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Prescription Opioid and Benzodiazepine Use After Road Traffic Injury

Janneke Berecki-Gisolf, MD, PhD,*
Behrooz Hassani-Mahmooei, PhD,*†
Alex Collie, PhD,† and Roderick McClure, PhD‡

*Monash Injury Research Institute, Monash University, Melbourne, Australia; †Institute for Safety, Compensation and Recovery Research, Monash University, Melbourne, Australia; ‡Harvard Injury Control Research Center, Harvard School of Population Health, Boston, USA

Reprint requests to: Janneke Berecki-Gisolf, MD, PhD, Monash Injury Research Institute, Building 70 Clayton Campus, Monash University, 3800 Melbourne, Australia. Tel: +61 3 99051275; Fax: +61 3 9905 4363; E-mail: janneke.berecki-gisolf@monash.edu.au.

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Abstract

Background. Motor vehicle crash victims with physical injury are likely to receive prescription opioids and benzodiazepines. Potential mental trauma and lack of primary treating physician contribute to the risk of adverse opioid outcomes for this group. The purpose of this study is to characterise opioid and benzodiazepine prescribing after road traffic injury.

Method. Individuals who claimed Transport Accident Commission compensation for a noncatastrophic injury that occurred between 2010 and 2012 in Victoria, Australia and who provided consent for pharmaceutical benefits scheme (PBS) linkage were included (n = 734). PBS records dating between 12 months preinjury and 18 months postinjury were provided by the Department of Human Services.

Results. In the year before injury, 10.5% of participants received prescription opioids; after injury, 45.1% of hospitalized and 21.1% of nonhospitalized participants received opioids. Benzodiazepines were used by 4.8% preinjury, and 7.0% and 7.4% postinjury (with and without hospitalization, respectively). Postinjury, 39% of opioid use and 73% of benzodiazepine use was potentially unrelated to the injury.

Conclusions. Prescription opioid and benzodiazepine before road traffic injury was substantial: the significance of postinjury prescription drug use cannot be established without taking preinjury use into account. It may be beneficial for pain medication to be managed by a pain treatment coordinator, in this injured population with high rates of preexisting opioid and benzodiazepine use.

Key Words. Opioid Analgesics; Road Trauma; Persistent Pain; Pharmacoepidemiology

Introduction

In the United States, there is currently an alarming trend in increased opioid prescribing [1], associated with increased prescription-drug overdose and fatality [2]. Escalation of prescription opioid use has also been reported in Australia, along with an increase in hospitalizations and deaths due to pharmaceutical opioids [3]. Among unintentional overdose deaths, opioid analgesics are often found in combination with benzodiazepines [4]. Prescription drug fatalities have increased at a higher rate in women than in men [5]. The recent increase in opioid prescribing and adverse outcomes is primarily due to increased opioid prescribing for chronic

non-cancer pain [6]. In a US study among chronic non-cancer pain patients, the distribution of opioid use was found to be highly skewed: the 5% of the patient population with the highest opioid use accounted for 47–70% of the total opioids used [7]. Prescription opioid use is particularly high among chronic pain patients with co-morbid mental health or substance abuse disorders [7,8].

In a study among chronic pain patients in an interventional pain management practice, patients with pain as a consequence of road traffic injury were most likely to abuse opioids [9]. Prescription opioid exposure after road trauma is high, because these drugs are commonly used to treat pain associated with injury. Furthermore, trauma is often associated with mental health disorders such as post-traumatic stress disorder and depression [10–13], which are risk factors for opioid abuse. Benzodiazepines, which are not recommended after post-traumatic stress disorder but in practice still commonly prescribed [14], further increase the risk of adverse outcomes of prescription opioid use: concurrent use of benzodiazepines increases the risk of respiratory depression due to an opioid overdose [15]. Motor vehicle crash injuries are treated by a range of medical practitioners, such as emergency department physicians, orthopaedic surgeons, and general practitioners, and central oversight into opioid prescribing for an individual patient may be lacking. Motor vehicle crash victims are, therefore, at risk of prolonged opioid use and adverse outcomes. However, little is known about opioid and benzodiazepine prescribing after road trauma. The purpose of this study is, therefore, to characterise opioid and benzodiazepine prescribing after road traffic injury. Specifically, the aims are to describe prescribing after road traffic injury, and to determine how prescribing before and after injury differs by age, gender, injury type, and history of mental health service use. Injury compensation claims records linked with health service and pharmaceutical records preinjury and postinjury are used in this analysis.

Methods

Study Design and Setting

An opt-in, fully consented data linkage study was conducted in the state Victoria in Australia. The study sample comprised a subset of those people injured in road crashes in Victoria who subsequently made an injury compensation claim to the transport accident commission (TAC), a comprehensive state-wide transport injury compensation scheme. In addition to the information obtained from the TAC claims database, data of prescription drugs subsidised through the pharmaceutical benefits scheme (PBS) and health service use subsidised through Medicare benefits schedule (MBS) were provided by the Department of Human Services. PBS records, MBS records, and TAC claims data were linked, resulting in a linked dataset of pharmaceutical and health service records dating from 1 year prior to the injury incident through to 18 months following the crash. The study was approved by the Monash University Human Research Ethics Committee in Melbourne (Project number: CF12/0875—2012000398) as well as the External Request Evaluation Committee at the Department of Human Services in Canberra (Project number: SF4060116).

Data Sources

Transport Accident Commission

The TAC is a state-government organization established to pay for treatment and benefits for people injured in traffic accidents in the state of Victoria, Australia [16]. The scheme is state-wide, funded from annual car registration payments by Victorian motorists. It is a no-fault scheme, that is, the injured person is eligible for benefits regardless of who caused the accident. Income replacement, medical, rehabilitation, and lifetime care costs resulting from transport injury are compensated by the scheme. A medical excess applies to medical and paramedical treatment costs: the initial AU$450–564 of medical expenses is not reimbursed by the scheme. Ambulance and hospital services are exceptions: the medical excess does not apply to these services. For any patient admitted to hospital for at least 1 day, the medical excess does not apply.

Medicare and the Pharmaceutical Benefits Scheme

Australia has a universal healthcare programme, Medicare, which is funded by the Australian government. Treatment by health professionals such as doctors and specialists is free or subsidised; allied health services are only subsidised under special circumstances. Prescription medication is subsidised through the PBS. The Australian Government subsidises medicines that are necessary to maintain the health of the community in a way that is cost effective: these drugs are listed in the PBS [17]. PBS codes are specific with regard to the medication generic name (generic), form, strength, and pack size.

Procedure

Residents of Victoria, Australia who successfully claimed TAC compensation for a road traffic injury that occurred between Jul 17, 2010 and Jul 22, 2012 were invited to participate. TAC clients aged less than 18 years and clients with a catastrophic injury were excluded. Clients who had recently been approached regarding TAC surveys or related research were also excluded. In total 10,998 TAC clients were invited to participate by paper mail. The study invitation included an explanatory statement from the investigators, consent form and reply envelope. Completed forms were returned to the investigators by reply envelope. Replies were collected and valid signed forms were forwarded to the Department of

Human Services (Canberra) for provision of MBS and PBS records. The MBS and PBS records supplied by the Department of Human Services were linked to TAC claims and payment records by study ID. Study ID was then removed and replaced by a new identification number to create a research database that could no longer be linked back to the participant database containing contact details and other identifiers. The TAC was not informed about the participation status of clients.

Sample

Of the 10,998 TAC clients invited to participate, 177 were returned to sender and 10 had passed away; 738 (7%) returned a valid and signed consent form. Comparisons were performed between the participant group and the mail-out sample in terms of demographic, accident and injury data, as well as postinjury opioid and benzodiazepine use based on TAC payments only: these data were available from the de-identified TAC claims data.

Study Variables and Analysis

Pharmaceuticals

Prescription drug payments in the TAC as well as the PBS data were provided with PBS codes and anatomical therapeutic chemical (ATC) classification codes. Using the information system available at the PBS Website [17], PBS codes were used to provide the medication generic name (generic), form, strength, and pack size. ATC codes starting with "N02A" were identified as opioids, and codes starting with "N05BA" as benzodiazepines. The occurrence of drugs used in opioid dependence ("N07BC") was also explored but this was relatively rare. Prescriptions that were reimbursed by both the TAC and PBS (i.e., the drug was subsidised via the PBS and remaining out-of-pocket costs were paid by the TAC) were identified as duplicates and one of two items was removed. Benzodiazepine use was expressed as the defined daily dose (DDD) per 1,000 person-days: the corresponding DDD of each drug was obtained from the World Health Organization Collaborating Centre for Drug Statistics Methodology Website [18]. Opioid use was expressed as morphine equivalent amount (MEA) per person per day. The MEA of each prescription was determined based on the substance type and form, and the total dosage contained in the pack (dosage *pack size). For conversion to oral morphine equivalents, the following conversion rates were used: oxycodone 2, codeine 0.15, tramadol 0.15, pethidine 0.25, morphine oral 1, methadone oral 2, morphine injection 2.5, methadone injection 3, hydromorphone 5, fentanyl 140, and buprenorphine 83 (for transdermal patches: the total amount in microgram is converted to mg oral morphine). Opioid conversion rates are generally determined clinically from the experience of switching patients from one opioid to another, or from one form of opioid to another. There is considerable variation in conversion rates used clinically [19].

Demographic, History, Accident Injury, and Service Use Variables

Participant demographic, accident, injury, and injury-related health service use details were available in the TAC claims data. Available demographics were gender and age in years, which was further categorised as $<$25, 25–44; 45–64 and $\geq$65. A relative socio-economic advantage/disadvantage score (IRSAD) was available based on the residential postal code [20]. The scores are ranked in State-wide deciles: lowest deciles indicate relatively low advantage and high disadvantage in terms of social conditions and income in the area; highest deciles indicate relatively high advantage and low disadvantage in the area. Accident information included the number of vehicles involved in the accident, which was further categorized as one, two, and three or more; and role in the accident: driver, passenger, motorcyclist, cyclist, pedestrian, or other. At fault status, based on police report, was also available as "at fault," "not at fault," or "unknown." Injury information included injury type, which was grouped as musculoskeletal, orthopaedic, other injury, or other severe. Injury related medical attendances were determined from TAC payment records as service items coded as "professional attendances" that took place within 18 months of the crash. The average number of attendances, as well as the number of unique service providers per patient, was determined from the TAC payments data. These do not include private health care or services that were not claimed from the TAC. Mental health history was derived from the linked 12 months' preinjury Medicare health services records. Patients who had attended a psychiatrist, psychologist, or a general practitioner in a visit coded as a mental health treatment plan prior to injury were classified as having a mental health service use history.

Statistical Analysis

Data were analysed using SAS 9.3 for Windows. Statistical differences in DDD or MEA within each of the variable categories were tested using Kruskal–Wallis nonparametric tests. These tests were conducted for preinjury as well as postinjury DDD or MEA. Chi-square tests were used to test group differences in frequency of opioid and benzodiazepine use. Logistic regression models were used to compare prescription filling among participants vs nonparticipants.

Results

Sampling Bias

Participants were older than the mail-out sample (median age of 50 [p25–75: 35–63] years and 38

Table 1 Postinjury opioid and benzodiazepine prescriptions paid for by the TAC: comparison of study participants and the invited sample

	Prescription Drug Users			Drug Amount		
	Participants	Nonparticipants	*P* Value*	Participants	Nonparticipants	*P* Value†
Opioids						
	% using opioids			MEA per person per day		
Admitted to hospital	25.7%	16.7%	<0.0001	0.918	0.833	<0.0001
Not admitted to hospital	2.7%	3.0%	0.74	0.019	0.069	0.74
Benzodiazepines						
	% using benzodiazepines			DDD per 1,000 person-days		
Admitted to hospital	2.2%	2.2%	0.97	4.296	3.673	0.97
Not admitted to hospital	1.1%	0.7%	0.43	0.491	0.684	0.43

MEA = morphine equivalent amount; DDD = defined daily dose.
* Chi-square test.
† Kruskal–Wallis nonparametric tests.

[26–53] years, respectively). Women (RR 1.28[95% CI 1.11–1.48]) and persons with musculoskeletal injuries (RR 0.69[95% CI 0.59–0.81]) were more likely to participate. TAC clients with ≤3 months' delay between the accident date and the start of the claim were also more likely to participate than those with greater delays (RR 2.22[95% CI 1.77–2.79]), as were those admitted to hospital after the crash (RR 1.39 [1.21–1.60]). An overview of postinjury opioid and benzodiazepine prescriptions claimed from the TAC by participants vs nonparticipants is shown in Table 1. Postinjury rates of benzodiazepine prescription filling did not differ significantly between study participants and nonparticipants. Opioid prescription filling did not differ significantly between participants in nonparticipants without hospital admittance, but among those with hospital admittance, prescription opioid use was greater among participants than nonparticipants. To determine if the difference in opioid use was due to the differences in demographics and injury detail in the two groups, a logistic regression model was used. In the full model (adjusted for age, gender, IRSAD, injury type, crash information, and hospital stay), study participation was mildly but statistically significantly associated with opioid prescription filling postinjury (odds ratio 1.29 [1.00–1.66], $P = 0.05$). Among those with at least one opioid prescription, the mean MEA did not differ between participants and nonparticipants.

Injury-Related Health Service Use

Of the study participants, 432 claimed "professional attendances" (such as visits to the GP and other medical practitioners) from the injury compensation scheme. The mean number of medical attendances by these study participants was 15.0 visits during the follow-up period. On average they were seen by 3.75 unique service providers; 25% of these participants were seen by five or more and 10% were seen by eight or more unique service providers. This includes only medical attendances claimed from the injury insurance scheme: services not related to the injury or not claimed for other reasons are not included.

Opioid and Benzodiazepine Use Before and After Injury

Among study participants, preinjury opioid use was high with 77 (10.5%) participants filling one or more opioid prescriptions during the 12 months prior to the crash. During the 18 months postinjury, 240 (32.7%) study participants filled one or more opioid prescriptions. Benzodiazepines were used by 35 (4.8%) participants preinjury; postinjury, benzodiazepines were used by 53 (7.2%) study participants. There were 32 (4%) participants who received an opioid and benzodiazepine prescription within 30 days of each other during the study period, suggesting simultaneous use. Overall, the use of opioids and benzodiazepines prior to injury was

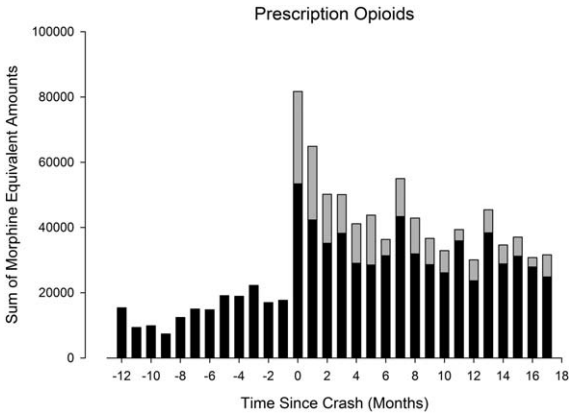

Figure 1 Opioid prescribing per month, subsidised through the TAC (gray) and/or the PBS (black).

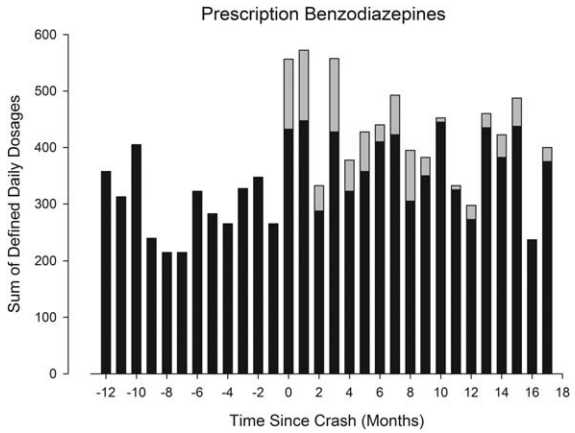

Figure 2 Benzodiazepine prescribing per month, subsidised through the TAC (gray) and/or the PBS (black).

substantial: in terms of use per person-days, 39% of postinjury opioid use and 73% of benzodiazepine use was potentially unrelated to the injury, based on the preinjury use as fraction of postinjury use. The use of opioid and benzodiazepine prescriptions over time is shown in Figures 1 and 2, respectively: the prescriptions claimed from the injury compensation scheme are shown in gray; PBS only prescriptions are shown in black.

Types of Opioids and Benzodiazepines

The number of prescriptions used in each drug category is given in Table 2. The most common preinjury prescription opioid was codeine (used by 6.4% of the study group), followed by oxycodone, tramadol, and buprenorphine (used by 4.1%, 2.3%, and 0.8%, respectively). Postinjury, the most commonly used opioid was oxycodone (used by 20.6% of the study group), followed by codeine, tramadol, and buprenorphine (used by 15.8%, 8.6%, and 3.5%, respectively). The most commonly used preinjury benzodiazepine was diazepam (used by 3.7%), followed by oxazepam and alprazolam. Postinjury, diazepam (used by 5.9%) was the most commonly used benzodiazepine, followed by oxazepam and alprazolam. Ranking of commonly used drugs in terms of numbers of participants is not equivalent to ranking of commonly occurring prescriptions: for example, participants were more likely to be receiving codeine than oxycodone in the year before injury, but preinjury oxycodone prescriptions outnumbered codeine prescriptions.

Table 2 Overall opioid and benzodiazepine prescriptions 12 months before and 18 months after the road traffic injury

	Preinjury Use		Postinjury Use			
			Without Hospitalization		With Hospitalization	
Substance name	Scripts N	MEA per 1,000 person-days	Scripts N	MEA per 1,000 person-days	Scripts N	MEA per 1,000 person-days
Opioids						
Total Opioids	467	668.2	644	839.7	1,167	2677.9
Morphine	21	23.0	20	26.2	6	7.9
Hydromorphone	0	0.00	0	0.00	8	14.4
Oxycodone	149	234.6	201	305.2	478	964.1
Oxycodone comb.	0	0.00	13	40.5	87	265.1
Codeine comb.	108	36.3	164	71.1	152	70.1
Fentanyl	32	220.3	19	84.3	51	699.6
Methadone*	3	9.0	0	0.00	3	12.3
Dextropropoxyphene comb.	0	0.00	1	0.5	5	2.5
Buprenorphine	40	54.1	70	94.8	99	155.7
Tramadol	114	91.0	156	217.2	278	486.2
	Scripts N	DDD per 1,000 person-days	Scripts N	DDD per 1,000 person-days	Scripts N	DDD per 1,000 person-days
Benzodiazepines						
Total Benzodiazepines	164	13.27	148	16.06	205	20.61
Diazepam	129	11.53	119	13.61	109	13.51
Oxazepam	33	1.46	26	1.84	88	5.56
Alprazolam	2	0.28	3	0.60	8	1.54

* Prescribed to treat pain that does not respond to other opioid analgesics.

Table 3 Preinjury and postinjury opioid use

		Preinjury Opioids 77/734 (10.5%)			Postinjury Opioids 240/734 (32.7%)					
					Without Hospitalization 80/379 (21.1%)			With Hospitalization 160/355 (45.1%)		
	N (col %)	Row %	MEA* Per Person-Day	*P* Value†	Row %	MEA Per Person-Day	*P* Value†	Row %	MEA Per Person-Day	*P* Value†
All	734	10.5	0.67		21.1	0.84		45.1	2.68	
Sex										
Men	335 (45.6)	8.1	0.27	0.04	17.7	0.84	0.19	46.2	2.64	0.10
Women	399 (54.4)	12.5	1.00		23.5	0.84		43.9	2.72	
Age										
<25	69 (9.4)	8.7	0.24	0.0004	17.5	0.47	<0.0001	27.6	0.33	0.06
25–44	222 (30.3)	5.9	0.47		10.5	0.24		40.8	2.77	
45–64	277 (37.7)	9.8	0.53		20.9	1.19		47.1	2.62	
≥65	166 (22.6)	18.7	1.34		40.8	1.38		52.2	3.42	
IRSAD score										
1st QTL	148 (20.4)	14.2	0.74	0.03	26.6	0.35	0.09	46.4	1.83	0.11
2nd QTL	160 (22.1)	14.4	0.38		20.5	0.51		46.8	3.08	
3rd QTL	155 (21.4)	9.7	1.46		27.3	2.14		52.6	4.64	
4th QTL	262 (36.1)	6.5	0.12		15.6	0.62		37.8	1.04	
Mental health history‡										
Yes	81 (11.0)	21.0	1.42	0.001	26.1	0.60	0.51	45.7	4.71	0.47
No	653 (89.0)	9.2	0.57		20.4	0.87		45.0	2.46	
Injury type										
Musculoskeletal	201 (27.4)	12.9	0.49	0.63	22.1	0.93	0.75	31.6	1.82	0.003
Orthopaedic	185 (25.2)	8.7	0.29		17.0	0.14		54.4	2.48	
Other injury	215 (29.3)	9.8	1.39		20.7	0.73		29.2	3.22	
Other severe	133 (18.1)	10.5	0.30		26.3	2.68		47.4	2.90	
Number of vehicles in accident										
One	302 (41.1)	8.3	0.65	0.17	17.2	0.28	0.04	47.1	2.86	0.53
Two	334 (45.5)	12.6	0.84		25.8	1.35		44.4	2.09	
Three or more	96 (13.4)	10.2	0.13		14.8	0.42		37.8	4.10	
Role in the accident										
Car-driver	394 (53.7)	13.5	0.90	0.0006	25.7	1.06	0.04	43.5	3.16	0.27
Car-passenger	60 (8.2)	15.0	1.80		20.1	1.38		54.8	4.72	
Motor cyclist	93 (12.7)	4.3	0.13		10.3	0.60		50.0	1.91	
Pedestrian	82 (11.2)	13.4	0.21		21.6	0.29		51.1	2.74	
Cyclist	95 (12.9)	0.0	0.00		6.8	0.02		35.3	0.48	
Other	10 (1.4)	0.0	0.00		25.0	0.77		33.3	3.92	
At fault (police report)										
Yes	376 (51.2)	10.4	0.57	0.88	23.6	0.72	0.73	45.7	2.91	0.48
No	269 (36.7)	11.1	0.60		21.2	0.69		45.9	2.15	
Unknown	89 (12.1)	9.0	1.30		19.7	1.45		34.8	4.62	

* MEA = morphine equivalent amounts.
† Kruskal–Wallis nonparametric tests.
‡ Defined has having used mental health services in the Medicare scheme in the year prior to the injury.

Factors Associated with Opioid Prescription Use

Opioid use per age group, sex, socio-economic ranking (IRSAD score), prior mental health, injury type, and accident features is given in Table 3. Preinjury, women used more prescription opioids than men, but postinjury there were no statistically significant sex differences in opioid use. Opioid use increased with age; this was seen preinjury as well postinjury in the group without hospitalization. Among those hospitalized, the increase in opioid

use with age was not statistically significant. Opioid use differed per IRSAD score only in the preinjury phase: those in the third quartile used the most opioids and those in the highest quartile used the least. Study participants with a mental health history were more likely than those without to use prescription opioids before the injury; postinjury use was not affected by mental health history. Opioid use after injury was associated with injury type among hospitalized but not among non-hospitalised patients. Among hospitalized patients, use was lowest among those with musculoskeletal injuries. Vehicle type involved in crash was associated with opioid use: cyclists were the least likely and car passengers were the most likely to use opioids preinjury and postinjury.

Factors Associated with Benzodiazepine Prescription Use

Benzodiazepine use per age group, sex, IRSAD score, prior mental health, injury type, and accident features are given in Table 4. Benzodiazepine prescription filling did not differ per age, sex, or IRSAD decile score. Study participants with a mental health history were more likely to use benzodiazepines before the injury as well as after the injury, with or without hospitalization. Injury type was associated with preinjury benzodiazepine use: those with musculoskeletal injury were most likely to use benzodiazepines preinjury. Accident details were not statistically significantly associated with benzodiazepine prescription filling with the exception of *at fault* status: those with "unknown" status were most likely to fill preinjury benzodiazepine prescriptions.

Discussion

Opioid and benzodiazepine prescription filling during the 12 months prior to road traffic injury was high with 10.5% of study participants filling at least one opioid prescription and 4.8% at least one benzodiazepine prescription. Opioids were used by 32.7% and benzodiazepines by 7.2% of study participants during the 18 months follow-up. In terms of dosages per person per day, approximately 39% of postinjury opioid use and 73% of benzodiazepine use was potentially unrelated to the injury.

The results of this study highlight the complexity of pain management after road traffic injury: additional to the potential lack of oversight due to multiple specialists involved in the treatment, pain management is also complicated by relatively high levels of opioid use prior to the injury, particularly by those with a history of mental health service use. A positive association between prescription opioid use and psychiatric/mental health disorders has been reported in a population at risk for alcohol, drug, and mental health disorders [21], as well as among individuals with non-cancer pain conditions [8] and veterans with persistent pain [22]. A causal pathway has not been established: that is, it is not evident if mental disorders directly lead to increased consumption of prescription opioids, or if this association is mediated by other factors. The term "adverse selection" has been proposed for the process whereby high risk patients such as those with mental health disorders or a history of substance abuse are more likely to be prescribed high-risk opioid regiments [23]. The results of the current study support the previously observed association between mental health disorders and prescription opioids prior to injury. The road traffic injury did not exacerbate high opioid consumption in this high-risk group: the results of this study do not suggest that "adverse selection" is prompted by injury. Possibly, those at greatest risk were already using long-term opioids preinjury and this remained unchanged in the postinjury phase. Benzodiazepine use postinjury was high in this group, however, warranting caution to prevent simultaneous use. A pain treatment manager, for example the general practitioner, needs to be considered to prevent unnecessary long-term opioid use, dose escalation, and hazardous drug combinations during the postinjury recovery period.

Older age was associated with greater opioid prescription filling, before injury as well as in response to injury. In previous studies in the United States, patients aged $\geq$80 years have been reported less likely to receive opioid prescriptions after discharge from the emergency department for musculoskeletal conditions [24]; a similar trend was observed among patients $\geq$50 [25]. These studies report discharge prescribing in relation to the musculoskeletal conditions for which emergency department treatment was sought. Results of the current study do not support previous reports of under-prescribing for older patients in the United States: study participants aged $\geq$65 years were most likely to receive prescription opioids preinjury, and they were also most likely to receive prescriptions opioids in response to injury. The relative under-prescribing of opioids for the $<$25 age year group merits future research: this phenomenon could reflect appropriate risk assessment to avoid long-term opioids for high risk patients (young age is a risk factors for opioid misuse [23]), or a possible unmet need for analgesics after road traffic injury in this age group, particularly among those who were hospitalized.

Study Implications

This study has several implications for clinical care and compensation claim management. The high rates of preinjury opioid and benzodiazepine use suggest a high prevalence of preinjury pain among study participants: when managing the care of road traffic injury patients, medical practitioners prescribing pain medication should be aware of any pain medication that the patient may already be taking. Furthermore, a range of medical practitioners are generally involved in postinjury care, demonstrated by the substantial number of unique medical practitioners attended by participants in this study. Management of pain medication by one single health care provider who is well informed about the

Table 4 Preinjury and postinjury benzodiazepine use

	Preinjury Benzodiazepine 35/734 (4.8%)			Postinjury Benzodiazepine 53/734 (7.2%)					
				Without Hospitalization 28/379 (7.4%)			With Hospitalization 25/355 (7.0%)		
	Row %	DDD* per 1,000 person-days	*P* value†	Row %	DDD* per 1,000 person-days	*P* value†	Row %	DDD* per 1,000 person-days	*P* value†
All	4.8	13.3		7.4	16.1		7.0	20.6	
Sex									
Men	4.2	14.17	0.50	5.9	15.82	0.38	7.1	20.65	0.93
Women	5.3	12.51		8.4	16.22		6.9	20.56	
Age									
<25	2.9	7.94	0.12	7.5	3.88	0.58	10.3	4.09	0.16
25–44	2.7	13.58		4.8	11.34		2.0	6.52	
45–64	5.1	12.88		8.6	21.94		8.7	37.13	
≥65	7.8	15.72		9.2	19.41		8.9	15.93	
IRSAD score									
1st QTL	4.7	16.34	0.35	8.7	12.83	0.76	7.3	55.13	0.81
2nd QTL	4.4	8.99		9.6	11.00		6.5	13.52	
3rd QTL	2.6	5.39		6.5	11.68		5.1	6.44	
4th QTL	6.5	19.27		5.9	24.15		8.7	15.50	
Mental health history‡									
Yes	17.3	65.62	<0.0001	19.6	44.07	0.0008	28.6	112.46	<0.0001
No	3.2	6.78		5.7	12.19		4.7	10.56	
Injury type									
Musculoskeletal	7.0	19.76	0.02	9.8	22.66	0.25	7.9	23.07	0.50
Orthopaedic	3.2	13.18		2.1	0.97		8.7	33.02	
Other injury	1.9	9.81		6.0	13.21		3.1	0.98	
Other severe	8.3	9.17		10.5	19.23		7.0	15.94	
Number of vehicles in accident									
One	6.3	21.50	0.10	7.0	15.05	0.34	8.1	25.53	0.78
Two	4.5	9.31		9.0	20.21		6.3	14.55	
Three or more	1.0	1.40		3.3	5.24		5.4	20.98	
Role in the accident									
Car-driver	5.8	16.85	0.06	8.4	17.48	0.18	8.3	30.98	0.67
Car-passenger	6.7	13.24		3.5	23.62		9.7	27.69	
Motor cyclist	1.1	0.74		2.6	8.20		3.7	2.71	
Pedestrian	7.3	27.06		13.5	28.14		11.1	23.54	
Cyclist	0.0	0.00		2.3	1.04		2.0	0.90	
Other	10.0	2.05		25.0	11.42		0.0	0.00	
At fault (police report)									
Yes	2.7	3.57	0.02	4.9	5.15	0.14	6.4	15.84	0.89
No	6.7	15.51		10.0	21.75		7.6	20.91	
Unknown	7.9	47.48		10.6	40.13		8.7	54.40	

* DDD = Defined daily dose.
† Kruskal-Wallis nonparametric tests.
‡ Defined has having used mental health services in the Medicare scheme in the year prior to the injury.

patients' previous health history is, therefore, warranted—for example the GP could take on this role. For compensation claims management, the results of this study highlight the importance of collecting information on preinjury and co-morbid health conditions: pain medication prior to the injury is common, and this needs to be taken into account when determining the risk of delayed recovery and long-term pain. Future studies could address the impact of opioid and benzodiazepine use on injury recovery and functional outcomes, distinguishing early vs late onset use, taking into account drug type, dosage, pack size, and repeat prescriptions.

Study Limitations

The main strength of this study is the use of linked pharmaceutical data predating the injury, thereby providing an objective measure of drug use without reliance on patient or physician recall. The simultaneous use of two sources of pharmaceutical data, national pharmaceutical benefits as well as state transport injury compensation data, is another study strength. However, this study has several limitations that should be acknowledged. First, the study sample was relatively small and not accurately reflecting the injured population: study participants were older and more severely injured compared with the injured population from which they were drawn, and used slightly more opioids after the injury, evident from compensation scheme prescription payments. Although this limits the generalizability of the results to the underlying injured population, it is unlikely to affect the internal validity of the study. In other words although the distribution of age, injury type, and severity in the sample may not accurately reflect that of the population, the observed factors associated with prescription drug use before and after injury are not likely to be affected.

Second, the pharmaceutical data is limited to that which is captured in the compensation schemes: over the counter pharmaceuticals without prescription and illicit pharmaceutical use are not captured. Preinjury, prescriptions that are not subsidised through the PBS (drugs that are below the threshold cost; private prescriptions) are not captured. Postinjury, some of these prescriptions are covered by the injury insurance scheme: therefore, the opioid and benzodiazepine prescription response to injury presented in this study is an overestimate. A further limitation is the lack of pain severity data: although injury details are captured, we did not have access to a measure of pain severity, which would have provided an indication of prescribing in relation to need. Finally, in this study prescription filling was assumed to equal consuming the drug. This may have resulted in an overestimate of the total amount of opioids and benzodiazepines used, as not all prescriptions that have been purchased have been consumed.

Conclusions

The results of this study show that prescription drug use before the injury was substantial, with 39% of postinjury opioid use and 73% of benzodiazepine use potentially unrelated to the injury. The significance of postinjury prescription drug use cannot be established unless the relatively high preinjury use is taken into account. Pain treatment in this injured population with high rates of preinjury opioid and benzodiazepine use and high prevalence of preinjury mental disorders could well be managed by a pain treatment coordinator such as the GP, to avoid unnecessary long-term use and potentially harmful drug combinations.

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