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Author(s): Carol A. Hawley

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**Title: RETURN TO DRIVING AFTER TRAUMATIC BRAIN INJURY -
A BRITISH PERSPECTIVE**

Authors:

**Neil Brooks
Rehab Without Walls
Presley Way
Crownhill
Milton Keynes
MK8 0ES**

**Carol A. Hawley
Principal Research Fellow
Centre for Health Services Studies
University of Warwick
Coventry
CV4 7AL**

Correspondence to: Carol Hawley
Principal Research Fellow
Centre for Health Services Studies
University of Warwick
Coventry
CV4 7AL
Tel. 02476 522459
Fax: 02476 524963
Email: c.a.hawley@warwick.ac.uk

**RETURN TO DRIVING AFTER TRAUMATIC BRAIN INJURY -
A BRITISH PERSPECTIVE**

BY

N BROOKS* AND C HAWLEY**

***Rehab Without Walls, Presley Way, Crownhill, Milton Keynes MK8 0ES**

****Centre for Health Services Studies, University of Warwick, Coventry, CV4 7AL**

Abstract

Primary Objective: to identify current legal situation, and professional practice in assisting persons with traumatic brain injury (TBI) to return to safe driving after injury.

Methods and Procedures

A brief review of relevant literature, a description of the current statutory and quasi-statutory authorities regulating return to driving after TBI in the UK, and a description of the nature and resolution of clinical and practical dilemmas facing professionals helping return to safe driving after TBI. Each of the 15 UK mobility centres was contacted and literature requested; in addition a representative of each centre responded to a structured telephone survey.

Main Outcome and Results

The current situation in Great Britain is described, with a brief analysis of the strengths and weaknesses both of the current statutory situation, and also the practical situation (driving centres), with suggestions for improvements in practice.

Conclusion

Although brain injury may cause serious limitations in driving ability, previous drivers are not routinely assessed or advised regarding return to driving after TBI.

INTRODUCTION

It is a cliché to say that traumatic brain injury (TBI) can cause serious and multiple problems in cognition, behaviour, and physical functions. It is equally a cliché to say that these problems may have a substantial negative impact upon the ability of the injured person to drive safely. Hardly surprisingly, return to driving is an issue that causes great anxiety for many professionals, raising issues of confidentiality and of the boundaries of the clinical relationship within which disclosure of information from an injured person can be tolerated before formal action has to be taken.

As has been pointed out elsewhere [1] driving is much more than a simple functional activity allowing mobility in the community. For the young person it is a right of passage, and a route to increased freedom and social standing within society. For the person who has suffered a TBI, return to driving may well be seen as the “gold standard” of recovery, and many family members have similar views, feeling that once the injured person has returned to driving, the injury is behind them, and recovery is complete. Unfortunately, the classic sequelae of TBI, particularly severe injury, can have a profoundly negative impact upon driving skill, and (perhaps more importantly) driving behaviour, and this has become an area of increasing interest in the medical literature (see for example, the recent special editions of the journal *Europa Medicophysica* (volume 37 No 4, volume 38 No 1).[2]

A good example of the potential problems facing the injured person, the professionals helping that person, and society at large comes from the study by one of the authors of this paper (CH) [3,4]. Indeed, and most unusually, the research [3] was picked up by the media, particularly the British Broadcasting Corporation (BBC) in a news bulletin on 31.05.01. The bulletin included statements such as “rage risk of head injured drivers..., half of those driving after head injury were angry, aggressive, and irritable”. The broadcast included a note that the researchers are “now calling for head injured patients to have both their mental and physical status assessed before they are allowed to drive”. This is an important point, as, within the clinical literature, many clinicians and researchers are now making similar demands, although, as will be noted below, an analysis of the relevant literature shows that there are absolutely no single measures, and arguably no combination of measures that will, with any accuracy, predict who is and who is not a safe driver after a TBI, or indeed any acquired brain injury. It is worth giving a brief analysis of the Hawley data because the paper identified some serious societal issues.

In response to an initiative by the UK Department of Health (DoH), a large multicentre study was carried out between 1991 and 1997 to investigate outcomes following rehabilitation for 563 adults with TBI [4]. Two-thirds of patients (383, 68%) had suffered a severe TBI (GCS: 3-8), 120 (21%) moderate TBI (GCS: 9-12), and 60 (11%) mild TBI (GCS: 13-15). Three-quarters of the study group were male. All patients and their families were interviewed at length, and it was soon apparent that return to driving was a crucial issue for many of them. The characteristics of patients who had returned to driving at 3-9 month follow-up were compared with the characteristics of those who had not. Of the 563 patients, 381 were drivers before the injury, and 139 had returned to driving by the time of the interview. Interestingly, not all previous drivers had received specific advice regarding their suitability for a return to driving, and only 61 (16%) had been formally advised not to drive following the injury. Consequently, the decision of whether or not to return to driving was usually made by the patient him/herself with or without advice from his/her family.

In this study, approximately half the current drivers reported problems which could affect their ability to drive safely. Nearly half of current drivers (67, 48.2%) reported problems with behaviour (anger, aggression, irritability). Almost two thirds had memory problems (89, 64%), and 39 (28%) had problems with concentration and/or vision. Drivers reported most driving-related problems as frequently as ex-drivers, with the exception of epilepsy and community mobility. The problems reported at interview for current drivers, ex-drivers and 'banned' drivers are presented in table 1.

Table 1 about here

In addition to the interview data, patients were assessed using the Functional Assessment Measure (FIM+FAM).[5] On this scale, a score of 7 represents complete independence for a given item and a score of 1 represents complete dependence. Significant differences were observed between the current drivers and ex-drivers for Attention, Orientation, Safety Judgement and Emotion. Current drivers were more functionally independent than ex-drivers. However there were no significant differences between banned and non-banned drivers for any item.

Overall, the current drivers had suffered less severe head injuries than ex-drivers. Nevertheless, over half (56.2%) of the current drivers had received a severe head injury. No significant differences in injury severity were observed between banned drivers and non-banned drivers. Of the 381 previous drivers, CT scan results were recorded for 229. Of these, 101 had no recorded haematoma, 48 had a left-sided haematoma, 47 a right-sided haematoma, and 33 a bilateral haematoma. Patients with a bilateral haematoma were slightly more likely than patients with a unilateral or no haematoma, to have problems with behaviour (63.6%), driving (39.4%) and anger management (24.2%), but there were no statistically significant differences between the groups.

In the UK there exists a group of mobility centres, linked with the Department for Transport, which offer formal assessment of driving ability for patients who have various physical and cognitive impairments. However, only a small proportion of the patients in this study were referred to a mobility centre, perhaps because mobility centres are more associated with older patients and with physical disabilities. In practice, the decision to resume driving was often made by the patient himself. Patients, with support from their families, often, but by no means always, exhibited common sense in delaying a return to driving and then resuming gradually. This finding is consistent with the report of Priddy et al [6] who also found that patients may be willing to restrict their driving activities to suit their reduced abilities.

The Hawley paper identified and quantified concerns that any rehabilitation practitioner will have in dealing with the issue of return to driving. One of the current authors (NB) runs a clinical practice involving managing severely brain injured people in the community, and driving is a frequent problematic issue causing tension between the injured person and clinicians trying to help him/her. A brief description of some recent clinical cases will be illustrative here.

Case Reports

Case 1

This was a 47 year old man who had a large frontal meningioma, who subsequently developed quite markedly “dysexecutive” behaviour, particularly while driving. Incidentally, and highly relevantly, his performance on a number of highly regarded putative tests of executive function was completely normal. The patient admitted to episodes of violent “road rage”, including chasing another driver for three miles after a minor altercation, eventually effectively cornering the driver and threatening him with physical violence. When counselled that this behaviour was highly risky, both to the other driver and to himself, the patient simply commented that that was not a problem as he now had “no fear”. This case, as do many others, provoked an intensive discussion within the practice about the responsibilities of a clinician in possession of such information. Some colleagues took the view that to inform the relevant authorities would be a tremendous breach of confidence, and as such, grossly unprofessional behaviour, probably sufficient to warrant a formal disciplinary hearing by a clinician’s professional body. Others within the practice thought that the clinician had no option but to inform the relevant authorities. In fact that was the action that was taken.

Case 2

This 23 year old male had suffered a very severe TBI with extensive frontal brain tissue loss and extensive cognitive impairments, with, particularly, impaired foresight, planning, and “look ahead”, and little if any ability to foresee the consequences of actions. This person, despite an expired driving licence, and, against our strong advice that he did not drive, managed to rent a car, shortly after which he was involved in a road traffic accident in which, witnesses reported, his driving had been careless or reckless. We were very disturbed to find that the family doctor subsequently advised the statutory authorities that the patient was safe to drive, and a new driving licence was issued. He continues to drive; as yet, no-one has, as far as we know, been injured.

Case 3

This is a 25 year old young man who again had suffered extensive frontal brain injury, but who had much insight into his difficulties. In addition he had quite marked visual problems, and a local Mobility Centre (see below) assessed him as unsafe to drive, but only because of the visual problems. Happily, the patient himself decided that he would not be a safe driver, and he decided not to drive and has not driven since then.

Although the clinicians involved in the three cases were aware of the relevant research and clinical literature dealing with return to driving after TBI, the literature was considered to be rather unhelpful in guiding practical day to day decision making. That literature will now be reviewed very briefly, focussing on a small number of key references, before moving to consider the role of the Mobility Centres in the British scene.

As noted above, there is considerable interest in the literature at the moment about ABI and driving, and it is worth a brief review with an attempt to identify some of the more important and durable references in this field. There are three particularly useful references, spanning a period of 15 years (1987 - 2002). The first of these, in 1988 is by Van Zomeren and colleagues in the Netherlands [7], with a further update in 2002 [8], the second [9] is a document by the British Psychological Society published in 2001, and the third [2] is the published proceedings of a Conference on Return To Driving after

Traumatic Brain Injury held in Italy in 2001, and published in the journal *Europa Medicophysica* in December 2001 and March 2002.

Van Zomeren and colleagues reviewed the broad area of return to driving after acquired brain injury, and reported a study carried out within their own service in the Netherlands [7]. They assessed nine young men who had sustained severe traumatic brain injury and compared them with a control group of family members or friends. The study was in five parts incorporating a neurological examination, clinical interview, neuropsychological test battery, a test of lateral position control in an instrumentive car, and a driving test in actual traffic in the person's own car. The neurological examination produced few surprises, with a few cases having residual hemiparesis or ataxia, and others having focal unilateral atrophy on CT brain scan. The results of the interview were interesting, showing that six of the nine patients stated that they were aware of shortcomings in their driving and therefore drove more carefully since their injuries; they were reported to be particularly concerned about night driving. Although the accident rate was small, Van Zomeren commented that "still, one patient's accident rate after his head injury was impressive" (for a further discussion on accident rates see Schultheis et al [10]). As far as neuropsychological test performance is concerned, there were many differences between the patients with head injury and controls, particularly in learning, rapid visual perception, and visuo-motor function, and attention. On lateral position control, head injured patients were much worse at control, showing much more variation around their mean position. Van Zomeren commented that it was equivalent to the effects of two alcohol drinks on an average sized male, or the effects of 10mg of Diazepam. However, despite the impairment on lateral position control, eight of the nine head injured patients were considered to stay "within the normal range", but the remaining patient demonstrated "potentially dangerous impairment in his tracking ability". The final assessment was an on road assessment by an advanced driver. This showed that the gross error rate did not differ particularly markedly between the two groups, but the driving instructors commented that the errors made by some patients were potentially more serious from the viewpoint of traffic safety. They categorised the overall driving rating in a six point scale (very good, good, quite satisfactory, satisfactory, dubious, insufficient). Four of the head injured patients were in the quite satisfactory or satisfactory categories, but the remaining five were in the insufficient category. Five of the nine controls were in the quite satisfactory or satisfactory category, and the remaining four were in the dubious category. Van Zomeren et al looked carefully for any relationship between neuropsychological test performance and driving competence, and could not find it. They commented that "neither the present study nor earlier studies identified a pattern of deficits that renders a subject unfit to drive". They were careful to point out that although residual neuropsychological deficits were found, these did not correlate with the quality of driving as judged by advanced driving experts. They speculate why it might be that there were no such relationships, and considered that there might be two "hidden" variables. The first was simply the driver's competence prior to the injury, and the second, the retention of insight or, as they called it, "integrity of global cognitive skills necessary for compensation of impairments". They concluded with the conjecture that insight and self criticism would be more important for a patient's fitness to drive than the degree of his cognitive deficits.

The British Psychological Society published an important report in 2001 entitled "Fitness to Drive and Cognition" [9]. This was the report of a multi-disciplinary working party which considered a variety of neurological impairments, not just brain injury. The report reviewed a number of aspects of driving and neurological impairment, with a

concentration on the role of psychological assessments in assessing fitness to drive. It concluded that while there was a relationship between cognitive impairment and driving ability, the evidence from neuropsychological tests is not enough to give any clear recommendations about which functions might be assessed, how they should be assessed, and the relationship between an assessed deficit and driving safety. They concluded that more research should be directed towards the role of cognitive testing to define more precisely the nature of the key cognitive deficit(s), and their likely consequences in terms of safe driving. Interestingly, the British Government Department responsible for driving (Department for Transport - DfT) has recently commissioned research on "medical aspects of fitness to drive - driving and cognitive impairment". The aim of the proposed contract is "provide the Medical Advisor of the Driver and Vehicle Licensing Agency (DVLA) with definitive guidance on the assessment of drivers with cognitive impairments, and to define carefully the need for medical opinions and on-road testing". There is an emphasis on psychological assessment of fitness to drive and the role of mobility centres. The cognitive impairments listed in the invitation to tender were dementia, stroke, progressive neurological degenerative diseases and head injury. This research is likely to commence in 2003, however, it appears that persons with head injury will not be included.

The recent European Conference organised by the European Brain Injury Society (EBIS) took place in Salsomaggiore Terme in September 2001. Clinicians, researchers, driving professionals and legislators all took part in the Conference, giving a pan-European view. Papers revealed diversity of experience and conclusions, with arguments both for [11], and against [12], the use of cognitive tests in assessing driving ability. Again, the importance of "adaptive strategies" was highlighted [13] noted also by Van Zomeren [7].

Driving and the Law - the British Situation

The statutory body responsible for all aspects of driving and driver licensing in Britain is the Driver and Vehicle Licensing Agency - DVLA. Their website address is www.dvla.gov.uk, and the website contains much useful and helpful information. The DVLA has a list of "notifiable" medical conditions. These are conditions which, if they are changed or worsened since the licence was granted, or appear de novo, must be notified to the DVLA. The list is as follows:-

- An epileptic event (seizure or fit).
- Sudden attacks of disabling giddiness, fainting or blackouts.
- Severe mental handicap.
- A pacemaker, defibrillator or anti-ventricular tachycardia device fitted.
- Diabetes controlled by insulin.
- Diabetes controlled by tablets.
- Angina (heart pain while driving).
- Parkinson's Disease.
- Any other chronic neurological condition.
- A serious problem with memory.
- A major or minor stroke.
- Any type of brain surgery, brain tumour.
- Severe head injury including in-patient treatment at hospital.
- Any severe psychiatric illness or mental disorder.
- Continuing/permanent difficulty in the use of arms or legs which affects the ability to control a vehicle.

The list is not considered to be exhaustive, and it is the driver's responsibility to decide if he/she is fit to drive. Of course, if a brain injury has affected judgement and responsibility, it is very difficult to see how the injured person can, realistically, undertake such a responsibility.

It is important to realise that it is the DVLA and only the DVLA which has statutory responsibility for making decisions about holding a driving licence. However, the would-be driver will come into contact with quite a wide range of individuals and agencies each of which may have a view about driving, and from each of which the potential driver may seek information and advice. Such agencies include individual professionals such as medical doctors, therapists, psychologists, social workers, nurses and others, the list also includes Mobility Centres and various voluntary groups such as Headway and other similar groups (for example, the voluntary groups dealing with neurological disorders such as strokes). While co-operative liaison between such individuals and agencies may be excellent, that is not always the case, and individual professionals may have doubts about their duties and responsibilities, and particularly a conflict between the duty to patients of confidentiality, and the duty to society of ensuring the safety of society as a whole. The British Psychological Society (BPS) document referred to above [9] gives a lucid and helpful flow chart about how decisions are made by DVLA regarding fitness to drive. The BPS report points out that the majority of decisions (perhaps as high as 90%) taken by the medical officers (see below) of the DVLA are based solely on medical reports. Only borderline cases are thought to require driving assessment or an independent examination, and an on-road driving test is very rarely required. However, a recent European study has indicated that clinicians are most confident about making a final decision about whether or not a patient is fit to drive if they have access to the results of an on-road driving test.[14]

The DVLA is advised by a Medical Advisory Panel, members of which may serve on a number of specific panels dealing with the following:-

- * Alcohol, drugs and substance misuse and driving.
- * Cardiovascular system and driving.
- * Diabetes mellitus and driving.
- * Disorders of the nervous system and driving.
- * Psychiatric disorders and driving.
- * Visual disorders and driving.

It is clear that at least four of those panels (alcohol, nervous system, psychiatric disorders, visual disorders) are of central importance in the matter of brain injury and driving. Members of the DVLA panels are largely medical practitioners, with a small number of lay members. The medical practitioners come from a variety of specialities including neurology, neurosurgery, psychiatry, and rehabilitation medicine. The panels meet regularly, and minutes of those meetings are published on the Internet. Scrutiny of the minutes of the advisory panel on driving and disorders of the nervous system shows that a wide variety of issues were discussed, including driving after cerebral neoplasia, driving and epilepsy, driving after stroke, driving and sudden and disabling giddiness, driving and sleep apnoea, and driving with unruptured cerebral aneurysms.

As noted above, individual clinicians dealing with the issue of return to driving are faced with some significant dilemmas. Those clinicians need to be aware of the official guidance about the responsibilities of drivers to inform the DVLA of their medical

conditions, and should advise their patients accordingly. The problem arises when a patient declines to accept the advice, and continues to drive. The clinician is then faced with a difficult problem of deciding whether and how to try and persuade the patient, or to deal directly with DVLA. In the event that DVLA is contacted, they will write to the licence holder seeking permission to obtain further medical information, and if the patient fails to comply within three weeks, then the driving licence will be revoked for non compliance. "Compliance" means that the licence holder gives consent for medical information and makes a self declaration in a questionnaire. That questionnaire is then passed on to a relevant clinician before a request is made for a more detailed medical report which will be received by DVLA. Based on that report, DVLA may decide that there is sufficient information to make a decision, which may be that the driving licence is revoked or refused, or alternatively, that there may be a regime of annual medical reviews issued. The driver does have the option of appealing to a Magistrate's Court in the event of a licence being revoked or refunded. If there is insufficient evidence for an instant decision, DVLA may refer the licence holder for an independent medical examination and/or a driving assessment, and/or a further free driving test. A driving assessment is likely to be carried out by one of the Mobility Centres which were referred to above. These will now be discussed further.

Mobility Centres

There are currently 15 such centres in the United Kingdom in England, Wales, Northern Ireland and Scotland. Their locations are indicated in Fig 1, which also shows the proportion of clients with TBI assessed annually by each centre, expressed as a percentage of the total. The Centres are loosely organised under the Forum of Mobility Centres which has its own website (www.justmobility.co.uk/forum), and is described by the Forum as "a network of organisations which aims to help elderly and disabled people achieve independent mobility as drivers, passengers and wheelchair users". Clearly, the Forum and the Centres deal with all conditions that might affect driving, not simply brain injury.

Figure 1 about here.

The Forum, a charitable company, is an umbrella organisation for its member centres, which aims to support the interests of those centres and their clients. The Forum centres are independent, except for the Mobility Advice and Vehicle Information Service (MAVIS), which is part of the Mobility and Inclusion Unit in the Department for Transport. For the remaining 14, half are part of an National Health Service (NHS) Trust and the other half are either part of a Disabled Living Centre, or an independent charity. The Department for Transport (DfT) and the Department of Health (DoH) have jointly grant funded the Forum-accredited English centres (except for the MAVIS) to the sum of £450,000 a year over the last three years (2000/2003). The DoH provide a lower level of funding than the DfT because they provide 'hidden' support to the NHS Trust-based centres. The DfT has now assumed Government responsibility for mobility centres and has recently announced increased grant funding of £2.25 million a year for the Forum-accredited English centres for 2003/2006. The smaller DoH contribution is likely to continue to be part of this and some centres will continue to receive some support from the NHS Trusts in which they operate. The devolved administrations provide grant funding at different and various levels to the Northern Ireland, Scottish and Welsh centres and over different funding cycles. The National Assembly for Wales has funded the two Welsh centres for many years but Scotland received funding a year after the

English centres. The Northern Ireland centre has only ever received a grant for driving tuition and their assessment service is financed totally by its parent organisation and client fees. The DfT is in the process of setting up a Departmental steering group, including the devolved administrations, to oversee the activities of the Forum and its member centres. However, the Forum is legally the responsibility of its Trustees.

In 2003 the authors carried out a telephone survey of all 15 UK mobility centres in order to establish the proportion of clients with TBI entering the centres, and to examine the characteristics of both the clients and the centres. Table 2 shows the total number of clients assessed annually by each centre, using figures published for the 2001/2002 financial year. The table also shows the proportion of clients with TBI, other brain damage and stroke. Figure 2 shows the number of patients assessed by the UK mobility centres according to medical category. Patients who had suffered a stroke, traumatic brain injury, acute generalised brain damage, or a brain tumour formed the category: 'Trauma, tumour, stroke', representing one third (32.7%) of the caseload of the mobility centres. 'Other neurological conditions' such as multiple sclerosis, motor neurone disease, Parkinsons' Disease, cerebral palsy, congenital learning disability, and muscular dystrophy accounted for another third (32.3%) of the caseload. The category 'Bones, soft tissue, spine' (29.1% of caseload) includes arthritic conditions, back problems, spinal cord injuries, amputees, and congenital or acquired limb abnormalities. The 'Other' category (1% of caseload) includes psychiatric conditions and heart and lung problems in young people. Table 3 shows the characteristics of each centre in terms of services offered, referral patterns, staff-mix and fees.

Table 2 about here

Figure 2 about here

Table 3 about here

In addition to the telephone survey, the authors wrote to each mobility centre asking for information on their services and for a copy of their current literature. The responses to these requests varied widely. Some centres sent very a detailed information pack including a breakdown of services, staffing, facilities, details of assessments, and samples of client questionnaires. At the other extreme, some centres sent only the briefest of leaflets and an application form. For self-referrals, all centres made a charge for an assessment and the fees varied quite significantly, from a minimum of £25 to a maximum of £130, over five times the minimum figure. The one Scottish centre did not accept self-referrals, and as a result, all assessments were free to the patient.

As far as the Mobility Centres are concerned, they are, of course, heavily involved in the assessment of driving after disability, but it is only a rather small percentage of their clients (around 6%) who have suffered a traumatic brain injury (see also Newby and Tyerman [15]). In addition, we note that a very small proportion of people with a disability are ever required to undergo a driving assessment prior to returning to driving, so that unsafe driving practice may never be identified, or may not be identified until there is an accident. Even then, the possible role of any traumatic brain injury may not be apparent in an accident. As discussed above, while there is one Government Agency with statutory responsibility for matters concerning driving (DVLA), a variety of other agencies (statutory, charitable, and otherwise), and people (clinicians, family members), may have a legitimate role in the judgement of whether or not someone is safe to return to driving after a traumatic brain injury. Unfortunately, those involved may be working very much in isolation, and may have little knowledge of others who are also concerned about driving in the case of a specific individual. Furthermore, for the clinicians, the issue of safety very often can be seen to conflict with the issue of confidentiality, so the clinicians may be very reluctant to inform the statutory agency (DVLA) that, in their (the clinicians) opinion, the patient is potentially unsafe. It will be enormously helpful to have these issues clarified, particularly for clinicians, and one way to achieve this would be to gather together all relevant agencies (for example at a seminar) in order to clarify not only statutory obligations, but what should be expected of an individual clinician in these matters.

Other sources of driving assessment

In addition to the mobility centres, there are some local initiatives, run by some of the county councils. Also, large driving schools such as the British School of Motoring offer some tuition for disabled drivers. However, as far as we are aware, there is no specific tuition or assessment programme for head injured drivers.

The brief review of the relevant literature, and of current clinical practice in this area highlights the crucial importance of cognitive psychological factors (see also [16], particularly cognitive dysfunction, and insight. These two issues will now be explored briefly.

Cognitive Problems

The issue of cognitive problems and driving has been much explored in the literature, not only in relation to traumatic brain injury, but also in relation to other forms of brain damage, [9, 13, 16]. At first sight it seems obvious that there should be a clear relationship between cognitive deficits as assessed by mental testing, and safety to drive. Unfortunately, despite extensive investigation, there is no consensus here, and, in our judgement, it is unlikely that a consensus will emerge. A thorough analysis of this issue by the British Psychological Society Working Party dealt with a number of cognitive areas such as visual perception, and neglect, attention, executive function, praxis, language, and memory. Their conclusions bore little comfort for those who believe that cognitive tests will be such indicators of driving ability. For example, their conclusions contain statements such as, "...the relationship between psychometric performance and driving ability is only strong when cognitive impairment is so gross that the driver will make obvious mistakes during driving....some evidence that memory correlates with driving behaviour, although this is by no means conclusive....some cut-off levels can cautiously be proposed in the context of decisions concerning future driving, albeit with several reservations". The recent conference proceedings reported in Europa

Medicophysicala [2] contained studies of cognitive functions in relation to driving, but no consensus emerged.

Insight

The final issue that emerges from the literature, and from clinical practice seemed to us to be important in this area is that of insight. As noted in our case studies, one of our patients had very severe cognitive problems, yet decided not to drive, because he considered that he would not be safe. Van Zomeren and colleagues [7] commented that a key factor in safe driving after traumatic brain injury was whether or not the injured person could “compensate for their motor and cognitive deficits by adapting their driving style, by restricted use of their cars, and by the use of technical adaptations of the vehicle”. The researchers went on to note that the first two of the compensation mechanisms require “awareness of one’s deficits and impairments”, and concluded therefore that “it is probable that compensation of psychological deficits will be possible in those brain-damaged drivers with preserved insight and self criticism”, we can only agree with that conclusion. Although there is a very large literature on frontal lobe deficits and behaviour, including globe deficits and insight, there is very little literature on helping patients to improve insight and self awareness after brain injury, and if anything there is much therapeutic pessimism in this area. It seems clear that any therapeutic programme devoted to helping TBI patients return to safe driving must incorporate the issue of insight, and that means the incorporation of neuropsychological skills input. Analysis of the responses from the various Mobility Centres, showed that direct neuropsychological input was not particularly common.

Conclusions

In conclusion, we have identified current practice in return to safe driving after traumatic brain injury in Great Britain. We have identified the role of Mobility Centres both in isolation, and in relation to other services and people who may be involved. We have considered the role of cognitive deficits, and particularly whether or not any simple or complex psychological tests may accurately identify those who are safe/unsafe to drive. Finally, we have considered the crucial role of retained insight in assisting return to safe driving.

While there is a large and increasing literature on returning to driving after head injury, it is clear that predicting who will be able to drive is neither easy nor accurate, and suggestions that psychological tests should be used as a main criterion for judging safe driving are premature and ill advised. The current situation in Great Britain is that even though head injury may cause serious limitations in driving ability, particularly where cognitive issues such as judgement, concentration, and mental speed are concerned, it is only rarely that a driving test involving on the road testing is required prior to returning to driving. Although the Driving Centres are heavily involved in driving and disability, patients who have had a traumatic brain injury, (TBI), comprise only a very small proportion (around 6%) of their caseload. This means that TBI patients are rather “hidden”, and as a result, we suspect that there are many unsafe drivers who have suffered a TBI, but who have never been assessed fully for driving, or advised about the consequences of TBI for driving. A further corollary of this is that the driving centres themselves, unless they have a specific neurological/TBI practice, will find it difficult to acquire expertise in the assessment of this particular client group.

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Table 1 Frequency of problems reported by respondents at interview

Problem	Number of current drivers (n = 139)	Number of ex-drivers (n = 242)	Number of Banned drivers (n = 61)	Number of Drivers not banned (n = 320)
Memory	89 (64.0%)	157 (64.9%)	41 (67.2%)	206 (64.4%)
Headaches	60 (43.2%)	89 (36.8%)	26 (42.6%)	123 (38.4%)
Fatigue	50 (36.0%)	93 (38.4%)	27 (44.3%)	116 (36.3%)
Sleep	42 (30.2%)	57 (23.6%)	22 (36.1%)	77 (24.1%)
Giddy Spells/Dizziness	41 (29.5%)	62 (25.6%)	19 (31.1%)	84 (26.3%)
Concentration/Attention	39 (28.1%)	72 (29.8%)	21 (34.4%)	90 (28.1%)
Vision	39 (28.1%)	91 (37.6%)	24 (39.3%)	106 (33.2%)
Depression	31 (22.3%)	44 (18.2%)	9 (14.8%)	66 (20.6%)
Driving	26 (18.7%)	81 (33.5%)	48 (78.7%)	59 (18.4%)
Balance/Co-ordination	18 (12.9%)	39 (16.1%)	9 (14.8%)	48 (15.0%)
Lack of Insight	13 (9.4%)	25 (10.3%)	10 (16.4%)	28 (8.8%)
Mood Swings	24 (17.3%)	41 (16.9%)	16 (26.2%)	49 (15.3%)
Epilepsy	5 (3.6%)	38 (15.7%)	27 (44.3%)	16 (5.0%)
Community Mobility	14 (10.1%)	43 (17.8%)	13 (21.3%)	44 (13.8%)
Irritability	35 (25.2%)	45 (18.6%)	14 (23%)	66 (20.6%)
Anger Management	32 (23.0%)	47 (19.4%)	14 (23%)	65 (20.3%)
All Behavioural*	67 (48.2%)	121 (50%)	28 (45.9%)	160 (50.0%)

* number of patients with at least one behavioural problem. Figures in *italics* show statistically significant differences between current and ex-drivers. Figures in **bold** show statistically significant differences between banned and non-banned drivers

Figure 1 The UK Mobility Centres and for each centre the number of TBI clients assessed as a percentage of each centre's total client group

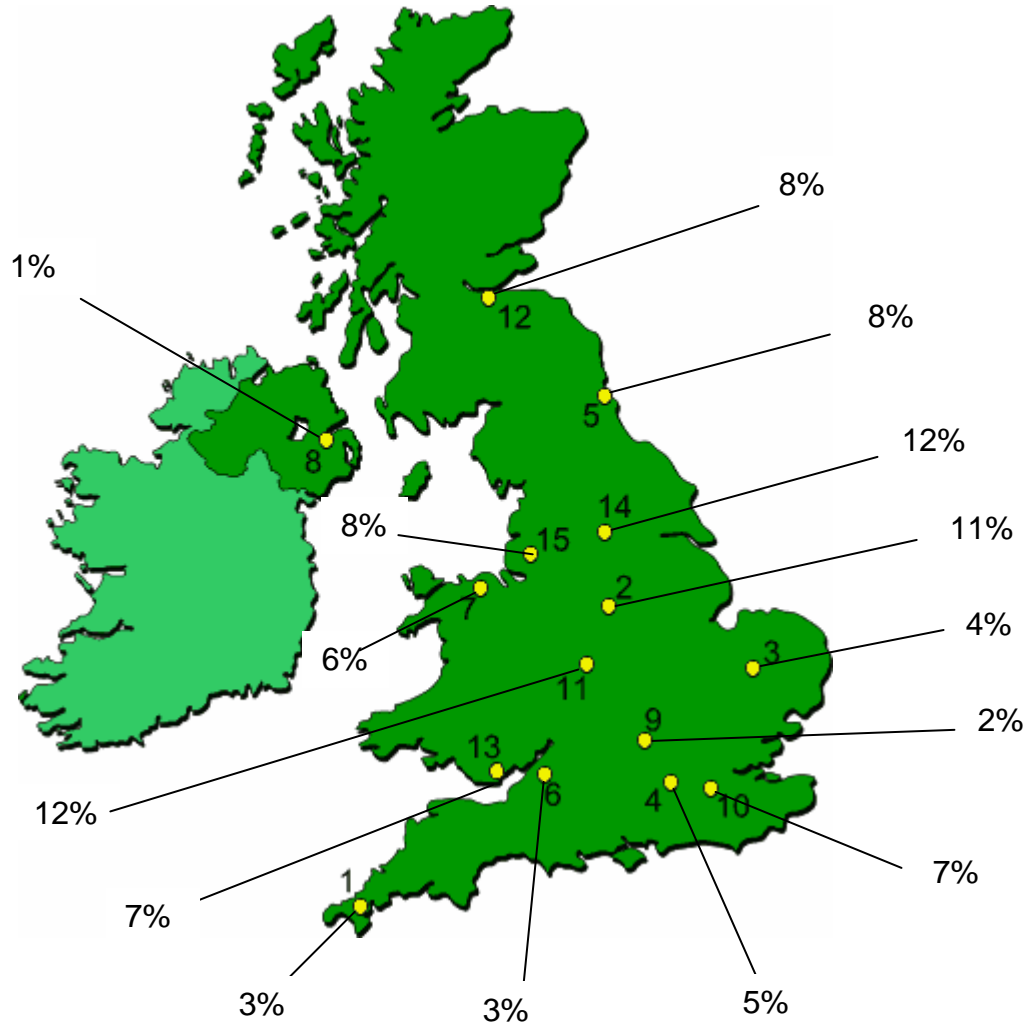


Table 2 The UK Mobility Centres: Number and type of patients assessed annually
(all based on 2001/2002 figures)

Centre	Total number of patients assessed	TBI patients assessed	TBI patients as Percentage of total %	Other brain damage/brain tumour No. patients assessed	Stroke patients assessed
1	336	10	3.0	7	80
2	289	33	11.4	9	67
3	235	9	3.8	4	57
4	493	25	5.1	11	81
5	298	23	7.7	10	82
6	173	6	3.5	11	40
7	145	9	6.2	3	39
8	544	6	1.1	4	177
9	213	4	1.9	2	57
10	924	67	7.3	19	178
11	215	25	11.6	5	46
12	816	64	7.8	62	160
13	272	19	7.0	4	64
14	187	22	11.8	3	54
15	332	28	8.4	11	91
TOTAL	5472	350	6.4	165	1273

Table 3 Characteristics of the UK Mobility Centres: Services offered and staff-mix

Centre	Services offered	Method of referral	Staff mix	Cost of Assessment to patient
1	A,B,C,D,E,F,G	1,2,3,4,5	2 x OT, 3 x Driving Instructors, 3 Mobility Assessors, 5 Technical Officers	£40 (£25 if on income support)
2	A,B,C,D,E,F,G	1,2,3,4,5	3 x OT, 1 x Driving Instructor	£95
3	A,B,C,D,E,G	1,2,3,4,5	3 x OT, 2 x Driving Instructors	£80
4	A,B,C,D,G	1,2,3,4,5	3 x OT, 2 x Driving Instructors	£60
5	A,B,C,D,G	1,2,3,4,5	2 x Mobility clinicians, 2 x Driving Instructors	£50
6	B,C,D,E,G	1,2,3,4	1 x OT, 1 x Driving Instructor, 1 x Driving Assessor	£85
7	A,B,C,D,G	1,2,3,4	1 x Physio, 2 x Driving Assessors	£45
8	A,B,C,D,E,G	1,2,3,4,5	2 x Driving Assessors	£50-100
9	B,C,D,E,G	1,2,3,4,5	1 x OT, 1 Driving Assessor, 1 Driving Instructor	£50-80
10	A,B,C,D,E,G	1,2,3,4,5	2 x OT , Driving Instructors, Honorary Consultants	£75-130
11	B,C,D,E,G	1,2,3,4,5	None at present	£80

12	A,B,C,D,G	1,2,4,5	5 x OT, 2 x Doctors, 7 Driving Assessors	Free
13	A,B,C,D,G	1,2,3,4	2 x OT, 1 Driving Assessor	£45 (if self-referral, Free if NHS referred)
14	A,B,C,D,G	1,2,3,4	3 x OT, 1 x Physiotherapist, 2 x Driving Instructors	£90
15	A,B,C,D,G	1,2,3,4,5	3 x OT, 2 Driving Assessors	£50 (if self-referral, Free if NHS referred))

Services offered:

A = simulator assessment

B = on-road assessment

C = cognitive assessment

D = free information service

E = driving tuition

F = Fitting of car adaptations

G = advice on return to driving after injury/illness/disability

Referral: 1 = by hospital doctor, 2 = therapist/health professional, 3 = patient him/herself, 4 = GP, 5 = DVLA

Figure 2 Patients Assessed by UK Mobility Centres According to Medical Category: 12 months: April 2001 to March 2002

Number of patients assessed annually according to medical category

