Return to driving after head injury

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Abstract

Objectives—To determine whether patients who return to driving after head injury can be considered safe to do so and to compare the patient characteristics of those who return to driving with those who do not.

Methods—In a multicentre qualitative study 10 rehabilitation units collectively registered 563 adults with traumatic brain injury during a 2.5 year period. Recruitment to the study varied from immediately after hospital admission to several years after injury. Patients and their families were interviewed around 3 to 6 months after recruitment. A total of 383 (67.5%) subjects were interviewed within 1 year of injury, of whom 270 (47.6%) were interviewed within 6 months of injury. Main outcome measures were the presence or absence of driving related problems reported by drivers and ex-drivers, and scores on driving related items of the functional independence/functional assessment measure (FIM+FAM).

Results—Of the 563 patients 381 were drivers before the injury and 139 had returned to driving at interview. Many current drivers reported problems with behaviour (anger, aggression, irritability; 67 (48.2%)), memory (89 (64%)), concentration and attention (39 (28.1%)), and vision (39 (28.1%)). Drivers reported most driving related problems as often as ex-drivers, main exceptions were epilepsy and community mobility. Current drivers scored significantly higher on the FIM+FAM (were more independent), than ex-drivers. The driving group had sustained less severe head injuries than ex-drivers; nevertheless, 78 (56.2%) current drivers had received a severe head injury. Few (61 (16%)) previous drivers reported receiving formal advice about driving after injury.

Conclusions—The existence of problems which could significantly affect driving does not prevent patients returning to driving after traumatic brain injury. Patients should be assessed for both mental and physical status before returning to driving after a head injury, and systems put in place to enable clear and consistent advice to be given to patients about driving. (*J Neurol Neurosurg Psychiatry* 2001;70:761-766)

Keywords: driving; brain injury

The overall annual incidence of traumatic brain injury in the United Kingdom is about 300/100 000.¹ As most victims are young and life expectancy is rarely reduced,^{2 3} it has been

estimated that as many as 500 000 people in the United Kingdom may be currently living with the consequences of their injury.⁴ Traumatic brain injury may be “a hidden disability”⁵ as a person may seem physically normal, yet have considerable cognitive, psychological, social, emotional, and behavioural problems. Psychosocial problems are reported long after discharge from acute services, and include impaired judgement, short temper, aggression, and intolerance of others.⁶⁻⁹ These problems are likely to affect the ability of the person to return to driving. Although people with brain injury have not been identified as at particularly high risk of road accidents, poor judgement and impulsivity must be major sources of risk, with physical problems playing only a minor role.¹⁰

Many people see the ability to drive again as a crucial index of recovery.¹⁰ Stopping driving is associated with lost social activities and depression, even when other forms of transport are easily accessible.¹¹

In the United Kingdom drivers are required to inform the Driver and Vehicle Licensing Agency (DVLA) if they have any disability which is likely to last for more than 3 months and which may affect their fitness to drive. The Medical Commission on Accident Prevention (MCAP) produces a guide for medical practitioners¹² which advises that after a serious head injury patients should abstain from driving for 6 to 12 months unless “clinical recovery is full and complete”. The responsibility for informing the DVLA lies with the patient; however, the guide strongly recommends that doctors advise the patient to do so, particularly when there is concern for the safety of the patient and other road users.¹³ However, this is not the case in all countries. In a review of the literature van Zomeren reported that in many countries patients with brain injury are required to have a medical examination before a driver's licence can be renewed.¹⁰

A large multicentre study investigating outcomes after postacute rehabilitation for adults with traumatic brain injury was carried out by a research team from the Centre for Health Services Studies (CHESS) at the University of Warwick.^{14 15} The aims of the study were to examine rehabilitative care given to patients and to identify those elements of a rehabilitation service which lead to good patient outcomes. The main source of data was in depth interviews with patients and their families. Part of the interview covered community mobility and return to driving, and it was clear that this was an important issue for many respondents. This paper examines return to driving, and compares the characteristics of those patients who had returned to driving with those who had not.

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Method

Ten English pilot sites received funding for 5 years to improve rehabilitation services for adults with traumatic brain injury, and to participate in a CHES directed evaluation study from 1992 to 1997.

PARTICIPANTS

Five hundred and sixty three adults with traumatic brain injury aged between 16 and 65 were referred for rehabilitation to the 10 collaborating sites. Mean age was 32.5 years (median 30 years (SD 13.13)); 77.1% were men. Severity of injury was determined using Glasgow coma scale (GCS)¹⁶ scores, or length of post-traumatic amnesia (PTA), or both, where recorded. The GCS scores were available for 402 (70.8%) patients and PTA for 196 (34.8%). Severity of injury was classified according to the criteria proposed by the Medical Disability Society¹⁷:

- *Mild brain injury*—an injury causing unconsciousness for 15 minutes or less, and/or a GCS of 13 to 15
- *Moderate brain injury*—An injury causing unconsciousness for more than 15 minutes but less than 6 hours, or a PTA of less than 24 hours, and/or GCS of 9 to 12
- *Severe brain injury*—An injury causing unconsciousness for 6 hours or more, or a PTA of 24 hours or more, and/or GCS of 6 to 8
- *Very severe brain injury*—An injury causing unconsciousness for 48 hours or more or a PTA of 7 days or more, and/or GCS of 3 to 5.

Using these criteria 230 (40.8%) of the study group had very severe head injuries, 153 (27%) severe, 120 (21.4%) moderate, and 60 (10.8%) mild.

TIME SINCE INJURY

Patients entered the study at different times after injury. Some units recruited directly from acute wards, others from community services, sometimes years after injury. Wherever possible interviews were carried out 3–6 months after recruitment. In practice 270 (47.5%) were interviewed within 6 months of injury, 383 (67.5%) within 1 year, 461 (81.9%) within 2 years, and a further 102 (18.1%) were interviewed more than 2 years after injury.

MEASURES

Face to face semistructured interviews were carried out with 563 patients and their families. Interview schedules were of a funnel design, beginning with unprompted comments describing the problems and concerns of both the patient and his family, followed by more structured questions on, for example, community mobility, driving, employment, social integration, information received from health service professionals, and satisfaction with services. Five trained researchers carried out the interviews using standardised interview questionnaires; all were members of the research team. Interviews were carried out with the patient and a relevant family member, most often spouse or parent, and took place in the patient's home in about 90% of cases. Because of this, the patient and family member were usually interviewed at

the same time. Problems reported by the patient and problems reported by the family member were recorded separately. A measure of functional independence, the functional assessment measure FIM+FAM,¹⁸ was carried out by clinicians to coincide with the timing of the interviews.

Patients who were drivers before the injury were divided into two groups, those who had returned to driving by the time of the interview, and those who had not. A subgroup of the ex-drivers had been formally instructed not to drive and were looked at separately.

Results

DRIVERS BEFORE INJURY AND AT INTERVIEW

Most people (381 (67.7%)) were drivers before injury. One hundred and thirty people (23.1%) were not drivers before injury, and no relevant information was available for 52 (9.2%).

Of the 381 previous drivers, 139 (36.5%) were driving at interview and 242 (63.5%) were not. Of the previous drivers only 41 (10.8%) reported receiving a formal driving ban from the DVLA due to their injury. Twenty seven (66%) of these was because of risk of seizures. A further 20 previous drivers (5.3%) reported being advised not to drive by a clinician, giving a total of 61 patients who had been specifically advised not to drive.

PROBLEMS REPORTED AT INTERVIEW RELATED TO DRIVING

The problems reported by patients and family members which were likely to be associated with driving performance (such as wakefulness, behavioural problems, attentional problems, sensory deficits, and memory problems), were examined for those currently driving, previous drivers not currently driving, and banned and non-banned drivers (table 1).

CURRENT DRIVERS

Almost half (67 (48.2%)) of those driving reported behavioural problems such as irritability, anger management, and aggression. Eighty nine (64%) reported memory problems. Problems which may impair wakefulness and alertness during driving were also often reported—that is, tiredness (50 (36%)) and sleep disturbances (42 (30.2%)). Problems with concentration and attention were reported by 39 (28.1%), giddy spells or dizziness by 41 (29.5%), and problems with balance and coordination by 18 (12.9%). Emotional problems were also reported: 31 patients (22.3%) reported depression, and carers reported that the patients displayed personality changes (20 (14.4%)) and lack of insight (13 (9.4%)).

EX-DRIVERS

Table 1 also shows the number of previous drivers who had not returned to driving reporting these problems. Most problem items were reported as often by ex-drivers as by current drivers. The χ^2 test of association was used to compare the two groups of drivers for each problem item. There were significant differences between the two groups for epilepsy

Table 1 Frequency of problems reported by respondents at interview: drivers, ex-drivers, banned drivers, all previous drivers not banned, and all patients

Problem	Number of patients returned to driving (%) (n=139)	Total number of previous drivers not returned (%) (n=242)	Number of previous drivers with medical ban† (%) (n=61)	Number of all previous drivers not banned (%) (n=320)	Number of all patients reporting (%) (n=563)
Memory	89 (64.0)	157 (64.9)	41 (67.2)	206 (64.4)	356 (63.2)
Headaches	60 (43.2)	89 (36.8)	26 (42.6)	123 (38.4)	211 (37.5)
Fatigability	50 (36.0)	93 (38.4)	27 (44.3)	116 (36.3)	191 (33.9)
Sleep problems	42 (30.2)	57 (23.6)	22 (36.1)	77 (24.1)	128 (22.7)
Giddy spells/dizziness	41 (29.5)	62 (25.6)	19 (31.1)	84 (26.3)	142 (25.2)
Concentration/attention	39 (28.1)	72 (29.8)	21 (34.4)	90 (28.1)	154 (27.4)
Visual problems	39 (28.1)	91 (37.6)	24 (39.3)	106 (33.2)	190 (33.7)
Depression	31 (22.3)	44 (18.2)	9 (14.8)	66 (20.6)	104 (18.5)
Aural problems	30 (21.6)	35 (14.6)	9 (14.8)	56 (17.5)	86 (15.3)
Problems concerning driving	26 (18.7)	81 (33.5)	48 (78.7)	59 (18.4)	113 (20.1)
Balance and coordination	18 (12.9)	39 (16.1)	9 (14.8)	48 (15.0)	92 (16.3)
Personality change	20 (14.4)	29 (12.0)	4 (6.6)	45 (14.1)	68 (12.1)
Alcohol/alcohol tolerance	18 (12.9)	18 (7.4)	9 (14.8)	27 (8.4)	59 (10.7)
Insight	13 (9.4)	25 (10.3)	10 (16.4)	28 (8.8)	56 (10.0)
Mood swings	24 (17.3)	41 (16.9)	16 (26.2)	49 (15.3)	27 (4.8)
Epilepsy	5 (3.6)	38 (15.7)	27 (44.3)	16 (5.0)	69 (12.3)
Epilepsy-like (absences, blank spells)	4 (2.9)	6 (2.5)	1 (1.6)	9 (2.8)	12 (2.1)
Community mobility	14 (10.1)	43 (17.8)	13 (21.3)	44 (13.8)	96 (17.1)
Irritability*	35 (25.2)	45 (18.6)	14 (23)	66 (20.6)	105 (18.7)
Anger management*	32 (23.0)	47 (19.4)	14 (23)	65 (20.3)	118 (21.0)
Aggression*	8 (5.7)	17 (7.0)	2 (3.3)	22 (6.9)	39 (6.9)
Other behavioural*	3 (2.2)	27 (11.2)	3 (4.9)	27 (8.4)	40 (7.1)
Frustration*	6 (4.3)	13 (5.4)	3 (4.9)	16 (5.0)	27 (4.8)
All behavioural†	67 (48.2)	121 (50)	28 (45.9)	160 (50.0)	272 (48.3)

*Categorised as behavioural problems.

†Number of patients with at least one behavioural problem.

‡Banned drivers are also included in the figures for previous drivers not returned.

Figures in italics depict items with statistically significant differences between current and ex-driver groups.

Figures in bold depict items with statistically significant differences between banned and non-banned drivers.

($p=0.001$), driving ($p=0.004$), community mobility ($p=0.038$), and vision ($p=0.048$) with ex-drivers reporting these problems more often than current drivers. "Other behavioural problems", which included temper and abusive behaviour, were also reported significantly more often by ex-drivers ($p=0.002$). Aural problems were reported more often by ex-drivers than current drivers but this not reach significance at the 5% level ($p=0.085$). Diminished alcohol tolerance was reported by more current drivers than ex-drivers, but the difference was not significant at the 5% level ($p=0.08$).

BANNED DRIVERS

Only 61 out of 381 previous drivers reported that they had been formally advised not to drive. Two of these drivers admitted driving despite their licence being revoked, and three said that they continued to drive although formally advised not to by clinicians. The

"banned drivers" reported most problem items as often as current drivers. Exceptions were a higher incidence of epilepsy (27 (44.3%)), mood swings (16 (26.2%)), problems with driving (48 (78.7%)), and lack of insight reported by their carers (10 (16.4%)). The χ^2 test of association was used to compare banned drivers ($n=61$) with non-banned drivers ($n=320$) for each problem item. The frequency of reported problems was only significantly different between the two groups for four items: epilepsy ($p=0.001$), driving ($p=0.001$), mood swings ($p=0.05$), and sleep problems ($p=0.05$).

FIM+FAM SCORES ON DRIVING RELATED ITEMS

Scores on the FIM+FAM were used as a more objective measure of driving related problems to corroborate the problems reported by patients and their families. The four items attention, orientation, emotional status, and safety judgement were chosen to assess those skills required by drivers. These items were defined using the FIM+FAM scoring decision tree¹⁹ and shown in table 2.

Table 3 shows the scores on the four FIM+FAM items for the whole study group ($n=538$), current drivers ($n=132$), ex-drivers ($n=231$), banned drivers ($n=58$), and all non-banned drivers ($n=305$). The FIM+FAM is scored from 1 to 7 where 1 is fully dependent on others and 7 is fully independent. A score of 6 indicates some problems, and 5 or less indicates that a patient requires help or is unable to perform the task.

For all four FIM+FAM items a score of 7 was achieved by a higher proportion of current drivers than both ex-drivers and the interview group as a whole. The means (SD) on the four items were (a) for current drivers: attention 6.3 (SD 1.01), orientation 6.8 (SD 0.75), emotion

Table 2 Definitions of the four driving related FIM+FAM items

FIM+FAM item	Definition
Attention	Includes the length of time able to concentrate on tasks taking into consideration distractibility, level of responsiveness, and the difficulty/length of task.
Orientation	A score <6 indicates the presence of some attentional deficits. Includes orientation to person, place, time, and situation. A person scoring <6 needs help to be oriented to person, place, time, and situation.
Emotional status	Includes frequency and severity of depression, anxiety, frustration, unresponsiveness, agitation, interference with general life functioning, ability to cope with and take responsibility for emotional behaviour. A score <6 indicates the presence of 'behaviour problems interfering with general life functioning'.
Safety judgement	Includes orientation to one's situation, awareness of one's deficits and their implications, ability to plan ahead, ability to understand the nature of situations involving potential danger and to identify risks involved, freedom from impulsivity, ability to remember safety related information, and ability to respond appropriately if danger arises. A person scoring <6 needs some help to operate safely in the community.

Table 3 Driving related FAM scores at interview

FIM+FAM item	FIM+FAM score	Number of current drivers (%) (n=132)* No of drivers=139	Total number of ex-drivers (%) (n=231)* No of ex-drivers=242	Number of previous drivers with medical ban (%)† (n=58) No of banned drivers=61	Number of previous drivers not banned (%) (n=305) No of non-banned drivers=320	Total number of all patients (%) (n=538)* No of all interviewees=563
Attention	7	74 (56.1)	75 (32.5)	23 (39.7)	126 (41.3)	192 (35.7)
Attention	6	37 (28.0)	57 (24.7)	15 (25.9)	79 (25.9)	130 (24.2)
Attention	≤5	21 (15.9)	99 (42.9)	20 (34.5)	100 (32.8)	216 (40.1)
Orientation	7	114 (86.4)	148 (64.1)	45 (77.6)	217 (71.1)	346 (64.3)
Orientation	6	9 (6.8)	27 (11.7)	6 (10.3)	30 (9.8)	67 (12.5)
Orientation	≤5	9 (6.8)	56 (24.2)	7 (12.1)	58 (19.0)	125 (23.2)
Emotional status	7	47 (35.6)	41 (17.8)	12 (20.7)	76 (24.9)	130 (24.2)
Emotional status	6	40 (30.3)	63 (27.4)	16 (27.6)	87 (28.5)	144 (26.8)
Emotional status	≤5	45 (34.1)	127 (55.0)	29 (51.7)	142 (46.6)	264 (49.1)
Safety judgement	7	99 (75.0)	90 (39.0)	25 (43.1)	164 (53.8)	241 (44.8)
Safety judgement	6	21 (15.9)	57 (24.7)	20 (34.5)	58 (19.0)	108 (20.1)
Safety judgement	≤5	12 (9.1)	84 (36.4)	13 (22.4)	83 (27.2)	189 (35.1)

*Not all of the interviewees had complete FIM+FAM scores, hence the discrepancy between the number of FIM+FAMs and interviewees.

†Banned drivers are also included in the figures for ex-drivers.

5.6 (SD 1.57), and safety 6.6 (SD 0.85); (b) for ex-drivers all mean scores were about one level lower: attention 5.3 (SD 1.86), orientation 5.9 (SD 1.91), emotion 4.7 (SD 1.93), and safety 5.3 (SD 2.0). For banned versus non-banned drivers the means (SD) were (a) for banned ex-drivers: attention 5.7 (SD 1.5), orientation 6.5 (SD 1.16), emotion 4.95 (SD 1.76), and safety 5.9 (SD 1.51), only slightly lower than those of the current drivers; (b) for all non-banned drivers mean scores were attention 5.7 (SD 1.71), orientation 6.2 (SD 1.71), emotion 5.0 (SD 1.87), and safety 5.8 (SD 1.82).

A recent study analysing the properties of the FIM+FAM concluded that raw ratings may be justifiably treated as good approximations to points on interval scales of measurement.²⁰ Consequently the χ^2 test of association was used to compare the FIM+FAM scores of the group of previous drivers who had returned to driving with the group of previous drivers who had not returned to driving. There was a significant difference between the two groups: $p=0.0001$ for attention, orientation, and safety judgement, and $p=0.002$ for emotion.

The χ^2 test of association was also used to compare banned drivers with non-banned drivers for each FIM+FAM item. Surprisingly there was no significant difference between banned and non-banned drivers on any of the four items.

SEVERITY OF INJURY AND RETURN TO DRIVING

The severity of traumatic brain injury was classified as mild, moderate, severe, and very severe.¹⁷ Cross tabulations using the χ^2 test of association were calculated to compare the injury severity of the drivers with the ex-drivers, and the banned drivers with the non-banned drivers. There was a significant difference in

injury severity between the drivers and the ex-drivers ($p=0.001$). Overall, the driving group had less severe head injuries than the ex-driving group, in particular, 31 (22.3%) current drivers had received a mild head injury, compared with only 19 (8.0%) of ex-drivers (table 4). There was no significant difference between the injury severity of the banned drivers and the non-banned drivers ($p=0.68$). Although most of the banned drivers (40 (65.6%)) had had a severe or very severe head injury, four (6.6%) had sustained a mild head injury.

Discussion

Many of those patients who had returned to driving after traumatic brain injury reported problems which could significantly affect their ability to drive. Importantly, the proportion of patients reporting these problems was very similar for both the driving and ex-driving groups. Visual problems and problems with concentration and attention were reported by over a quarter of those who were driving. Half the drivers reported behavioural problems such as a "short fuse", uncontrolled aggression, and irritability. Other emotional problems such as depression and mood swings were not reported any less often by the drivers than the ex-drivers. For the subgroup of formally banned drivers there was a higher incidence of epilepsy and mood swings than was found among non-banned drivers.

Family members of the driving group reported personality change and lack of insight in the patient as often as family members of the ex-driving group. These two factors have been identified¹⁰ as being particularly important in increasing risk and reducing driving skills because psychological deficits are less likely than physical deficits to be identified and compensated for. Although most of those people who had returned to driving were physically competent to drive a vehicle, it may be argued that some were putting themselves and others at risk due to their psychological, emotional, and cognitive problems.

As a group, the patients who had returned to driving had received a less severe traumatic brain injury than those who had not yet returned to driving. This finding is likely to be influenced by the short follow up period, when those who had had mild injuries were most likely to have returned to driving. Nevertheless,

Table 4 Severity of injury for current drivers, ex-drivers, banned drivers, and non-banned drivers

Injury severity	Current drivers (%) (n=139) No of drivers=139	Ex-drivers (%) (n=240)* No of ex-drivers=242	Banned drivers (%)† (n=61) No of banned drivers=61	Non-banned drivers (%) (n=318)* No of non-banned drivers=320
Mild	31 (22.3)	19 (7.9)	4 (6.6)	45 (14.2)
Moderate	30 (21.6)	51 (21.3)	17 (27.9)	64 (20.1)
Severe	39 (28.1)	78 (32.5)	23 (37.7)	92 (28.9)
Very severe	39 (28.1)	92 (38.3)	17 (27.9)	117 (36.8)

*Less than whole group due to missing data.

†Banned drivers are also included in the figures for ex-drivers.

over half (56.2%) of the current drivers had received a severe, or very severe head injury.

On the FIM+FAM drivers achieved significantly higher scores than ex-drivers, indicating that clinicians thought them to be more independent. This finding is consistent with that found by others.²¹ However, there were no significant differences between banned and non-banned drivers. This may be because risk of epilepsy was the main reason for a driving ban rather than other deficits.

The four items chosen to be particularly relevant to driving performance are all FAM items, which have been found to demonstrate lower interrater reliability than FIM items.¹⁸ However, recent research suggests that both FIM and FAM items have a highly acceptable level of internal consistency and reliability.²⁰ The FIM+FAM has, however, been shown to have ceiling effects when used with patients after traumatic brain injury, which causes the measure to be relatively insensitive to changes, and may mask the incidence of higher level cognitive and emotional deficits.²²

MEDICAL FITNESS TO DRIVE: ADVICE TO PATIENTS Holders of a British driving licence are advised to inform the Driver and Vehicle Licensing Agency (DVLA) "At once if you have any disability (includes any physical or mental condition) which affects (or may future affect) your fitness as a driver if you expect it to last more than three months".

The freely available MCAP guides advise medical practitioners that responsibility for determining the fitness to drive of an individual person rests with the DVLA; however, doctors should advise the patient to inform the DVLA of any condition which may affect the patient's fitness to drive.¹²⁻²³ Only in exceptional circumstances should a doctor breach patient confidentiality and inform the DVLA himself. Responsibility for informing the licensing authorities is also problematic in other countries. In a survey carried out in the United States the different states have different requirements for impaired drivers: 15 states authorise physicians to report impaired drivers, of which seven *require* physicians to report them, and in thirty five states drivers are required to report themselves.²⁴

Visual deficits were reported by about one third of previous drivers (current drivers 28.1%; ex-drivers 37.6%) of whom few reported that they had received specific visual examinations or advice about driving. Special considerations are required when assessing whether a person with brain injury is visually fit to drive, and close liaison should be maintained between the optometrist and other head injury professionals involved in the patient's care.²⁵ Many of our interviewees reported that they were unable to judge distances, were dazzled by oncoming cars, and found it difficult to see well enough to drive at night, factors also noted by others.²⁶⁻²⁷

From our interviews it seems that few patients were told that the DVLA should be informed, or were given any formal advice, particularly if they had made a good physical

recovery and there was a delay before referral to the rehabilitation team. Rehabilitation professionals were often concerned to find that a patient had returned to driving despite problems with vision, coordination, anger, and uncontrolled aggression. Attempts to stop the patient driving were thwarted by the fact that "the doctor told me I could".

For those patients who have epilepsy diagnosed, the regulations are fairly straightforward,²⁸ but are much less so for other disorders associated with head injury. We were told that general practitioners had given patients a green light to drive without the benefit of any formal assessment, but sometimes with advice to keep initial journeys short. One patient reported that his general practitioner had advised him against informing the DVLA, suggesting that it would be very difficult to get his licence back.

An example of conflicting advice was a patient who had a moderate head injury at the age of 43. He was a self employed long distance lorry driver. At the interview he reported double vision, memory problems, severe headaches, and fatigue. At his outpatient appointment the neurosurgeon informed him that he could return to work, apparently without realising that the patient worked as a driver of a heavy goods vehicle. His case manager, concerned for the patient's safety managed to get this decision reversed. This action left the patient confused, and he reported to us that although his treatment had been good, it had "worked against me". He had received "a letter from the doctor saying it is absolutely fine to go back to work"; then had the decision overturned. His subsequent inability to work caused the family severe financial hardship. He reported that he wished he had not gone to rehabilitation and withdrew from therapy shortly afterwards, leaving the area without a forwarding address.

At the time of the interviews none of the study sites seemed to have a formal policy about giving advice and information on return to driving; however, during the course of the 5 year study this issue came to be considered more systematically by five of the sites. The National Head Injuries Association (Headway) produce a leaflet advising patients on return to driving,²⁹ yet few of the patients we interviewed were aware of this information. In practice, the decision to resume driving was often made by the patient himself, a finding consistent with that made by Priddy *et al*³⁰ who also noted that patients were willing to restrict their driving activities to suit their altered abilities. From our interviews we found that patients, and particularly their families, showed good common sense in delaying a return to driving and then resuming gradually, starting with short and familiar journeys, often accompanied. Some patients took refresher driving lessons of their own volition.

DRIVING ASSESSMENTS

Four of the study sites had close access to specialist disabled driving centres which were able to provide a formal assessment of the person's suitability to return to driving. Study patients

who seemed to have few problems were often offered a "fast track" assessment which ensured that the patient was competent to drive on the road. However, such assessments do not generally assess the higher cognitive levels required in driving as noted by van Zomeren *et al.*³¹ Study patients who had a formal driving assessment and were passed as fit to drive reported that this increased their confidence and improved their quality of life. Being able to drive again often meant that they could resume previous activities. Those unable to resume driving often reported frustration with their situation, and felt trapped in their homes.

POSSIBLE LIMITATIONS OF THE RESEARCH

This research project was not an epidemiologically based study. However, the project presented an opportunity to study a large group of patients selected to receive rehabilitation by centres of good practice whose resources were enhanced by Department of Health grants specifically for head injury rehabilitation, and thus expected to receive a better service than could be offered by units without the benefit of a dedicated head injury team. Despite this, it seemed that driving advice was often not routinely given to previous drivers, or if it was, then the patients themselves did not recall it, which is of equal concern.

UNANSWERED QUESTIONS AND FUTURE RESEARCH

This paper reports interview responses mostly made during the early months after injury when patients had not long returned to driving. A long term follow up of these patients is crucial to ascertain whether a head injury predisposes drivers to further accidents.

Conclusions

Few patients reported that doctors had advised them not to drive after their traumatic brain injury. Risk of epilepsy was the most likely reason for a formal driving ban. Patients who had returned to driving reported a similar pattern of deficits as those who had not returned to driving, the main difference between the two groups being a higher level of functional independence among the current drivers. Patients were not given clear nor consistent advice about return to driving and often had to rely on informal advice from therapists, on their common sense, or that of their family. It is recommended that patients are informed of their entitlement to drive after a head injury by the rehabilitation team and their general practitioner. However, such advice can be unpopular with patients, and not necessarily followed. For patients who do meet the current medical standards of fitness to drive careful assessment and monitoring can lead to a safe return to driving and a consequent improvement of their quality of life.

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- 1 British Society of Rehabilitation Medicine. *Rehabilitation after traumatic brain injury*. London: BSRM, 1998.
- 2 NHS Health Advisory Service. *Thematic review of mental health services: heading for better care. Commissioning and providing mental health services for people with Huntington's disease, acquired brain injury and early onset dementia*. London: The Stationery Office, 1996.
- 3 Rimel RW, Jane JA, Bond MR. Characteristics of the head injured patient. In: Rosenthal M, Griffith ER, Bond MR, *et al*, eds. *Rehabilitation of the adult and child with traumatic brain injury*. 2nd ed. Philadelphia: FA Davis, 1990.
- 4 McMillan T, Greenwood R. *Rehabilitation programmes for the brain injured adult* [discussion paper]. London: Department of Health, 1991.
- 5 Social Services Inspectorate Social Services Department. *Information strategies and systems (with reference to community care): inspection overview*. London: Department of Health, 1995.
- 6 McKinlay WW, Brooks DN, Bond MR, *et al*. The short term outcome of severe blunt head injury as reported by relatives of the injured persons. *J Neurol Neurosurg Psychiatry* 1981; 44:527-33.
- 7 Tate RL, Lulham JM, Broe GA, *et al*. Psychosocial outcome for the survivors of severe blunt head injury: the results from a consecutive series of 100 patients. *J Neurol Neurosurg Psychiatry* 1981;52:1128-34.
- 8 Thomsen IV. Late psychosocial outcome in severe traumatic brain injury. Preliminary results of a third follow-up study after 20 years. *Scand J Rehabil Med* 1992;(suppl 26):142-52.
- 9 Koskinen S. Quality of life 10 years after a very severe traumatic brain injury (TBI): the perspective of the injured and the closest relative. *Brain Injury* 1998;12:631-48.
- 10 Van Zomeren AH, Brouwer WH, Minderhoud JM. Acquired brain damage and driving: a review. *Arch Phys Med Rehabil* 1987;68:697-705.
- 11 Legh-Smith J, Wade DT, Hewer RL. Driving after a stroke. *J R Soc Med* 1986;79:200-3.
- 12 Taylor JF, ed. *Medical aspects of fitness to drive. A guide for medical practitioners*. London: The Medical Commission on Accident Prevention, 1995.
- 13 Schutte, P, Barker, J. Medico-legal considerations. In: Taylor JF, ed. *Medical aspects of fitness to drive. A guide for medical practitioners*. London: The Medical Commission on Accident Prevention, 1995.
- 14 Hawley CA, Stilwell J, Davies C, *et al*. A national multicentre study of post-acute rehabilitation for adults after traumatic brain injury. *Br J Ther Rehabil* 2000;7:116-22.
- 15 Stilwell J, Hawley C, Stilwell P, *et al*. *The report of the national traumatic brain injury study*. University of Warwick, Coventry: Centre for Health Services Studies, 1998.
- 16 Teasdale G, Jennett B. Assessment of coma and impaired consciousness: a practical scale. *Lancet* 1974;ii:81-3.
- 17 Medical Disability Society. *The management of traumatic brain injury*. London: Royal College of Physicians, 1988.
- 18 Hall KM, Hamilton BB, Gordon WA, *et al*. Characteristics and comparisons of functional assessment indices: disability rating scale, functional independence measure, and functional assessment measure. *J Head Trauma Rehabil* 1993;8:60-74.
- 19 State University of New York at Buffalo. *FAM decision tree*. Buffalo, New York: State University of New York at Buffalo, 1989.
- 20 Hawley CA, Taylor R, Hellawell DJ, *et al*. The use of the functional assessment measure (FIM+FAM) in head injury rehabilitation: a psychometric analysis. *J Neurol Neurosurg Psychiatry* 1999;67:749-54.
- 21 Fisk GD, Schneider JJ, Novack TA. Driving following traumatic brain injury: prevalence, exposure, advice and evaluations. *Brain Injury* 1998;12:683-95.
- 22 Hall KM, Mann N, High WM, *et al*. Functional measures after traumatic brain injury: ceiling effects of FIM, FIM+FAM, DRS, and CIQ. *J Head Trauma Rehabil* 1996; 11:27-39.
- 23 Drivers Medical Group, DVLA. *For medical practitioners: at a glance guide to the current medical standards of fitness to drive*. Swansea: DVLA, 1996.
- 24 Pidkiti RD, Novack TA. The disabled driver: an unmet challenge. *Arch Phys Med Rehabil* 1991;72:109-11.
- 25 Shute RH, Woodhouse JM. Visual fitness to drive after stroke or head injury. *Optical Physiol Opt* 1990;10:327-332.
- 26 Munton G. Vision. In: Taylor JF, ed. *Medical aspects of fitness to drive. A guide for medical practitioners*. London: The Medical Commission on Accident Prevention, 1995.
- 27 Mortimer RG. Night driving. In: Gale AG, Freeman MH, Haslegrove ML, *et al*, eds. *Vision in vehicles*. New York: Elsevier, 1986.
- 28 Jennett B. Epilepsy and neurosurgical disorders. In: Taylor JF, ed. *Medical aspects of fitness to drive. A guide for medical practitioners*. London: The Medical Commission on Accident Prevention, 1995.
- 29 Headway. *Driving after a head injury*. Nottingham: National Head Injuries Association 1989.
- 30 Priddy DA, Johnson P, Lam CS. Driving after a severe head injury. *Brain Injury* 1990;4:267-72.
- 31 Van Zomeren AH, Brouwer WH, Rothengatter JA, *et al*. Fitness to drive a car after recovery from severe head injury. *Arch Phys Med Rehabil* 1988;69:90-6.