gas	38	60
Captured	32	51
Falling Item	24	38
Lost consciousness	22	35
Stream	21	33
Lost Temperature	18	29
Error with equipment	16	25
Bell Drifted	11	17
Error with Gas	9	14
Lost Mask	9	14
Uncontrolled Ascent	8	13
Close to Propeller	7	11
Explosion	5	8
Lost Communication	5	8
Sucked In	4	6
Clamped	3	5
Lost Direction	3	5
Uncontrolled Pressure	3	5
Water in Bell	3	5
Attacked	2	3
Leakage	2	3
Mobbed	2	3
Bell Lost	1	2
Electrical Current	1	2
Evacuation	1	2
Uncontrolled Heat	1	2

Appendix B

Differences in Symptoms Before and After the Compensation Arrangement was Established,
Measured with MMPI-2 and IES-R.

Variable	Before March 2004			After March 2004				
	M (*SD*)		Valid *n*	*M* (*SD*)		Valid *n*	*df*	*t*-value
MMPI-2								
Validity scales								
L	53.55	(7.87)	74	54.53	(9.59)	62	134	0.65
F	61.99	(15.57)	74	57.15	(11.99)	62	134	-2.00*
K	46.12	(9.86	74	49.77	(9.94)	62	134	2.14*
MMPI-2								
Clinical scales								
Hs	75.97	(12.74)	74	75.56	(13.18)	62	134	-0.18
D	75.50	(11.55)	74	74.19	(15.29)	62	134	-0.57
Hy	75.80	(16.94)	74	72.53	(15.80)	62	134	-1.15
Pd	57.70	(13.03)	74	55.13	(11.00)	62	134	-1.23
Mf	46.78	(8.52)	74	44.90	(8.60)	62	134	-1.28
Pa	59.68	(12.82)	74	58.24	(12.06)	62	134	-0.67
Pt	65.73	(14.24)	74	66.08	(15.36)	62	134	0.14
Sc	69.23	(14.47)	74	65.94	(13.58)	62	134	-1.36
Ma	48.88	(9.50)	74	47.06	(10.68)	62	134	-1.05
Si	57.84	(10.76)	74	57.55	(12.90)	62	134	-0.14
MMPI-2								
Content scales								
ANX	61.01	(12.75)	74	59.66	(13.74)	62	134	-0.59
FRS	48.39	(11.61)	74	46.23	(9.29)	62	134	-1.18
OBS	51.36	(10.68)	74	49.47	(11.11)	62	134	-1.01
DEP	65.32	(11.82)	74	62.35	(13.98)	62	134	-1.34
HEA	73.07	(13.12)	74	70.15	(14.21)	62	134	-1.25
BIZ	52.42	(12.48)	74	49.23	(9.14)	62	134	-1.67
ANG	55.23	(11.70)	74	52.48	(12.27)	62	134	-1.33
CYN	50.97	(9.85)	74	47.16	(8.86)	62	134	-2.35*
ANP	49.86	(9.46)	74	47.26	(8.03)	62	134	-1.71
TPA	51.86	(10.87)	74	49.69	(10.54)	62	134	-1.18
LSE	58.81	(11.28)	74	56.03	(13.35)	62	134	-1.32
SOD	55.05	(11.53)	74	55.48	(11.36)	62	134	0.22
FAM	53.22	(11.94)	74	46.90	(9.53)	62	134	-3.36**
WRK	61.15	(10.69)	74	59.53	(12.93)	62	134	-0.80
TRT	60.05	(14.05)	74	58.02	(13.38)	62	134	-0.86
Keane PTSD	63.08	(14.05)	71	59.23	(15.68)	62	135	-1.50
IES/IES-R								
Intrusion	16.09	(9.87)	72	17.46	(9.73)	55	125	0.78
Avoidance	17.01	(10.29)	71	20.30	(9.85)	53	122	1.79
Sum IES 15	33.12	(19.36)	71	37.45	(18.42)	52	121	1.25
Hyperarousal	14.44	(8.71)	73	14.94	(8.16)	54	125	0.33
Sum IES-R 22	49.32	(28.14)	71	53.94	(26.93)	51	120	0.91

Note. MMPI-2 abbreviations: L = Lie, F = Correction, K = Self-presentation, Hs = Hypochondriasis, D = Depression, Hy = Hysteria, Pd = Psychopatic deviation, Mf = Masculinity/Femininity, Pa = Paranoia, Pt = Psychastenia, Sc = Schizophrenia, Ma = Hypomania, Si = Social introversion, ANX = Anxiety, FRS = Fears, OBS = Obsessiveness, DEP = Depression, HEA = Health concerns, BIZ = Bizarre mentation, ANG = Anger, CYN = Cynicism, ASP = Antisocial practices, TPA = Type A personality, LSE = Low self-esteem, SOD = Social Discomfort, FAM = Family problems, WRK = Work interference, TRT = Negative treatment indicator.
* *p* < .05. ** *p* < .01.

Appendix C

Correlations Between MMPI-2 Clinical and Content Scales, and IES/IES-R Sum and Subscale

Scores.

MMPI-2 scale	IES				
	Sum IES 15 n=123	Avoidance n=124	Intrusion n=126	Hyperarousal n=127	Sum IES-R 22 n=122
Hs	0,28*	0,24*	0,31*	0,38*[a]	0,32*
D	0,47*	0,43*	0,51*[a]	0,51*[a]	0,51*
Hy	0,26*	0,23*	0,27*	0,33*[a]	0,28*
Pd	0,28*	0,23*	0,31*[a]	0,26*	0,28*
Mf	0,15	0,13	0,16	0,14	0,14
Pa	0,32*	0,25*	0,36*[a]	0,33*	0,34*
Pt	0,52*	0,48*	0,51*	0,57*[a]	0,55*
Sc	0,52*	0,45*	0,52*	0,57*[a]	0,55*
Ma	0,23*	0,20*	0,18*	0,20*[a]	0,23*
Si	0,42*	0,41*	0,41*	0,45*[a]	0,45*
ANX	0,60*	0,54*	0,61*	0,62*[a]	0,63*
FRS	0,32*	0,30*	0,34*[a]	0,30	0,33*
OBS	0,44*	0,43*	0,40*	0,47*[a]	0,47*
DEP	0,56*	0,51*	0,57*[a]	0,55*	0,58*
HEA	0,39*	0,35*	0,40*	0,45*[a]	0,42*
BIZ	0,36*	0,29*	0,37*[a]	0,31*	0,37*
ANG	0,39*	0,35*	0,37*	0,43*[a]	0,42*
CYN	0,30*	0,26*	0,31*[a]	0,28*	0,31*
ASP	0,25*	0,22*	0,26*[a]	0,21*	0,26*
TPA	0,33*	0,32*[a]	0,30*	0,30*	0,34*
LSE	0,47*	0,46*	0,43*	0,49*[a]	0,50*
SOD	0,30*	0,29*	0,31*	0,35*[a]	0,33*
FAM	0,26*	0,23*	0,26*[a]	0,24*	0,26*
WRK	0,58*	0,56*	0,55*	0,62*[a]	0,62*
TRT	0,51*	0,47*	0,50*	0,51*[a]	0,53*

Note. * $p < .05$. [a] The highest correlation for the respective MMPI-2 scale.

Appendix D

Table D1

Correlation Analysis Between Intrusion Items and MMPI-2 Clinical and

Content Scales.

MMPI-2	Intrusion							
Clinical scales	9	1	2	6	16	20	3	14
Hs	.25*	.25*	.34*	.17*	.27*	.20*	.26*	.23*
D	.39*	.38*	.39*	.38*	.45*	.36*	.40*	.48*
Hy	.23*	.20*	.28*	.19*	.25*	.21*	.14	.26*
Pd	.30*	.29*	.29*	.21*	.31*	.23*	.24*	.22*
Mf	.08	.16	.06	.13	.19*	.16	.04	.09
Pa	.31*	.30*	.24*	.32*	.36*	.26*	.29*	.28*
Pt	.33*	.37*	.45*	.39*	.43*	.40*	.50*	.43*
Sc	.37*	.40*	.44*	.42*	.48*	.43*	.47*	.36*
Ma	.09	.13	.16	.17	.21*	.24*	.19	-.04
Si	.30*	.31*	.28*	.29*	.38*	.31*	.37*	.38*
Content scales								
ANX	.44*	.47*	.48*	.45*	.54*	.51*	.51*	.45*
FRS	.19*	.31*	.29*	.27*	.28*	.21*	.35*	.27*
OBS	.19*	.26*	.32*	.28*	.35*	.34*	.41*	.31*
DEP	.39*	.43*	.42*	.42*	.58*	.42*	.51*	.49*
HEA	.30*	.37*	.33*	.23*	.38*	.27*	.36*	.30*
BIZ	.25*	.32*	.24*	.28*	.30*	.24*	.36*	.23*
ANG	.28*	.25*	.24*	.26*	.36*	.34*	.32*	.28*
CYN	.20*	.30*	.21*	.26*	.27*	.16	.34*	.21*
ANP	.17*	.23*	.23*	.17*	.25*	.17	.28*	.13
TPA	.25*	.29*	.18*	.22*	.27*	.27*	.30*	.14
LSE	.23*	.33*	.29*	.35*	.40*	.31*	.41*	.37*
SOD	.23*	.21*	.17	.27*	.31*	.23*	.29*	.33*
FAM	.19*	.24*	.17*	.17*	.27*	.26*	.23*	.12
WRK	.34*	.38*	.38*	.42*	.54*	.46*	.48*	.47*
TRT	.29*	.41*	.36*	.36*	.51*	.35*	.43*	.42*

Note. Bivariate Pearson correlation test, with two-tailed test of significance. MMPI-2 abbreviations are as for Table A1. The full item wording for every IES-R item can be found in Appendix E.
$*p < .05$.

Table D2

Correlation Analysis Between Avoidance Items and MMPI-2 Clinical and

Content Scales.

MMPI-2	Avoidance							
Clinical Scales	11	5	22	17	12	13	8	7
Hs	.14	.05	.12	.08	.19*	.22*	.23*	.14
D	.35*	.03	.24*	.11	.38*	.33*	.40*	.25*
Hy	.18*	.05	.11	.06	.19*	.23*	.25*	.17*
Pd	.17*	.15	.15	-.11	.23*	-.02	.25*	.11
Mf	.18*	-.02	.13	.06	.10	.10	.09	.16
Pa	.18*	.11	.13	-.05	.23*	.03	.25*	.17
Pt	.34*	.16	.28*	.03	.40*	.34*	.39*	.35*
Sc	.27*	.17	.32*	.01	.36*	.24*	.37*	.35*
Ma	.06	.09	.23*	-.00	.13	.07	.05	.23*
Si	.26*	.09	.34*	.07	.33*	.26*	.33*	.27*
Content scales								
ANX	.40*	.13	.38*	.13	.50*	.29*	.43*	.27*
FRS	.23*	.06	.20*	.06	.22*	.21*	.36*	.14
OBS	.29*	.07	.36*	.07	.34*	.26*	.24*	.36*
DEP	.40*	.14	.36*	.14	.43*	.24*	.39*	.37*
HEA	.21*	.03	.23*	.03	.28*	.25*	.28*	.27*
BIZ	.19*	.08	.23*	.08	.23*	.06	.15	.18*
ANG	.23*	.09	.24*	.09	.29*	.16	.29*	.20*
CYN	.09	.09	.23*	.07	.23*	.08	.16	.17*
ANP	.10	.09	.22*	.05	.22*	-.03	.13	.03
TPA	.07	.12	.30*	.04	.26*	.12	.22*	.11
LSE	.32*	.09	.37*	.14	.40*	.30*	.25*	.35*
SOD	.19*	.08	.22*	.05	.27*	.19*	.30*	.19*
FAM	.16	.01	.26*	-.02	.17	-.02	.19*	.19*
WRK	.38*	.07	.45*	.18*	.50*	.38*	.39*	.33*
TRT	.30*	.08	.40*	.15	.42*	.24*	.28*	.36*

Note. Bivariate Pearson correlation test, with two-tailed test of significance. MMPI-2 abbreviations are as for Table A1. The full item wording for every IES-R item can be found in Appendix E.
*p < .05.

Table D3

Correlation Analysis Between Hyperarousal Items and

MMPI-2 Clinical and Content Scales.

MMPI-2	Hyperarousal					
Clinical Scales	18	4	15	21	19	10
Hs	.29*	.15	.45*	.27*	.33*	.28*
D	.40*	.26*	.45*	.40*	.36*	.46*
Hy	.25*	.14	.37*	.21*	.25*	.27*
Pd	.22*	.17	.22*	.22*	.13	.31*
Mf	.03	.09	.10	.02	.16	.27*
Pa	.17	.21*	.18*	.30*	.25*	.38*
Pt	.45*	.35*	.46*	.43*	.36*	.52*
Sc	.46*	.38*	.42*	.46*	.44*	.45*
Ma	.13	.13	.06	.22*	.18*	.18*
Si	.39*	.24*	.28*	.39*	.39*	.39*
Content scales						
ANX	.44*	.34*	.49*	.52*	.48*	.55*
FRS	.21*	.17	.17*	.22*	.24*	.37*
OBS	.41*	.27*	.31*	.34*	.31*	.46*
DEP	.41*	.32*	.36*	.45*	.42*	.53*
HEA	.29*	.21*	.41*	.36*	.41*	.35*
BIZ	.24*	.16	.11	.33*	.22*	.30*
ANG	.27*	.43*	.20*	.37*	.31*	.30*
CYN	.23*	.16	.12	.34*	.21*	.18*
ANP	.27*	.16	.08	.25*	.11	.08
TPA	.21*	.30*	.14	.33*	.20*	.20*
LSE	.38*	.27*	.31*	.39*	.39*	.43*
SOD	.27*	.22*	.16	.33*	.30*	.32*
FAM	.21*	.11	.07	.22*	.23*	.31*
WRK	.51*	.34*	.42*	.50*	.50*	.49*
TRT	.38*	.30*	.32*	.42*	.41*	.44*

Note. Bivariate Pearson correlation test, with two-tailed test of significance. MMPI-2 abbreviations are as for Table A1. The full item wording for every IES-R item can be found in Appendix E.
*p < .05.

Appendix E

Impact of Events Scale – Revised. The English Version with Item Numbers and Full Wording.

Impact of Events Scale - Revised
1 Any reminder brought back feelings about it.
2 I had trouble staying asleep.
3 Other things kept making me think about it.
4 I felt irritable and angry.
5 I avoided letting myself get upset when I thought about it or was reminded of it.
6 I thought about it when I didn't mean to.
7 I felt as if it hadn't happened or wasn't real.
8 I stayed away from reminders about it.
9 Pictures about it popped into my mind.
10 I was jumpy and easily startled.
11 I tried not to think about it.
12 I was aware that I still had a lot of feelings about it, but I didn't deal with it.
13 My feelings about it were kind of numb.
14 I found myself acting or feeling like I was back at that time.
15 I had trouble falling asleep.
16 I had waves of strong feelings about it.
17 I tried to remove it from my memory.
18 I had trouble concentrating.
19 Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or a pounding heart.
20 I had dreams about it.
21 I felt watchful and on guard.
22 I tried not to talk about it.

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