

# Prediction of Psychological Outcomes One Year After a Motor Vehicle Accident

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**Objective:** The authors' goal was to identify predictors of 1-year outcomes for consecutive patients in a hospital emergency department following motor vehicle accidents and to describe the prevalence and course of four types of psychiatric outcomes after such accidents.

**Method:** Consecutive patients aged 17–69 years who attended a general hospital emergency department following a motor vehicle accident were identified. Medical information for these patients was extracted from case notes, and the patients completed self-report questionnaires at baseline (soon after the accident), 3 months after the accident, and 1 year after the accident. Measures included a self-report scale for posttraumatic stress disorder (PTSD), the Hospital Anxiety and Depression Scale, and questions about pho-

bic travel anxiety. Logistic regression was used to examine predictors of outcome.

**Results:** Different frequencies and courses of PTSD, phobic travel anxiety, general anxiety, and depression were reported by a third of the subjects at both 3-month and 1-year follow-up. Many of the subjects reported improvements between 3 and 12 months, but others described late onset of psychiatric outcomes after the accident. There were differences in baseline and 3-month predictors of each type of 1-year outcome.

**Conclusions:** The four types of psychiatric outcomes after a motor vehicle accident that were noted overlap, are persistent, and have different early predictors. These findings have implications for the early recognition of psychiatric consequences of motor vehicle accidents that would enable early intervention.

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Stressful events have subjective meanings, such as loss, threat, and fear, which are important in the etiology of depression (1), anxiety, specific phobias, posttraumatic stress disorder (PTSD), and other psychiatric disorders. However, research on trauma (i.e., exceptionally frightening and threatening events, with or without physical injury) has largely focused on PTSD. Even so, it has repeatedly been observed in general population studies (2–4) and in studies of disasters (5, 6), combat (7), and other types of trauma (8) that depression, phobic avoidance, substance abuse, and other psychiatric problems are also frequent outcomes.

This article is concerned with the range of psychiatric outcomes after trauma, specifically the trauma experienced by subjects who attended a hospital emergency department as victims of motor vehicle accidents. Previous prospective studies of outcome have shown that a variety of psychiatric complications—PTSD, general anxiety, depression, and specific phobic anxiety about travel—are common (9–13) and that there is considerable overlap among them. However, they also occur separately, and our previous work (11) suggested that there are people who do not meet diagnostic criteria for PTSD who nevertheless report phobias and anxieties about travel that are just as distressing and disabling (11).

We have been able to examine the relationship among the different psychiatric outcomes after trauma in a prospective study over a 1-year period of a large group of consecutive patients aged 17–69 who attended a general hospital emergency department following a motor vehicle, bicycle, or pedestrian road accident. In this article we describe the frequency and course of four categories of psychiatric disorder (PTSD, general anxiety, phobic travel anxiety, and depression) and the extent to which 1-year outcomes are predicted by variables identified as being important in previous research or clinical practice (11, 14) and assessed either shortly after the accident or 3 months later.

## Method

Consecutive patients aged 17–69 who attended the Accident and Emergency Department of the John Radcliffe Hospital, Oxford, following a motor vehicle accident (vehicle occupants, motorcyclists, bicyclists, pedestrians) (N=1,441) were approached to take part in the study and given or sent a questionnaire. Those who completed the questionnaires in the hospital were more likely to have been admitted. A further 81 subjects were not asked to take part for different reasons. Individuals with head injury who had been unconscious for more than 15 minutes (N=23) or were too ill to complete a questionnaire (N=11) were excluded; seven people died in the emergency department. Overseas visi-

tors (N=32) and those with learning or psychiatric problems (N=8) were also excluded. There were 12 initial refusals.

Data were collected by means of self-completion questionnaires as specified by the local ethics committee. The baseline questionnaire covered background details, previous travel, health and daily activities, previous tendency to worry, and emotional problems. Follow-up questionnaires, which were sent at 3 months and 1 year after the accident, covered physical recovery; financial, work and legal problems; return to traveling; cognitions; and cognitive strategies. Participants also completed the Posttraumatic Stress Symptoms Scale (15), the Hospital Anxiety and Depression Scale (16), and a six-question health and daily activities questionnaire derived from the 36-Item Short-Form Health Survey (17).

### Measures

**Outcome variables.** The outcome variable of phobic travel anxiety, a measure based on previous research (18), combines increased nervousness about traveling and avoidance of traveling. The cutoff points are consistent with the DSM-IV criteria for phobia. For the outcome variable of general anxiety we used the recommended cutoff of 10 or more on the Hospital Anxiety and Depression Scale (16). For depression we used the recommended cutoff of 10 or more on the Hospital Anxiety and Depression Scale. For PTSD we used the minimum number of symptoms on the Posttraumatic Stress Symptom Scale (15) required by DSM-IV criteria.

**Predictor variables.** Thirteen baseline variables were included in the present study because previous research or theoretical considerations suggested they may be predictors of PTSD (see our earlier report [14]), general anxiety, depression, or phobic travel anxiety. A further seven measures assessed at 3 months were also examined, three social stressors and four cognitive "maintaining factors" (19).

The 13 baseline variables were gender, hospital admission, severity of injury, accident group, previous confidence as a passenger, previous motor vehicle injury, previous frequency of road use, previous emotional problems, tendency to worry, and four reactions to the accident (dissociation, blaming oneself, fear, and negative emotions).

The severity of the injury was classified as no injury, soft tissue injury only, or fracture. The accident group included vehicle driver, passenger, motorcyclist, bicyclist, and pedestrian. The subject's previous confidence as a passenger was rated on a 5-point scale ranging from very relaxed to very nervous. For previous frequency of road use, seven modes of travel (car driver, passenger, bus, motorcycle, moped, bicycle, on foot) were rated on a 5-point scale on which 1=daily and 5=never. Previous emotional problems were rated on a 6-point scale on which 1=not at all and 5=extremely in response to the question, "During the 4 weeks before the accident how much were you bothered by emotional problems (such as feeling anxious, depressed or irritable)?" This question was from the 36-Item Short-Form Health Survey (17). The tendency to worry was rated on a 7-point scale on which -3=very much disagree and 3=very much agree with the statement, "I tend to worry a lot about things."

Negative emotions and dissociation after the accident were rated on a 5-point scale on which 0=not at all and 4=extremely in response to a question about how subjects were feeling "at the moment" in regard to 10 emotional responses (angry, numbed, shaky, excited, relieved, weepy, anxious, guilty, dazed, calm). Negative emotions were the mean of the ratings for anxious, shaky, and weepy minus the rating for calm. Dissociation was the mean of the ratings for dazed and numb. Feeling to blame after the accident was rated on a 3-point scale on which 1=yes, 2=partly, and 3=no in response to the question, "Do you blame yourself at all for the accident?" The reaction of fear was rated on a 4-point scale on

which 1=not frightening and 4=very frightening in reply to the question, "How frightening was the accident?"

Social stressors assessed at 3 months included health problems, financial problems, and litigation. Subjects rated their recovery from accident injuries on a 3-point scale on which 0=back to normal, 1=fully recovered, and 2=major problems. They rated their financial problems on a 3-point scale on which 0=no and 2=major in reply to the question, "Has the accident resulted in financial problems for you now?" Litigation was assessed by asking whether the respondent was making a claim for compensation.

**Cognitive variables.** The frequency of cognitions about memories of the accident was rated on a 5-point scale on which 0=never and 4=always. Rumination was the mean score in response to two questions, "Why did it happen to me?" and "I dwell on memories of the accident." Thought suppression was the mean score in response to "I try to push them out of my mind" and "I try to distract myself." Negative interpretations of intrusive recollections was the mean of "I must be going out of my mind" and "I will never get over it." Anger was the score on "Others have harmed me." Categorical scales were treated as if they had equal intervals, but most were dichotomized for the analysis.

### Statistical Analysis

Logistic regression was used to examine predictors of outcome. The dichotomous dependent variables were the logits of the probability of a poor outcome at 1 year. Logistic regression models were fitted, each independent variable being fitted separately and then adjusted for the remaining factors. Most of the continuous predictor variables were not normally distributed and were dichotomized. This inevitably resulted in some loss of information and reduced the total amount of deviance explained in the models, but the categories were felt to be more useful in a clinical context than log-transformed continuous variables. Cutoff points were chosen to provide meaningful groups of a reasonable size. Significance levels were set at  $p < 0.003$  because of the 20 variables included (Bonferroni correction).

## Results

Of the 1,441 eligible patients 1,148 (80%) completed a questionnaire at baseline. At 3 months, 865 (75%) of the 1,148 participants completed a follow-up questionnaire, and at 1 year 773 (67%) did so. Table 1 shows some of the characteristics of the participants. Just over half were men, and half were younger than 30 years old. The mean age of the total group was 32.47 years (SD=13.10). Men and women did not differ significantly in age: the mean age of the men was 32.64 (SD=12.96), and the mean age of the women was 32.93 (SD=13.28). The majority suffered soft tissue injuries (abrasions or lacerations) only. Seven in 10 said they could remember the accident clearly, and two-thirds rated the accident as moderately to very frightening.

### Comparison of Participants With Nonparticipants and Dropouts

To examine selection bias, we compared the 293 eligible people who did not take part in the study with the 1,148 participants on demographic and medical factors available from the hospital notes. Initial participation was not related to accident group (being a vehicle driver, passenger, motorcyclist, bicyclist, or pedestrian). Women were significantly more likely to participate (82% [N=517] of the

TABLE 1. Characteristics of Participants in a Survey of Psychiatric Outcomes After a Motor Vehicle Accident

Characteristic	Men (N=631)		Women (N=517)		Total (N=1,148)		Analysis		
	N	%	N	%	N	%	$\chi^2$	df	p
Accident group							74.15	4	<0.001
Vehicle driver	332	52.6	268	51.8	600	52.3			
Passenger	87	13.8	153	29.6	240	20.9			
Motorcyclist	110	17.4	25	4.8	135	11.8			
Bicyclist	75	11.9	48	9.3	123	10.7			
Pedestrian	27	4.3	23	4.4	50	4.4			
Injury type							33.46	2	<0.001
Fracture	156	24.7	63	12.2	219	19.1			
Soft tissue	346	54.8	358	69.2	704	61.3			
None	128	20.3	96	18.6	224	19.5			
No answer	1	0.2	0	0.0	1	0.1			
Admitted to hospital							10.32	1	<0.01
Yes	176	27.9	102	19.7	278	24.2			
No	455	72.1	415	80.3	870	75.8			
Employment status							98.96	4	<0.001
Working	476	75.4	308	59.6	784	68.3			
Not working	64	10.1	35	6.8	99	8.6			
Student or trainee	73	11.6	89	17.2	162	14.1			
Housekeeper	2	0.3	69	13.3	71	6.2			
Retired	16	2.5	16	3.1	32	2.8			
Previous motor vehicle accident injury							17.65	1	<0.001
Yes	221	35.0	122	23.6	343	29.9			
No	407	64.5	392	75.8	799	69.6			
No answer	3	0.5	3	0.6	6	0.5			
Emotional problems in last 6 months							5.87	1	<0.05
None or slight	510	80.8	390	75.4	900	78.4			
Moderate to extreme	116	18.4	126	24.4	242	21.1			
No answer	5	0.8	1	0.2	6	0.5			
Blames self for accident							4.69	2	<0.10
Yes	90	14.3	57	11.0	147	12.8			
Partly	107	17.0	76	14.7	183	15.9			
No	427	67.7	381	73.7	808	70.4			
No answer	7	1.1	3	0.6	10	0.9			
Memory of accident							8.45	2	<0.05
Clear	426	67.5	372	72.0	798	69.5			
Patchy	160	25.4	126	24.4	286	24.9			
None	41	6.5	15	2.9	56	4.9			
No answer	4	0.6	4	0.8	8	0.7			
Fear							49.25	1	<0.001
Found accident not or slightly frightening (including no memory)	273	43.5	122	23.6	395	34.4			
Found accident moderately to very frightening	354	56.1	393	76.0	747	65.1			
No answer	4	0.6	2	0.4	6	0.5			
Negative emotions							100.89	1	<0.001
High level	90	14.3	210	40.6	300	26.1			
Low level	525	83.2	299	57.8	824	71.8			
No answer	16	2.5	8	1.5	24	2.1			

628 women compared with 78% [N=631] of the 813 men) ( $\chi^2=4.85$ ,  $df=1$ ,  $p<0.05$ ), as were those over age 30 (84% [N=552] of those older than 30 compared with 76% [N=596] of those 30 years old or younger) ( $\chi^2=11.13$ ,  $df=1$ ,  $p<0.01$ ). More of those who were admitted to the hospital participated in the study (89% [N=278] of those who were hospitalized compared with 77% [N=870] of those who were not hospitalized) ( $\chi^2=19.49$ ,  $df=1$ ,  $p<0.001$ ).

The 375 participants who dropped out of the study during the follow-up year were compared with the 773 who remained in the study. Women were more likely to remain in the study for the whole year than men, as were those over age 30. Employment status at first assessment was also related to continuing participation: only 52% (N=51) of the 99 subjects who were out of work or off sick completed the 1-year questionnaire, compared with 94% (N=30) of the 32 retired subjects and 70% (N=594) of the 855

subjects who were employed or were minding the home ( $\chi^2=26.65$ ,  $df=4$ ,  $p<0.001$ ). Patients who were admitted to the hospital after the accident were also more likely to remain in the study than those who were not admitted (80% [N=222] of 278 compared with 63% [N=551] of 870) ( $\chi^2=26.15$ ,  $df=1$ ,  $p<0.001$ ). However, none of the other predictor variables measured at first assessment or at 3 months were related to subsequent participation.

### Characteristics

Table 1 summarizes the characteristics of the participants. There were a number of gender differences. More men than women suffered fractures and were admitted to the hospital, and men were more likely to have been injured in a previous road accident. More men also said they were to blame for the accident, but this was because more women were passengers. Women were significantly more

**TABLE 2.** Frequency of Four Psychiatric Outcomes Among 1,148 Subjects 3 Months and 1 Year After a Motor Vehicle Accident<sup>a</sup>

Outcome and Time of Follow-Up	Men			Women			Total		
	N	With Outcome		N	With Outcome		N	With Outcome	
		N	%		N	%		N	%
Phobic travel anxiety									
3 Months <sup>b</sup>	457	72	16	398	113	28	855	185	22
1 Year <sup>c</sup>	402	43	11	369	84	23	771	127	16
General anxiety									
3 Months <sup>d</sup>	453	49	11	394	98	25	847	147	17
1 Year <sup>e</sup>	402	48	12	373	97	26	769	145	19
Depression									
3 Months	452	17	4	397	25	6	849	42	5
1 Year	402	19	5	365	28	8	767	47	6
PTSD									
3 Months <sup>f</sup>	461	83	18	396	115	29	857	198	23
1 Year	402	59	15	367	69	19	769	128	17

<sup>a</sup> Numbers differ because of missing data.<sup>b</sup> Significant difference between men and women ( $\chi^2=19.89$ ,  $df=1$ ,  $p<0.001$ ).<sup>c</sup> Significant difference between men and women ( $\chi^2=20.23$ ,  $df=1$ ,  $p<0.001$ ).<sup>d</sup> Significant difference between men and women ( $\chi^2=28.87$ ,  $df=1$ ,  $p<0.001$ ).<sup>e</sup> Significant difference between men and women ( $\chi^2=26.16$ ,  $df=1$ ,  $p<0.001$ ).<sup>f</sup> Significant difference between men and women ( $\chi^2=14.46$ ,  $df=1$ ,  $p<0.001$ ).

likely to report emotional difficulties in the month before the accident and more fear and emotional distress after the accident.

### Frequency, Onset, and Course of Psychiatric Disorders

A third of the subjects reported psychiatric outcomes after the accident. In view of the overrepresentation of women among the participants, Table 2 shows the frequency of each of our four main categories of psychiatric disorders for men and women. More women than men had phobic travel anxiety and general anxiety at 3 months and 1 year and PTSD at 3 months. More passengers, both male and female, had phobic travel anxiety at 1 year than drivers (data not shown). Age and employment status were not associated with psychological outcome for men or women.

Table 3 shows the onset and course of each type of disorder for subjects for whom information was available at all three assessments; there were marked similarities in course for the four outcomes. In the majority of cases, onset of the disorder was within 3 months of the accident. The disorder was persistent at 1 year in about half of the subjects with phobic travel anxiety (52% [ $N=75$ ]), general anxiety (58% [ $N=66$ ]), and PTSD (50% [ $N=76$ ]) but in only 39% ( $N=13$ ) of those with depression (data not shown). Late onset between 3 months and 1 year was reported by around 5% of subjects for each type of psychiatric outcome. A small number of people ( $N=35$ ) had another accident between the 3-month and 1-year assessment, and this was associated with late-onset general anxiety (13% [ $N=8$ ] of 60 subjects with late-onset general anxiety compared with only 4% [ $N=27$ ] of 611 subjects with early-onset or no anxiety) ( $\chi^2=7.07$ ,  $df=1$ ,  $p<0.01$ ) but not with phobic travel anxiety, PTSD, or depression (data not shown).

### Litigation

At 1 year, 31 (58%) of the 536 people who felt they were not to blame for the accident were claiming compensation. Among these subjects, gender and age were not related to being a claimant, but those who were working were less likely to claim than those who were out of work, retired, or at home.

### Comorbidity

There was considerable overlap among the psychological outcomes after phobic travel anxiety, PTSD, general anxiety, and depression at both 3 months and 1 year, but sizable proportions of individuals with psychological outcomes had only one or two types of psychiatric disorder. This is shown in a correlation matrix (Table 4) and in a Venn diagram (Figure 1). For simplicity of presentation, Figure 1 does not include depression; there were only 10 people with depression who did not have general anxiety as well.

### Predictors of Outcomes at 1 Year

The results of the logistic regression analyses for the three anxiety disorders are shown in Table 5. A number of variables were significant ( $p<0.003$ ) for the prediction of depression when entered on their own (baseline negative emotions, and 3-month health and financial problems, anger, and rumination). The results of logistic regression for depression are not shown because there were no significant predictors of depression after adjustment.

As might be expected given the overlap among the outcomes, a number of predictor variables entered separately into the regression were common to phobic travel anxiety, general anxiety, and PTSD. Among the baseline variables, these were previous emotional problems in the month before the accident, previous low levels of confidence as a passenger, finding the accident frightening, and dissocia-

**TABLE 3. Onset and Course of Four Psychiatric Outcomes Among 1,148 Subjects Involved in a Motor Vehicle Accident<sup>a</sup>**

Outcome	Men			Women			Total		
	N	With Outcome N	%	N	With Outcome N	%	N	With Outcome N	%
Phobic travel anxiety <sup>b</sup>									
Not present	355	287	81	334	219	66	688	506	74
Present at 3 months only	355	30	8	334	38	11	688	68	10
Present at 3 months and 1 year	355	19	5	334	56	17	688	75	11
Present at 1 year only	355	19	5	334	20	6	688	39	6
General anxiety <sup>c</sup>									
Not present	352	295	84	330	213	65	681	508	75
Present at 3 months only	352	17	5	330	30	9	681	47	7
Present at 3 months and 1 year	352	19	5	330	47	14	681	66	10
Present at 1 year only	352	21	6	330	39	12	681	60	9
Depression									
Not present	351	328	93	331	296	89	682	624	91
Present at 3 months only	351	8	2	331	12	4	682	20	3
Present at 3 months and 1 year	351	6	2	331	7	2	682	13	2
Present at 1 year only	351	9	3	331	16	5	682	25	4
PTSD <sup>d</sup>									
Not present	359	283	79	330	220	67	689	503	73
Present at 3 months only	359	29	8	330	47	14	689	76	11
Present at 3 months and 1 year	359	28	8	330	48	15	689	76	11
Present at 1 year only	359	19	5	330	15	5	689	34	5

<sup>a</sup> Numbers are smaller than in Table 2 because subjects were restricted to those responding at all three times.

<sup>b</sup> Significant difference between men and women ( $\chi^2=27.68$ ,  $df=3$ ,  $p\leq 0.001$ ).

<sup>c</sup> Significant difference between men and women ( $\chi^2=33.37$ ,  $df=3$ ,  $p\leq 0.001$ ).

<sup>d</sup> Significant difference between men and women ( $\chi^2=16.70$ ,  $df=3$ ,  $p\leq 0.001$ ).

**TABLE 4. Correlations Between Four Psychiatric Outcomes Among 760 Subjects 1 Year After a Motor Vehicle Accident<sup>a</sup>**

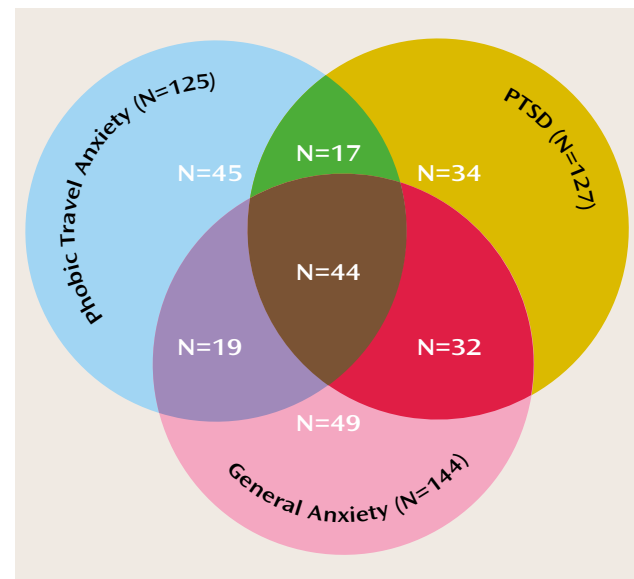
1-Year Outcome	r (df=758)		
	Phobic Travel Anxiety	General Anxiety	Depression
Phobic travel anxiety			
General anxiety	0.36		
Depression	0.25	0.39	
PTSD	0.38	0.47	0.35

<sup>a</sup> Analysis restricted to subjects for whom information was available on all four outcomes. All of the correlations were significant (two-tailed  $p<0.01$ ).

tive symptoms and a high level of negative emotions after the accident. The tendency to worry predicted general anxiety, and variables measuring aspects of travel mainly predicted phobic travel anxiety. Medical variables other than hospital admission were not significant predictors of any outcomes before or after adjustment.

All of the cognitive measures taken at 3 months were predictors of phobic travel anxiety, general anxiety, and PTSD when entered singly. Financial and health problems and litigation at 3 months also predicted these three outcomes and were the only significant single predictors of depression (data not shown). Thought suppression was a more powerful predictor for men than women (data not shown).

After adjustment for the remaining predictor variables, the unique predictors of each outcome were rather different. Phobic travel anxiety was predicted by baseline travel measures, previous emotional problems, and finding the accident frightening, but not by any of the 3-month maintaining factors. For PTSD, rumination and negative interpretations of intrusive recollections at 3 months were the

**FIGURE 1. Prevalence of Three Anxiety Outcomes Among 1,148 Subjects 1 Year After a Motor Vehicle Accident<sup>a</sup>**

<sup>a</sup> Four subjects for whom there was incomplete information on all three outcomes were excluded.

only remaining significant predictors. Rumination and negative interpretations also remained significant for general anxiety, together with two baseline measures, gender and previous emotional problems.

## Discussion

This paper confirms and extends evidence of the characteristics of four categories of psychiatric outcomes often



TABLE 5. Rate Ratios of Three Anxiety Outcomes Among 1,148 Subjects 1 Year After a Motor Vehicle Accident<sup>a</sup>

Item	Phobic Travel Anxiety			General Anxiety			PTSD		
	Unadjusted Rate Ratio	Adjusted Rate Ratio	95% CI Adjusted	Unadjusted Rate Ratio	Adjusted Rate Ratio	95% CI Adjusted	Unadjusted Rate Ratio	Adjusted Rate Ratio	95% CI Adjusted
Baseline									
Gender female	2.3*			2.6*	2.2**	1.3–3.5	1.5		
Medical									
Admitted to hospital	1.4			1.1			1.8*		
Severity of injury									
Fracture	1.1			1.2			2.3		
Soft tissue	1.0			1.7			1.9		
Accident/travel									
Accident group									
Motor cycle	1.9*	4.6**	2.1–10.4	0.7			1.0		
Passenger	2.6*	3.1**	1.7–5.5	1.5*			1.0		
Previous low level of confidence as passenger	3.2*	2.9**	1.5–5.7	3.1*			1.9*		
Previous motor vehicle accident injury	1.5			1.0			1.3		
Previous low level of road use	1.6*			0.8			1.0		
Previous mood									
Emotional problems	2.6*	2.3**	1.3–3.9	3.4*	3.0**	1.8–4.9	2.3*		
Tendency to worry	1.5			2.3*			1.7*		
Emotional response									
Dissociation	2.4*			2.0*			2.7*		
Does not blame self	1.9*			1.5			1.6		
Found accident frightening	3.0*	2.2**	1.3–3.7	2.4*			2.2*		
High level of negative emotions	3.1*			2.7*			2.8*		
3 months									
Social problems									
Financial problems	2.3*			2.8*			3.8*		
Litigation	1.7*			1.9*			4.0*		
Health problems	2.7*			3.5*			3.8*		
Cognitive variables									
High level of rumination	3.8*			4.6*	2.3**	1.4–3.9	7.6*	3.2**	1.8–5.8
High level of anger	3.8*			3.0*			5.6*		
High level of thought suppression	2.7*			2.3*			2.9*		
High level of negative interpretation	3.4*			5.1*	2.9**	1.7–5.0	6.4*	2.6**	1.5–4.5
Deviance									
Total									
$\chi^2$	556.0			603.9			546.0		
df	633			617			633		
Due to model***									
$\chi^2$	127.0			143.6			153.2		
Percent	22.8			23.8			28.1		
df	11			8			7		
Due to residual									
$\chi^2$	429.8			460.3			392.8		
df	622			627			626		

<sup>a</sup> Each rate ratio is compared with a reference category that has the value 1.00. The reference category for each dichotomous factor is the remainder with presence/absence or low/high levels as appropriate; for the accident group it is other (i.e., driver/cyclist/pedestrian); for severity of injury it is no injury. Nonsignificant adjusted rate ratios are not shown. Wald chi-square analysis (df=1) with Bonferroni correction (0.05/20) was used to determine significance.

\*p<0.05. \*\*p≤0.003. \*\*\*p<0.001.

seen after a motor vehicle accident (11, 13). Although there is considerable overlap, the four disorders may occur separately and are different in onset and course. There were marked differences between men and women in the frequency and course of all psychiatric outcomes after motor vehicle accidents.

Most previous research on outcomes after motor vehicle accidents has concentrated on the comorbidity of PTSD and depression. The present results show that general anxiety is also common, as is another posttraumatic syn-

drome, phobic travel anxiety. Phobic travel anxiety can be both distressing and markedly disabling, leading to avoidance of travel or of situations or circumstances that are reminders of the accident, such as passing the place of the accident, similar road conditions, or traveling in a vehicle of the same make or color.

Although the large size and nature of our study group are important advantages, there are some limitations to our study. Findings refer only to patients who attended an emergency department. The information was collected by

self-report. One-fifth of the potential sample did not take part in the initial assessment, and they differed from participants in some important respects. Women, subjects older than 30, and admitted patients were overrepresented among participants, affecting the generalizability of the results. Diagnostic categories were used rather than clinical diagnoses defined by recognized criteria for outcomes other than PTSD. However, the findings are consistent with those of a previous interview study that had a high response rate (11).

### ***Predictors of 1-Year Outcome***

We considered predictor variables identified in previous research on PTSD, anxiety, and depression, together with variables related to travel. Several predictor variables were common to all four types of psychiatric disorder, but there were also differences. Most notably, variables related to travel predicted phobic travel anxiety but not the other outcomes. For example, male and female passengers did worse than drivers. It is not clear why this should be, but it is possible that lack of control over events on the road makes passengers feel more threatened. Motorcyclists were eight times more likely than men suffering other types of accidents to describe phobic travel anxiety. In the earlier study (11), 42% of motorcyclists had given up their motorcycles 1 year after an accident.

For those who developed PTSD and general anxiety, cognitive and social factors measured at 3 months were generally better predictors than initial emotional response and characteristics of the accident. In particular, persistent health problems, rumination about the accident, and negative interpretations of intrusive recollections were strong predictors of 1-year outcome, increasing the probability of a patient suffering anxiety or PTSD four to seven times. Explanations of the reasons why some people develop phobic travel anxiety rather than general anxiety or PTSD are speculative. It may be that some victims overgeneralize the specific danger of driving, whereas others feel more threatened in general.

Our findings can be seen as reflecting the complex psychological meaning of a motor vehicle accident, whether or not there is injury. It may be perceived to be life-threatening and frightening. There can be continuing physical problems and disability interfering with everyday life and ambitions. Financial loss and anxiety are frequent. There may be guilt. It is to be expected that the varied meanings of different types of accident and injury to individuals will result in a wide range of psychological outcomes.

### ***Clinical and Policy Implications***

The finding that at least a third of consecutive patients who came to an emergency department following a motor vehicle accident suffered persistent psychiatric disorders has important implications both for the psychological care of people who have suffered medically minor physical injuries and for wider social policies. It is likely that

those at high risk of chronic difficulties could be recognized clinically soon after the accident and be offered early treatment. It is reasonable to expect that a clinical assessment instrument based on the rather simple self-report variables described in this and our other research (13) could substantially improve the accuracy of recognition of those at risk who might benefit from early psychological treatment. There is a need for research to demonstrate that early identification is both possible and effective.

The findings also emphasize the predictive importance of medical and other maintaining factors, such as continuing health problems, cognitions, litigation, and financial difficulty, during the months after the accident. This suggests opportunities for psychological interventions and for changes in the organization of care to improve outcome. A current Oxford randomized controlled trial is evaluating the effectiveness of cognitive behavior therapy in treating PTSD identified in the year following an motor vehicle accident. Apart from improvements in medical and psychological care, there are wider policy implications. Litigation is a continuing reminder of the accident that may interfere with a natural tendency toward symptom resolution. Changes in compensation procedures, as have been discussed in relation to whiplash neck injury (20), might also have considerable benefits.

We conclude that awareness of all the psychiatric outcomes after motor vehicle accidents and the development of clinically useful procedures for early recognition and prediction of chronic problems should contribute to planning changes in medical and legal procedures and the introduction of psychological interventions that will contribute to the management of a very large public health problem.

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