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The role of mental health problems and common psychotropic drug treatments in accidental injury at work, a case-control study

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Abstract

Objectives—Mental illness and psychotropic drugs have been linked with workplace injury, but few studies have measured exposures and outcomes independently or established their relative timings. To address this shortcoming, we conducted a case-control study nested within a database prospectively recording injury consultations, diagnoses and drug prescriptions.

Methods—The Clinical Practice Research Datalink logs primary care data for 6% of the British population, coding all consultations (by the Read system) and drug prescriptions. We identified 1,348 patients aged 16-64 years from this database who had consulted a family doctor or hospital over a 20-year period for workplace injury (cases, 479 diagnostic codes) and 6,652 age, sex, and practice-matched controls with no such consultation. Groups were compared in terms of consultations for mental health problems (1,328 codes) and prescription of psychotropic drugs prior to the case's injury consultation, using conditional logistic regression.

Results—In total, 1,846 (23%) subjects had at least one psychiatric consultation before the index date and 1,682 (21%) had been prescribed a psychotropic drug. The odds ratio for prior mental health consultation was 1.44 ($P < 0.001$) and that for psychotropic drug treatment was 1.57 ($P < 0.001$). Risks were significantly elevated for several subclasses of mental health diagnosis (e.g. psychosis, neurosis) and for each of the drug classes analysed. Assuming causal relationships, about 9-10% of all workplace injuries leading to medical consultation were attributable to mental illness or psychotropic medication.

Conclusions—Mental health problems and psychotropic treatments may account for an important minority of workplace injuries.

Background

Common mental health problems and prescribed psychotropic medicines have the potential to cause drowsiness and impair judgement, alertness and vigilance. In theory, therefore, such illnesses and treatments might increase risks of occupational injury. In an earlier review [1] we identified 15 reports that assessed injury risks at work in relation to mental illness [2-16] and nine in relation to medication [14,17-24]. More recently, there have been a few further studies [25,26]. Findings to date are compatible with a modest elevation of risk.

However, many previous investigations could have overestimated risks, since typically both exposures and outcomes were ascertained by self-report after the event. Bias can arise in these circumstances from non-independence in measurement of exposures and outcomes

(common instrument bias) and reverse causation. For example, workers who perceive and report more anxiety on a screening questionnaire may more readily recall minor injuries at work, while workplace injury may cause anxiety neurosis (or lead to its diagnosis), rather than being consequent upon it. We found only a few cohort and case-control studies in which these two concerns were overcome by independent assessment of exposure and outcome and by assurance regarding the timing of exposures (e.g. tranquilliser use and low mood) relative to injuries. However, two higher quality studies adopted a preferable approach in which events and their timings were corroborated using hospital billing records and dispensary databases [14,20].

In view of the limitations in the existing evidence base, we undertook a case-control analysis nested within a dynamic cohort of patients for whom consultations for workplace injury, other diagnoses and drug prescriptions had been recorded prospectively, with full information on the dates of events.

Methods

Since 1987 the Clinical Practice Research Datalink (CPRD) (formerly the GPRD) has logged all consultation episodes associated with significant events, illnesses, or medical activity (e.g. diagnosis, referral, hospital admission, prescription) among patients from participating general practices across Great Britain [27]. Records are maintained by the Medicines and Healthcare Products Regulatory Agency (MHRA) of the Department of Health and relate to some five million patients from 590 practices. Data are uploaded monthly and screened for completeness and validity. A nested case-control analysis was undertaken within the cohort of patients registered on this database at any time between 1st January 1987 and 31st December 2009.

CPRD consultation episodes are classified by Read diagnostic codes. In a scoping exercise, we identified 479 codes for occupational injury, ranging from the non-specific (e.g. codes: L5250W “accident at work”, T920 “accident on duty”) through to events distinguishable as involving machinery or tools likely only to be used during work (e.g. TG31400 “Accident caused by forging machine”, TG37500 “Accident caused by transmission pulley”), plant or off-road vehicles at work (e.g. T605.00 “Accident involving industrial self-propelled truck”), or in work locations (e.g. T736.00, “Place of accident or poisoning, industrial yard”). Appendix 1 (*proposed as an online supplement*) provides a full list. The MHRA supplied us with an anonymised dataset containing the full primary care medical records of 9,612 cohort members comprising (1) 1,700 patients who had consulted their general practice or attended hospital with a qualifying injury code during 1987-2009 (cases), and (2) 8,500 patients with no workplace injury (controls). A pre-defined algorithm was applied to match the controls individually to cases (five per case) by sex, nearest year of birth, general practice, and being in the database at the time of the matched case’s injury consultation.

All coding decisions and analyses were undertaken in relation to an index date – for a case, the date of their injury consultation and, for controls, the date of injury consultation of their matched case. Subjects who were ≥ 65 years on the index date (n=1,476) were excluded, as were a few controls matched to more than one case (n=69), and a few cases and their matched controls where the underlying injury was found to be non-accidental (e.g. assault at work) (n=67). Thus, analysis was based on 8,000 subjects, comprising 1,348 cases and 6,652 controls, and exposures of interest (illnesses, treatments) were counted only if prior to the index date.

Diagnostic codes for psychiatric illness, based upon the Read system, were supplied by the first author of a report for the Home Office which had employed CPRD data to investigate

mental health problems [28] (with kind permission of Frisher *et al*). The 1,328 codes had originally been grouped into six diagnostic categories: (a) neurosis, (b) psychoses, (c) paranoia, (d) schizophrenia, (e) personality disorders, and (f) other disorders (which includes “insomnia not otherwise specified”, “behaviour problems”, “hallucinations”, “hallucinations auditory”, “behaviour antisocial”, and “disorder behaviour”). For the purposes of this analysis, the 416 codes recorded in our study subjects (Appendix 2, *proposed as on online supplement*) were aggregated similarly, although category (c) was later omitted, there being no subjects with the diagnosis before the index date. All subjects were coded as having (or not having) one or more of these mental health problems at any time before the index date and at least 12 months before the index date.

Prescriptions with psychotropic or hypnotic effects were ascertained using the British National Formulary codes for hypnotics (code *04010100*), anxiolytics (*04010200*), barbiturates (*04030100* or *04030200* or *04030300* or *04030400*) and antidepressants (*04010300*). The full list included sedative antihistamines and all the commonly prescribed categories of antidepressant, as well as drugs with potential to cause sedation but sometimes used for other purposes (e.g. control of incontinence). Appendix 3 (*proposed as on online supplement*) lists all the medicines and codes. Subjects were coded as being or not being prescribed one or more of these drugs at any time before the index date and during the 12 months before the index date.

Associations between injury consultation and prior mental illness or psychoactive treatment were assessed using conditional logistic regression, with findings expressed as odds ratios (ORs) with associated 95% confidence intervals (95% CI). Analysis adjusted for a history of problem drinking (identified through a search for codes relating to alcohol misuse, alcoholic medical complications and high weekly intake – details available on request).

Where risks were significantly elevated, we calculated the attributable fraction in the exposed using the standard formula $(RR-1)/RR$, and the population attributable fraction by the formula $Pe*((RR-1)/RR)$, where Pe represents the proportion of exposed injury cases. These ratios can be interpreted as the attributable fractions of injury consultations in exposed persons and the total population respectively, assuming that measured associations were causal.

Finally, in a sensitivity analysis, we explored associations according to the type of occupational injury and the external cause, and assessed risks in relation to ‘severe’ injuries, defined as those involving any of: fracture, traumatic amputation, or hospital attendance.

Results

The final sample had a mean age of 39.9 (SD 12.7) years and included 5,915 men. Among the cases, details on the circumstances and nature of the injury were commonly missing, but, where recorded, injuries often involved power tools, machinery, burns or poisonings, and quite often resulted in sprains, soft tissue injuries, or lacerations and open wounds (Table 1). In all, 159 cases (12%) had attended hospital, while 230 cases (17%) had been issued with a medical certificate to cover absence from work.

Prior to the index date, at least one consultation for psychiatric illness had occurred in 1,846 (23%) of the 8,000 subjects, and 1,682 subjects (21%) had been prescribed at least one psychotropic medicine. The most common reason for consultation was neurosis (1,437 subjects), followed by psychosis (651 subjects), while hypnotics, anxiolytics and antidepressants were commonly prescribed treatments. The median time from first mental health diagnosis to the index date (duration of illness) was 5.3 years, IQR 2.2 to 11.6 years.

Table 2 presents associations of occupational injury with ever having consulted with a mental health problem prior to the index date and with specific categories of psychiatric illness. A statistically significant association was found for mental health problems overall, the odds of injury being raised some 44% ($P<0.001$). Statistically significant associations were also found with consultations related specifically to psychosis (OR 1.29, $P=0.016$), neurosis (OR 1.41, $P<0.001$) and certain other mental health conditions (OR 1.53, $P=0.012$). Associations with mental health consultations more than 12 months before the index date were broadly similar (online supplementary Table S1). The overall attributable fraction among exposed persons was 30.5% and the corresponding population attributable fraction was 8.6%.

Table 3 shows associations between occupational injury consultation and being prescribed psychotropic drugs before the index date. The odds of injury consultation were raised 57% for patients prescribed any of the drugs in comparison with subjects who had never had such a prescription, and risks were even higher in relation to hypnotics (OR 1.63) and anxiolytics (OR 1.74). All findings were highly significant statistically ($P<0.001$). Associations with prescription in the previous 12 months were similar, although analyses were based on smaller numbers (online supplementary Table S2).

For antidepressants it proved possible to distinguish risks by some major sub-categories of treatment. A total of 711 subjects had taken a tricyclic antidepressant and 700 subjects a selective serotonin re-uptake inhibitor (SSRI) before the index date; however, monoamine oxidase inhibitors and 'other' antidepressant drugs were taken too infrequently to warrant further consideration. Risks of injury consultation were significantly elevated, and to a similar extent, for both of the main classes of antidepressant: OR for tricyclic antidepressants, 1.39 (95% CI 1.14-1.69), $P=0.001$; OR for SSRIs, 1.34 (95% CI 1.09-1.65), $P=0.005$. Attributable fractions in exposed subjects ranged from 27% (antidepressants) to 42.5% (anxiolytics). The corresponding population attributable fraction for taking a psychotropic drug ever before the index event was 9.9%.

As patients with mental health problems are commonly treated with psychotropic drugs, and psychotropic drugs are mostly prescribed for mental illness, the relative contribution of each to risk of injury bears clarification. We therefore compared risks in subjects with a mental health diagnosis but no prior psychotropic drug treatment, and those with a mental health diagnosis who did receive a psychotropic drug, taking as a reference subjects with neither consultation for mental illness nor prescription of psychotropic medication (Table 4). (The permutation, "drug treatment without mental health diagnosis" was not considered informative, as the 1,328 codes used to identify mental health problems will not have perfectly captured every mental health case. For example, "tiredness", which was not included, would be indeterminate, having physical as well as psychological causes.) Risks were significantly elevated, even in subjects who had a mental health consultation but no psychotropic drug prescription prior to the injury consultation (OR 1.41, $P=0.001$).

Risks varied little according to the type or external cause of injury (online supplementary Table S3). They were significantly elevated, also, among severe cases (those involving fracture or amputation or hospital attendance) when assessed separately: OR 1.45, 95% 1.00-2.10 for previous psychiatric consultation and 1.55, 95% CI 1.07-2.26 for previous prescription of a psychotropic drug. Risks overall differed only marginally when analyses carried out separately for men and women (data available on request).

Discussion

These data support the conclusion of our previous review [1], that mental illnesses and prescribed psychotropic treatments moderately increase the risks of occupational injury. Risks were elevated 44% overall in relation to mental health problems and 57% overall in relation to psychotropic drug treatments. There was evidence that the effects of having a mental health condition are not solely a consequence of psychotropic medication. For patients taking common classes of antidepressants we estimate that risks of injury are raised about 35-40%. The data further indicate that approximately 1 in 10 of all workplace injuries may be attributable to mental health conditions or psychotropic medication, the potentially avoidable fraction being higher (about 30% to 40%) among individuals with such health problems or taking such prescribed treatments.

Our study had several strengths and a few limitations. The database allowed us to identify a large sample of occupational injuries across Britain, together with a selection of age-, sex- and location-matched controls. Almost everyone in Britain registers with a family doctor for services that can be freely accessed at the point of delivery. Thus, general practice patient lists offer a sampling frame that is generally representative of the total population. Moreover, the CPRD database, which has been shown empirically to have a high degree of completeness (>97%) and validity for many measures [29,30], is likely to capture a very high proportion of acute injuries presenting to medical services (hospital attendances, which are logged within the database, are also free at the point of care, while accidents are rarely treated privately). Set against this, we could not investigate injuries that were only self-treated, or mishaps resulting only in damage to property or near miss events. The complexity of the coding system was such that we may not have discovered every case of occupational injury or mental illness within the sampling frame. However, errors of omission would be unlikely to cause bias, since the process of case ascertainment was independent of the exposures of interest.

A more significant limitation of the CPRD is that it does not maintain a reliable record of patients' occupations. Thus, while cases would have been selected from those in work, some controls may have been unemployed; cases may also have been drawn more often from manual occupations than controls. Bias might arise if controls over-represented the prevalence of mental illnesses or treatments for disorders that prevent work, or if these were more common in manual jobs. However, as we have demonstrated elsewhere [31], the resultant bias is likely to be small in practice. (This is because the excess prevalence in controls would reflect the weighted average of risks in subgroups, and be diluted on the one hand by a low background rate of unemployment and on the other by the small difference in risk between manual and non-manual occupations. Moreover, potential biases would act in opposite directions.)

The CPRD record tends to lack information on the circumstances of occupational injury and some cases could have been injured through the fault of third parties rather than themselves. Furthermore, some codes were ambiguous as to occupational causation (such that 15% of cases were possibly, but not probably occupational, as judged independently by two of us (KTP and ECH) blinded to exposure status). Such errors would, if anything, bias risk estimates towards the null and cannot explain the elevation in risks that we observed. Risks of workplace injury could also have been reduced by healthy worker selection effects in the study population – for example, subjects with health problems opting for work with less injury potential or being screened out of hazardous work. This well-known effect would not compromise the internal validity of our study (as risks in workplaces would truly be lower), but is a threat to external validity, as simple extrapolation to unselected workforces could lead to an underestimation of risks.

A notable strength of the CPRD is that for each subject we could access a hugely detailed medical record, in which mental health diagnoses and treatments had been contemporaneously logged, independently of the injury consultation, and with full information on dates of events. The relative timing of events was thus established, although, as a further safeguard against the possibility that errors in the coding of dates masked an element of reverse causation, we explored associations with diagnoses made at least 12 months before the injury consultation in a sensitivity analysis: risk estimates were unchanged.

A further sensitivity analysis explored risks by nature and by external cause of injury, and found them to be broadly and generally elevated (*supplementary Table S3*). Non-specificity of effect raises a concern that risk estimates may have been inflated by an overall propensity among cases to consult a family doctor (which is a requirement both of case definition and of qualifying exposures); but a similar significant magnitude of effect among severe cases (those seen in hospitals and those with fractures and amputations) tends to argue against important bias arising in this fashion.

The findings from this study are broadly compatible with other published data on mental illness and accident risk. Thus, in our previous review [1], 21 of 22 risk estimates across 11 studies were elevated, 60% of them significantly so at the 5% level, and with a median RR of 1.5. The four largest studies (>1,400 subjects analysed [5,7,14,16]), including a large multi-stage probability sample from the US Health and Retirement Study cohort [16], provided risk estimates ranging from 1.07 to 1.47. However, studies mostly took self-reported low mood on a screening questionnaire as the basis for exposure definition, and only six of the 22 effect estimates were based on a physician's diagnosis of mental illness.

Earlier findings on psychotropic drugs and occupational injury risk have been more mixed. In our review [1], 13 of 25 risk estimates (from nine studies) were increased, five of them significantly, the median RR being 1.2. However, the spread of risk estimates was wider than for mental illness, and two high quality case-control studies with date of event information (to limit scope for reverse causation) reached different conclusions. Voaklander *et al* [14] reported that prescription of anxiolytics, sedatives, or hypnotics in the preceding 30 days was associated with a three-fold increase in odds of hospital attendance with work-related injury, whereas Gilmore *et al* [20], in a study of similar design, found much lower RRs (0.8 in men and 1.5 in women). Two other studies favoured a more than doubling of risk from medication [17,18] although both had the potential for inflationary bias through reverse causation – in Wadsworth *et al* [18], for example, the taking of sleeping pills related to the 14 days prior to questioning whereas injuries might have occurred up to a year beforehand. Studies mostly evaluated risks from hypnotics, anxiolytics and sedatives (or did not specify the class of agent), there being relatively few investigations of injury risk from antidepressants and antipsychotics, and, in contrast to this report, none that estimated risks by major classes of antidepressant. Hence, our findings, as well as providing estimates of risk based on accurate date of event information, provide a greater depth of information on specific agents.

On balance, we conclude that a range of common mental health illnesses and classes of psychotropic treatment contribute to an important, minority of workplace injury events. Absolute risks do not justify exclusion of individuals from employment, especially as individualised assessment may reveal factors that mitigate the risk of injury or its impact. However, the data suggest a need to exercise caution in the occupational placement of individuals with such problems, especially in relation to work that carries an unusual degree of risk or special responsibility for the safety of others.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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What is known

Mental illness and psychotropic drugs have been linked with occupational injury in earlier studies, but inability to measure exposures and outcomes independently, or to establish their relative timings, may have led to risks being over-estimated.

What this study adds

Using a database that overcame these problems, we focussed on events that preceded medical injury consultation. Prior mental health diagnoses and psychotropic drug prescriptions were associated with significantly higher risks of injury consultation. About 9-10% of all workplace injuries leading to medical consultation appeared to be attributable to these factors.

Table 1
Nature and circumstances of the injuries in cases

Injury	No. of cases	Causal agent/type of event	No. of cases
Sprains or soft tissue injuries	280	Accidents involving a power tool or machinery	192
Haematoma, contusions or crush injuries	78	Accidents involving a non-powered tool or item of equipment	59
Lacerations or open wounds	123	Accidents involving a motor vehicle	56
Fractures	50	Chemical or other burns	154
		Chemical poisonings or inhalation injuries	146
Other (specified)	50	Other (specified)	59
Missing	805	Missing	683
All*	1386	All*	1349

* Totals exceed the number of cases (1348) as several subjects sustained >1 injury within the same episode and one had two external causes

Table 2
Relation between consulting with an occupational injury and consulting with a mental health problem

Before the index date	Cases N (%)	Controls N (%)	OR*	95 % CI	P-value	Attributable fraction in the exposed
No mental health consultation	966 (71.7)	5188 (78.0)	1	(reference)		
Consultation with:						
Any psychiatric condition	382 (28.3)	1464 (22.0)	1.44	(1.25-1.65)	<0.001	30.5%
Psychosis	132 (9.8)	519 (7.8)	1.29	(1.05-1.59)	0.016	22.5%
Schizophrenia	3 (0.2)	19 (0.3)	0.74	(0.22-2.50)	0.63	-
Neurosis	298 (22.1)	1139 (17.1)	1.41	(1.21-1.64)	<0.001	29.0%
Personality problem	34 (2.5)	137 (2.1)	1.20	(0.82-1.76)	0.35	16.7%
Other mental health condition	50 (3.7)	166 (2.5)	1.53	(1.10-2.14)	0.012	34.6%

Some subjects had more than one diagnosis

* Adjusted for problem drinking

Table 3
Relation between consulting with an occupational injury and being prescribed a hypnotic, anxiolytic or antidepressant drug

Before the index date	Cases (n=1348) N (%)	Controls (n=6652) N (%)	OR*	95 % CI	P-value	Attributable fraction in the exposed
Never prescribed any of these drugs	982 (72.8)	5336 (80.2)	1			
Prescribed one or more of these drugs	366 (27.2)	1316 (19.8)	1.57	(1.36-1.81)	<0.001	36.3%
Prescribed						
- Antidepressants	244 (18.1)	945 (14.2)	1.37	(1.17-1.62)	<0.001	27.0%
- Hypnotics	201 (14.9)	659 (9.9)	1.63	(1.37-1.94)	<0.001	38.7%
- Anxiolytics	147 (10.9)	443 (6.7)	1.74	(1.42-2.12)	<0.001	42.5%

Some subjects had more than one treatment

* Adjusted for problem drinking

Table 4
The overlap between mental health problems and psychotropic prescriptions and their relation to consulting with an occupational injury

Before the index date	Cases (n=1348) N (%)	Controls (n=6652) N (%)	OR	95 % CI	P-value
No prescription or MHP	854 (63.4)	4814 (72.3)	1		
MHP but no prescription	128 (9.5)	522 (7.8)	1.41	(1.15-1.74)	0.001
Both MHP and a prescription	254 (18.8)	942 (14.2)	1.60	(1.36-1.89)	<0.0001

MHP – mental health problem, as listed in Table 2; ‘Prescription’ – any of the classes of psychotropic drug listed in Table 3