Personality as a predisposing factor for DCI: a pilot study

Sam Harding and Phil Gee

Key words
Decompression illness, accidents, personality, psychology

Abstract

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This study aimed to identify differences in personality characteristics related to decompression illness (DCI) in recreational scuba divers. A matched control group of nine divers (without DCI) and a research group of nine divers (with DCI) were recruited. Following a chamber dive (control group), or treatment for DCI (study group), three psychometric scales – Locus of Control, Eysenck's Personality Questionnaire – Revised, and Sensation Seeking Scale – were administered together with a diving history questionnaire and questions on motoring. One significant difference was identified and lay between engine sizes, with those experiencing DCI having cars with larger engines ($P < 0.01$). The data were inconsistent with previous research that suggested a relationship between sensation seeking and risk taking. Further research is needed to elucidate the relationship between diving injury and personality.

Introduction

Scuba divers, be they recreational, occupational or military, are routinely screened for medical fitness as a number of medical conditions are known risk factors for diving injury. In addition to medical fitness, it is also possible that psychological characteristics are related to the risk of diving injury; however, psychological assessment of divers

is far from routine. The occupational and military diver may undergo some form of psychometric testing during their career, but not as part of a routine assessment.[1]

There are many reasons why scuba divers are injured in the water. Improper use or care of equipment, and failure to follow recommended procedures are among the leading causes.[2] As these can be seen as examples of suboptimal behaviour, it seems reasonable to speculate that the likelihood of such errors may be related to the personality characteristics of the individual.

There is some support in the literature for the suggestion that personality may be related to competence in professional divers. For example, navy divers were found to be more autonomous and less dependent on others than the general population,[3] and Baddeley et al included personality variables in their attempt to determine what makes a 'good' or 'bad' commercial diver.[4] However, there is little evidence relating to recreational divers, despite there being a large number involved in the sport (between 1996 and 2005 the number of people gaining certification with the Professional Association of Diving Instructors increased by approximately three per cent a year from 6,965,480 to 14,730,658).[5] Along with this increase in the number of people participating in scuba diving, there has been an increase in the absolute number and in the proportion of divers that are involved in an incident. The British Sub-Aqua Club annual incident reports show that in 1995 at least 0.25% of BSAC divers were involved in an incident; in 2005 this had risen to just short of 0.5%.[2]

Although there has been limited research investigating personality characteristics of recreational divers, there has been considerable research on personality factors and risk in motoring.[6–8] Like diving, motoring is an area where inadequate maintenance or errors in judgement can have serious consequences. This similarity led us to select some of the most significant psychological variables that have been associated with risky motoring for examination.

Using the psychometric scale Locus of Control (LoC), research has shown that people with an external LoC reacted slower than people with an internal LoC when the cruise control failed on a test vehicle following a lead vehicle on a test track.[9] Actuarial data show that the highest accident rate in motoring incidents is in young men 16 to 24 years old.[10] It is also this group that scores highest in sensation seeking.[11] It has been shown that high sensation seekers take longer than their low sensation seeking counterparts to recognise hazards when driving.[9]

The Eysenck Personality Questionnaire – Revised (EPQ-R) is another measure of personality that has been used in motoring research. Young males with traffic violations were found to have significantly higher extroversion scores than a control group.[12] It has also been noted that neuroticism might be a risk factor, with research suggesting that those scoring high on neuroticism were more likely to be overwhelmed with feelings of fear and anxiety during underwater accidents, resulting in ineffective behaviour such as panic.[6]

Taking a lead from such research on personality and risky motoring behaviour, the present study aimed to identify possible personality differences between recreational divers who have experienced DCI and those who have not.

Methods

PARTICIPANTS

The study was carried out at the Diving Diseases Research Centre (DDRC) in Plymouth, United Kingdom (UK). The study was approved by the Local Research Ethics Committee following British Psychological Society Guidelines and the Declaration of Helsinki. Written informed consent was obtained. The participants were nine recreational divers not suffering from DCI (two females, seven males; average age 36.5 years), and nine recreational divers that had presented with suspected DCI (two females, seven males; average age 39.4 years). Divers with a suspected patent foramen ovale (PFO) were excluded from the study. The non-DCI cases were members of the University of Plymouth sub-aqua club approached following recompression chamber dives undertaken as an experience dive or during their attendance at the DDRC for a sport diving medical.

INSTRUMENTS

Diving and motoring questionnaire

A diving and motoring questionnaire was developed by the staff at DDRC as part of the assessment of patients presenting for treatment. It contains requests for demographic information and diving history: number of dives, qualifying bodies (PADI, BSAC, etc) and level of qualification. The motoring section covers such factors as the number of years driving, number of accidents, engine size of current vehicle and other motorised vehicle ownership. The number of driving licence endorsement points awarded following conviction for motoring offences was recorded. More severe offences or repeated minor offences lead to a higher points total. Twelve points or more leads to a suspension of the driving licence in the UK.

Locus of Control

LoC was measured using Rotter's scale.[13] LoC varies from 'internal' (high personal control over events) to 'external' (causes of events seen to be outside personal control). Rotter's LoC has been used in a wide range of fields from perceptions of justice to sporting injuries and has also been used in studies of risky motoring behaviour.[13] Externality appears to be related to a failure to take precautionary steps to avoid the occurrence of unfavourable outcomes.[14] The

scale is a continuum from 0 to 23, with the norm set at 10, therefore scores below 10 represent an internal LoC, and above 10 an external LoC.

Eysenck Personality Questionnaire – Revised (EPQ-R)

The EPQ-R assesses emotional stability, extroversion, neuroticism and the tendency to give socially desirable answers.[15] A typical introvert is a quiet, retiring sort of person, inward looking, fond of books rather than people, tending to plan ahead and look before he leaps. A typical extrovert is sociable, likes parties, has many friends, needs to have people to talk to, and does not like reading or studying by himself.[16] The EPQ-R has been found to correlate with traffic convictions and involvement in crashes and an interaction of high extroversion and neuroticism has been found in in people involved in accidents.[16–19]

Sensation Seeking Scale

Zuckerman's Sensation Seeking Scale has been demonstrated to have consistent links to risky motoring behaviour.[20,21,22] The scale is sub-divided into four sub-scales; thrill and adventure-seeking (TAS), experience-seeking (ES), disinhibition (Dis), and boredom-susceptibility (BS).

PROCEDURE

The study was conducted over a period of two months in the summer of 2002. Participants were individually briefed. They were then allowed to complete the questionnaires on their own to maximise privacy. On completion of the questionnaires the researcher debriefed the participants. The DCI group completed their questionnaires once they had been discharged from DDRC.

STATISTICAL ANALYSIS

All statistical analysis used in this research was conducted using the non-parametric Mann-Whitney U test, with the level of significance set at $P < 0.05$.

Results

Table 1 shows the average number of dives logged and level of qualification of the two groups. No significant differences between the groups on the level of diving qualification, ($z = -1.26$, $P = 0.26$, two tailed), or the number of dives performed since being qualified, ($z = 0.86$, $P = 0.86$, two tailed) were found.

Table 2 shows how the LoC scores for the DCI group compare to those of the general population, Non-DCI group and the naval divers as studied by Biersner and LaRocco.[3] The difference in LoC found between the DCI and Non-DCI groups was not statistically significant, ($z = -0.56$, $P = 0.61$, two tailed).

Motoring data (Table 3) indicate that the DCI group drove cars with significantly larger engines ($z = -2.39$, $P = 0.015$, two tailed). There was no difference in the average number of penalty points/endorsements on their licences compared to the control group. The DCI group did show a higher incidence of involvement in accidents, but this failed to reach significance.

The DCI group reported lower levels of experience seeking, but this was not statistically significant ($z = -1.52$, $P = 0.14$, two tailed). The DCI group also scored lower than the non-DCI group on thrill and adventure-seeking behaviour on the SSS, but this difference also was not statistically significant ($z = -1.54$, $P = 0.16$, two tailed). No statistical differences were found between groups or norms on any of the EPQ-R sub-scales (Lying: $z = -1.39$, $P = 0.19$, two-tailed; Extroversion: $z = -0.04$, $P = 1.0$, two-tailed; Neuroticism: $z = -0.53$, $P = 0.61$, two-tailed).

Discussion

The only significant difference found in this study was that in the engine size of vehicles owned by the DCI and Non-DCI groups. There were no statistically significant differences in the selected personality measures between recreational

Table 1
Number of dives logged and qualification level of DCI and non-DCI groups

	Number of dives logged
Non-DCI divers	358
(range)	(3–4,000)
DCI divers	380
(range)	(4–1,500)
Level of qualification *	
Non-DCI divers	2.33 +/- 0.87
DCI divers	1.78 +/- 0.97

***** Qualifications were coded to allow for comparison between groups: a coding of 1 = in training, 2 = British Sub-Aqua Club (BSAC) qualification level of 'Club Diver' and 3 = BSAC qualification of 'Sport Diver'

Table 2
Mean scores on LoC scale

	LoC *	**Range**
Non-DCI divers	8.11	1–15
DCI divers	9.22	2–15
Navy divers[3]	7.37	not reported
Norms[14]	10.00	0–23

* 'Internal' LoC is less than 10.00 and 'External' LoC is greater than 10.00; the range of scores is 0–23

Table 3
Mean data of engine size and licence endorsements

	Average engine size (cc)	Average endorsement points	Involved in a road accident
Normal population	1723 *	- #	- #
Non-DCI divers	1730	2.33	0.67 §
DCI divers	2288	2.33	0.78 §

* Department for Transport (2005)
# Information not available from the Department for Vehicle Licensing (2005)
§ A coding of 0 meant that the participant had not been involved in a motoring accident, 1 meant that they had been in an accident

scuba divers that had or had not suffered a recent case of DCI. However, the small sample size recruited for the study severely limits the confidence with which conclusions about personality effects or their absence can be made.

The difference in engine size between the groups within this study is challenging to explain. Unfortunately data regarding income level, 'type of employment' and the specifics of second motor vehicles were not recorded, and to date no literature has been identified exploring the relationship between engine size, accidents and personality. One explanation may be the location of DDRC; the members of the DCI group did not live in the South West peninsula of the UK. This means that they had to travel in excess of 100 miles to their dive sites, whereas the control group were local and would not necessarily require such a large vehicle to undertake their diving. However, the willingness to travel to participate in scuba diving could also suggest a higher desire to participate in risky sports.

It is possible that the relationships between personality and diving found in professional divers do not exist in recreational divers. While a person who chooses diving as a career may be of a distinct 'type', those participating as a recreational activity are likely to be more typical of the general population. The question of whether this typicality extends to those who are at greatest risk of suffering DCI awaits research with greater statistical power.

The nature of this pilot study meant that only a short recruitment period was used and the number of DCI cases treated (without suspected PFOs) at DDRC was less than the authors had anticipated. A multi-centre and/or longitudinal study would facilitate greater numbers of divers to be recruited.

The preferred way to examine the role of personality as a predisposing factor in DCI would be to measure variables before as well as after the incident. Without such data the possibility of the experience having an effect on supposedly stable personality characteristics cannot be ruled out. The authors are investigating the possibility of a longitudinal study of a relatively large sample of divers in order to address this issue.

Despite the problems outlined above, the authors consider that the work has value as a first attempt to examine this relationship in recreational divers. There were several interesting trends in the data. For example, Biersner and LaRocco found that navy divers had a significantly more internal LoC than the population norms published by Rotter.[3,13] Although the LoCs of the DCI and Non-DCI groups in the present study were not significantly different from each other or from the norm, the mean for the DCI group was higher than that of the Non-DCI group. Many diving accidents are at least in part attributable to failure to follow correct procedures,[2] and the suggestion that divers who suffer DCI might have less belief in their own agency is interesting and may merit re-examination with a larger sample.

Adie et al found that the weight given to the role of safety procedures in reducing accident risk differed between offshore and non-offshore divers.[23] They proposed that the more highly trained offshore divers place lower emphasis on the role of organisational culture and higher emphasis on individual competency in preventing accidents. This may transpose to the recreational diving community, with those with greater diving experience placing less emphasis on the level of accredited dive qualifications obtained and more on the individual diver's safety record, and other divers' recommendations. This may be an alternative methodology to explore personality, diving experience, safety, and DCI.

Future work on personality and DCI might benefit from the inclusion of trait anxiety as a variable, as use of the STAI (State Trait Anxiety Inventory) with novice divers suggested that trait anxiety may predict panic behaviour.[6] It is likely that a diver who is more susceptible to panic would be more likely to be involved in a diving incident.

Conclusions

The present research failed to reveal significant differences between the groups studied in selected personality characteristics. Further work is needed to ascertain whether the lack of statistical significance is attributable to the small sample size or reflects an absence of relationship in the population.

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Sam Harding, MSc, is a postgraduate research student, and Phil Gee, PhD, is a Senior Lecturer in Psychology in the Department of Psychology, University of Plymouth.

Address for correspondence:
Sam Harding,
Department of Psychology, University of Plymouth
Drakes Circus, Plymouth
PL4 8AA, United Kingdom

Phone: *+44-(0)1752-209999*
Fax: *+44-(0)1752-209115*
E-mail: *<sharding.jb@googlemail.com>*