

Chronic Pain Following Motor Vehicle Collision

A Systematic Review of Outcomes Associated With Seeking or Receiving Compensation

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Objective: Motor vehicle collisions (MVC) are a major cause of injury, which frequently lead to chronic pain and prolonged disability. Several studies have found that seeking or receiving financial compensation following MVC leads to poorer recovery and worse pain. We evaluated the evidence for the relationship between compensation and chronic pain following MVC within a biopsychosocial framework.

Method: A comprehensive search of 5 computerized databases was conducted. Methodological quality was evaluated independently by 2 researchers according to formal criteria, and discrepancies were resolved with a third reviewer.

Results: We identified 5619 studies, from which 230 full-text articles were retrieved and 27 studies were retained for appraisal. A third of studies (37%) were of low quality, and 44% did not measure or control for factors such as injury severity or preinjury pain and disability. Most studies (70%) reported adverse outcomes, including all of the highest quality studies. Engagement with compensation systems was related to more prevalent self-reported chronic pain, mental health disorders, and reduced return to work. Recovery was poorer when fault was attributed to another, or when a lawyer was involved. Five studies compared Tort "common law" and No-Fault schemes directly and concluded that Tort claimants had poorer recovery.

Conclusions: Although causal relationships cannot be assumed, the findings imply that aspects of loss, injustice, and secondary mental health outcomes lead to chronic pain following MVC. Further robust prospective research is required to understand the complex relationship between compensation systems and pain following road trauma, particularly the role of secondary mental health outcomes.

Key Words: chronic pain, accident, injury, compensation, trauma
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Motor vehicle collisions (MVCs) are a major cause of serious injury worldwide, affecting approximately 50 million people each year.^{1,2} Recovery from injuries sustained in MVCs can be slow, leading to long-term health problems long after the injury has healed.³ The persistence of pain for >3 months, or beyond the time expected for injured tissue to heal (ie, chronic pain),⁴ is prevalent following MVC. Those involved in a MVC have an 84% increased risk of having chronic pain compared with others in the community.⁵ Approximately one third of those who attended an emergency department after road trauma also report complex psychological problems (eg, posttraumatic stress disorder [PTSD], fear of driving or traveling, anxiety and mood disorders such as depression and emotional distress) within 1 year, even after minor injury.⁶

While half of injured persons return to regular activities soon after a MVC,⁷ others continue to require high levels of health care, and have significant loss of earnings, decreased productivity, and increased disability benefits.⁸ These issues create a significant financial burden for the individual, their family, and society, particularly for compensation schemes that provide financial support to individuals who are injured in a MVC. However, individuals who seek or receive compensation often report poorer recovery compared with individuals who do not seek financial support,^{9,10} even when controlling for injury severity.¹¹ Moreover, chronic pain conditions that arise as a consequence of injury (eg, whiplash-associated disorders [WAD] or back pain) are often found to be associated with increased health and compensation costs.¹² Because traumatic injury alone increases the risk of chronic pain it is important to systematically evaluate the evidence on the role of compensation systems in chronic pain following MVC.

Several systematic reviews have previously examined the role of compensation in recovery from specific injuries (ie, head injury, surgery),^{9,13,14} or following workplace injury.^{9,13,15,16} These reviews all conclude that individuals

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who receive compensation have poorer return to work, greater functional impairment, and report more severe symptoms compared with persons not eligible for compensation; however, the quality of these reviews is limited.¹⁷ Few systematic reviews have examined outcomes specific to chronic pain (although see Rohling et al¹⁸), and no systematic review has evaluated the evidence regarding chronic pain outcomes across general pain syndromes following compensable injury from MVC (ie, not specifically for whiplash-associated pain^{7,19}).

Given the introduction of major changes in compensation system administration and eligibility in some countries in the past 2 decades, including the introduction of No-Fault compensation, which aimed to address this paradoxical “antitherapeutic effect” of compensation, it has become increasingly pertinent to examine the evidence for pain outcomes related to receiving compensation. Moreover, recovery from MVC may follow different trajectories compared with injuries in the workplace. For instance persons injured in MVC potentially differ from those injured at work in socioeconomic status and attributions of blame. This is the first systematic evaluation of evidence for the relationship between compensation and the incidence, severity and impact of all types of chronic pain following a MVC, including a secondary focus on the relationship between compensation and functional and psychological health outcomes. We examined chronic pain outcomes with respect to compensation processes (ie, eligibility, seeking, settled), and between scheme types (ie, for No-fault and Tort-based schemes). We ultimately sought to gain insight into the factors contributing to chronic pain following road trauma, including compensation scheme factors, which will have implications for management of injured persons.

METHODS

Analytic Approach

The present approach considered study quality when contemplating the implications of study findings for future research and compensation system policy. Studies were screened for inclusion and quality by 2 authors (who were always blinded to the other’s decision), after which key data were extracted for synthesis. In the first instance, we intended to conduct a meta-analysis of pain-related outcomes from studies rated as moderate-to-high quality; however, it became apparent that this was not possible for continuous or dichotomous data (eg, regarding the frequency of adverse effects in populations with/without compensation) due to study heterogeneity. The included studies varied regarding population (eg, inconsistent comparison groups), outcome measures, baseline time points (ie, not all studies compared with time of injury), follow-up time periods, design (ie, cross-sectional, prospective, retrospective), reporting of appropriate data for comparable follow-up time points, and the types of compensation scheme factors reported. Moreover, compensation-related factors were often entered into multivariate analyses as one of many predictors, so unique variance was not always possible to extract for meta-analysis. As a result, we decided to present the key findings from all studies (see Table 3, results), but to only discuss findings from moderate-to-high quality studies in text, especially prioritizing the studies that had considered the confounding role of socioeconomic, health factors, and

injury factors. We separately reported outcomes from Tort and No-Fault compensation systems. On the basis of the biopsychosocial model of chronic pain, primary outcomes were specific to self-reported chronic pain (ie, outcomes such as prevalence of pain, pain intensity). Secondary outcomes included those specific to physical health (eg, return to work, disability, treatment outcomes, health care utilization) and psychological health (eg, depression, anxiety) in relation to pain.

Search Strategy

Five electronic database engines were searched (search date: May 27, 2013), including Medline (1950-present), Embase (1980-present), CINAHL, PsychINFO, and The Cochrane Library. Search terms were developed in consultation with a medical librarian. A total of 150 keywords and medical subject headings (MeSH) were used, which focused on “motor vehicle collision,” “compensation,” “chronic pain,” and “recovery.” Search terms related to “chronic pain” or “recovery” were combined with “compensation,” with the end search combined with “motor vehicle collision” (see supplementary material for Medline search strategy, Supplemental Digital Content 1, <http://links.lww.com/CJP/A339>). Reference lists were examined for additional relevant studies. Search outputs were managed with Endnote X6.

Inclusion Criteria

Only peer-reviewed original papers that characterized the link between compensation and chronic pain as an outcome following MVC, and included a comparison group (ie, between compensation schemes, compensable and noncompensable groups, or seeking litigation or not) were included. MVCs were defined as any crash involving at least 1 motorized vehicle including an automobile, truck, bus, or motorcycle and excluding vehicles that operate on rails such as trains and trams. All types of injury resulting from a MVC were included, with injury severity ranging from minor to severe. Non-English language articles were excluded due to lack of resources for translation. Studies on worker’s compensation, or with undifferentiated compensable samples, were excluded.

Study Assessment and Data Extraction

References were screened for inclusion by 2 researchers, based on title and abstract, and were assigned an inclusion code (yes/no/unsure). Reviewers were blind to the other reviewer’s decisions. Full-text articles were obtained for all references that were marked “yes” or “unsure,” by either reviewer, and independently assessed for eligibility by 2 reviewers. Disagreements were resolved through consultation with another reviewer. Data were independently extracted, including: first author name, year, title, country, aim/hypothesis, population, study design, study period, compensation type, measures used, analytic approach, key results, and conclusions.

Quality Appraisal

A quality appraisal by 2 researchers assessed each study for potential bias for the domains of study participation, study attrition, prognostic factor measurement, outcome measurement, confounder measurement, and analysis using the process recommended by Hayden et al²⁰ (see supplementary material for overall sources of potential bias in the included studies, Supplemental Digital

Content 2, <http://links.lww.com/CJP/A340>). We placed particular emphasis on the measurement of baseline confounding factors given their importance in recovery from injury. An overview of study quality is presented in Table 1. Disagreement between reviewers was resolved during consultation with a third reviewer. Studies were rated moderate-to-high quality if they adequately handled most or all sources of bias across the 6 quality criteria.

RESULTS

The search yielded 5619 references and after duplicates were removed, 5353 remained. An additional 64 references were sourced from reference lists. Twenty-seven references met the inclusion criteria for data extraction (Fig. 1). The earliest study was published in 1983, and 13 (48.1%) were published between 2000 and 2009. Most studies were undertaken in Australia (n = 9; 33.3%) and the UK (n = 7; 25.9%). Nineteen (70.4%) involved Tort schemes, whereas 4 (14.8%) involved No-Fault schemes. Four studies (14.8%) compared Tort and No-Fault compensation schemes. Fifteen (55.6%) studies reported physical health outcomes, and 9 (33.3%) reported psychological health outcomes, in addition to pain (Tables 2 and 3).

Chronic Pain

Tort Compensation

Seeking compensation under a Tort scheme within the first 3 months of injury predicted chronic pain severity (from no pain to “very severe” pain) at 1 and 3 years postinjury.³⁷ Those seeking compensation reported more intense and frequent neck pain (Neck Disability Index [NDI]⁴⁹ and Visual Analogue Scale [VAS]),^{23,28,48,49} and poorer physical functioning on the Short-Form Health Survey (SF-36)⁵⁰ and Functional Rating Index (FRI),⁵¹ compared with those who did not seek compensation.³⁶ Having pain-related symptoms on the NDI was linked to an increased likelihood of seeking compensation.²³ Claimants who had settled at 2 years postinjury were more likely to report having neck pain than those who had not yet settled.⁴¹ Sterling et al⁴⁵ identified unique trajectories of pain in patients with WAD after MVC, whereby receiving compensation predicted mild and moderate neck pain trajectories, but not trajectories to chronic-severe pain (NDI). Some of these studies did not control for injury severity.^{23,36} Lawyer involvement predicted neck pain intensity at 6 months (NDI)³³; however, Casey et al²⁴ did not find that lawyer involvement predicted health and pain outcomes (SF-36, FRI, and Pain Catastrophizing Scale)⁵² following WAD. Those who consulted a lawyer were less likely to achieve minimal clinical change in

TABLE 1. Quality Appraisal

References	Quality Summary	Study Participation	Study Attrition	Prognostic Factor Measurement	Outcome Measurement	Confounder Measurement and Account
Abbott et al ²¹	Low	+	?	-	+	-
Ameratunga et al ²²	Moderate-high	++	+	++	++	+
Bunketorp et al ²³	Moderate-high	++	+	+	++	+
Casey et al ²⁴	High	++	+	++	++	+
Cassidy et al ²⁵	High	++	+	++	++	+
Cassidy et al ²⁶	High	++	+	++	++	+
Cote et al ²⁷	High	++	++	++	++	++
Dufton et al ²⁸	Moderate	+	?	++	+	+
Elbers et al ²⁹	Moderate	+	?	++	-	++
Giroto et al ³⁰	Low	-	?	-	?	-
Grushka et al ³¹	Low	+	?	+	++	-
Gun et al ³²	Low	+	-	+	++	-
Harris et al ³³	Moderate	+	+	+	+	+
Hodgson and Grundy ³⁴	Low	-	-	-	-	-
Joslin et al ³⁵	Low	+	-	-	-	-
Littleton et al ³⁶	Moderate-high	+	+	++	++	+
Mayou and Bryant ³⁷	Moderate-high	++	+	+	+	+
Norris and Watt ³⁸	Low	+	?	?	?	-
Parmar and Raymakers ³⁹	Low-moderate	+	+	+	++	-
Pennie and Agambar ⁴⁰	Low	-	-	+	++	-
Pobereskin ⁴¹	Moderate-high	+	+	+	++	++
Rebbeck et al ⁴²	Moderate-high	+	+	++	++	+
Sapir and Gorup ⁴³	Low	++	-	++	++	-
Soward et al ⁴⁴	Low	-	-	+	++	?
Sterling et al ⁴⁵	Moderate	++	-	+	++	-
Swartzman et al ⁴⁶	Moderate	+	?	+	+	+
Williamson et al ¹¹	Moderate-high	++	+	+	++	+
Yang et al ⁴⁷	Moderate-high	++	+	++	++	+

Study participation: the study sample represents the population of interest on key characteristics, sufficient to limit potential bias to the results; Study attrition: loss to follow-up (from sample to study population) is not associated with key characteristics (ie, the study data adequately represent the sample), sufficient to limit potential bias. Prognostic factor measurement: the prognostic factor of interest is adequately measured in study participants to sufficiently limit potential bias. Outcome measurement: the outcome of interest is adequately measured in study participants to sufficiently limit potential bias. Confounder measurement and account: important potential cofounders are appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest.

“-” indicates not adequate or reported; “+,” partially adequate or reported; “++,” appropriate and low risk of bias; “?” unclear.

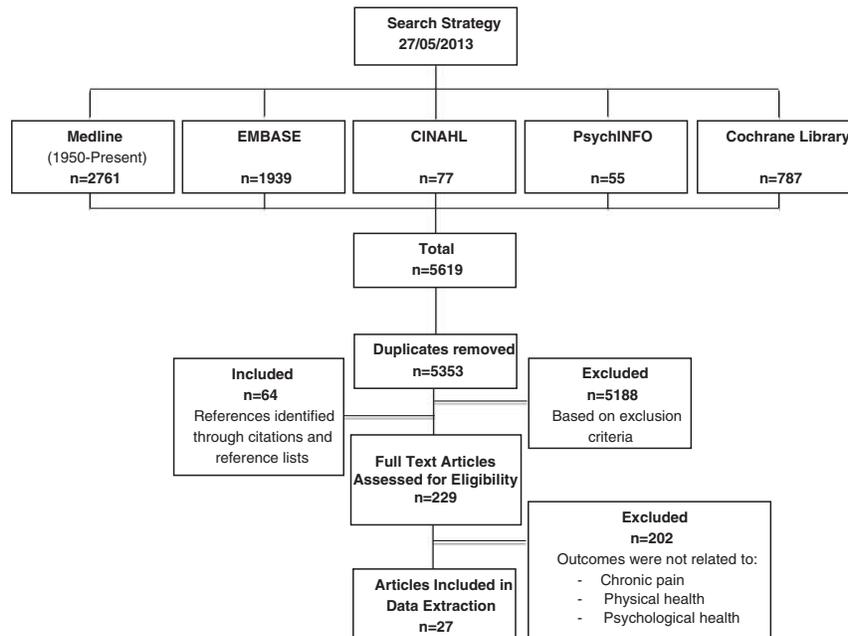


FIGURE 1. PRISMA diagram.

neck pain after treatment, especially those with less intense pain at the initial time point using VAS and Canadian Back Institute Questionnaire.^{28,53} Residual pain symptoms frequently persisted after settlement as measured by VAS and NDI scores,²³ or intensity (VAS) ratings were sometimes increased in those who had reached settlement compared with those whose claims were pending.⁴¹

Tort Compensation Compared With No-Fault Compensation

One study reported that Tort claimants had more intense neck pain, pain-related symptoms, and percent of the body in pain than No-Fault claimants on the SF-36 and VAS ratings.²⁶

No-Fault Compensation

Receiving compensation was associated with moderate or severe self-reported pain (NRS)⁵⁴ at 6 months,¹¹ and 12 months,⁴⁷ post injury compared with those ineligible for compensation (ie, because they may not have been injured in road accidents). Ameratunga et al²² found that seeking compensation was not significantly associated with self-reported neck pain at 5 or 18 months following a MVC, although this study did not control for baseline demographic, health, or injury characteristics in their multivariate models.

The association between claim settlement and chronic pain under a No-Fault compensation scheme was only examined in 1 study. Claim settlement appeared to be positively related to recovery, whereby current claimants reported more frequent and severe pain (VAS ratings) compared with those whose claim was complete⁴⁶; however, this study did not examine outcomes with respect to injury severity and involved claimants that were suing for damages. Two other studies found that lower pain intensity

(VAS ratings) at follow-up was associated with faster claim closure.^{25,27}

Physical Health and Functional Status

Tort Compensation

Seeking compensation had a negative relationship with physical function. Several studies reported that those who sought compensation had poorer physical health outcomes with the SF-36 Physical Component Summary (PCS) and FRI³⁶ compared with those who did not seek compensation. Another study found no difference in return to work between those who sought compensation and those who did not.⁵⁶ The relationship between claim settlement and recovery of physical function was not clear. Claim settlement predicted improved function (SF-36 PCS and FRI) when compared with those with pending claims.^{25,42}

Tort Compensation Compared With No-Fault Compensation

One study found that No-Fault claimants had greater physical improvements on the SF-36 PCS compared with Tort claimants over time.²⁶

No-Fault Compensation

Receiving compensation in a No-Fault scheme was associated with poor physical function outcomes 12 months after injury.⁴⁷ Ameratunga et al²² found no difference in the SF-36 PCS between claimants and nonclaimants at either 5 or 18 months postinjury; however, this study did not control for injury severity or pain at baseline.

Lawyer involvement was found to be related to poorer physical health, higher frequency of symptoms, and delayed return to work.²⁸ Claim settlement was found to have a positive relationship with physical health (SF-36) compared with ongoing litigation,^{25,27} even in a study that examined

TABLE 2. Study Characteristics, Research Design, Compensation Scheme, Analytic Approach and Key Results

References	Country	Compensation Type	Study Design and Data Collection Time Points	Outcome Measure/s	Sample Size (n)			
					Total	None	Seeking	Settled
Abbott et al ²¹	Australia	T	Cross-sectional Pain clinic sample	Retrospective review of patient files	55	12	28	15
Ameratunga et al ^{22*}	New Zealand	NF	Prospective Baseline, 5 and 18 mo	SF-36, IES, Whooley Instrument for Depression, ISS	286	165	103	
Bunketorp et al ²³	Sweden	T	Prospective Baseline and 17 y	VAS, NDI	58 WAD; 41 no WAD	33 WAD; 34 no WAD	25 WAD; 7 no WAD	
Casey et al ^{24*}	Australia	T	Cross-sectional Baseline (≤ 3 mo of injury)	FRI, SF-36, PCS	246		246	
Cassidy et al ²⁵	Canada	B	Prospective Baseline, 6 wk; 4, 8, and 12 mo	SF-36, CES-D, VAS	1607			703 Tort; 904 No-Fault
Cassidy et al ²⁶	Canada	B	Prospective Baseline, 6 wk; 4, 8, and 12 mo	SF-36	657			260 Tort; 397 No-Fault
Cote et al ^{27*}	Canada	B	Prospective Baseline, 6 wk; 4, 8, and 12 mo	VAS, SF-36, CES-D (outcome: time-to-claim closure instead of recovery)	5398			2377 Tort; 3021 No-Fault
Dufton et al ²⁸	Canada	B	Prospective First treatment (< 91 d from injury) to discharge from treatment (m = 73 d)	VAS, CBIQ	2185	1348 No lawyer	837	
Giroto et al ^{30†}	Croatia	T	Prospective Baseline (ER examination), 12 wk	Retrospective review of patient files: physical examination notes	1077	552	101	
Grushka et al ^{31*†}	USA	T	Cross-sectional Up to 3 y (median = 11 mo)	Random retrospective review of patient files	136	19	35	
Gun et al ^{32*}	Australia	T	Prospective Baseline (first 6 wk > injury; m = 3 wk) and 12 mo	NPOS, VAS	135		87	
Harris et al ³³	Australia	T	Prospective Baseline and 6 mo	SF-36, NDI	232	44.20%	55.80%	
Hodgson and Grundy ³⁴	UK	T	Prospective Baseline (medical record) and 10 y	Retrospective review of patient files and follow-up data collection (no tools listed)	40			40
Joslin et al ^{35*†}	UK	T	Cross-sectional 3.5 y postinjury	NDI	80	40	20	20
Littleton et al ³⁶	Australia	T	Prospective Baseline (m = 8 d > accident), 6 and 12 mo	SF-36, FRI, HADS	95	64	31	
Mayou and Bryant ³⁷	UK	T	Prospective Baseline (ED admission), 3 mo, 1 and 3 y	PSS, HADS, SF-36	1148	755	392	
Norris and Watt ^{38*}	UK	T	Prospective Baseline (max 7 d > injury) to at least 6 mo	Range of motion			41 (15-G1, 16-G2, 10-G3)	
Parmar and Raymakers ³⁹	UK	T	Prospective Baseline (initial claim) to follow-up (m = 8 y; 3-20 y)	Retrospective patient files review from past 18 y; "outcome measures"	100		9	91
Pennie and Agambar ⁴⁰	UK	T	Prospective Baseline (at referral to treatment > injury) to discharge/up to 5 mo	Clinical examination, Linear analogue pain scales	144	28	116	
Pobereskin ⁴¹	UK	T	Prospective Baseline (56-104 d > injury, m = 77 d) to 12 mo	Pain: neck pain lasting > 1 wk after accident; neck pain lasting at least 1 d a week at 1 y after accident, VAS	503	267	236	
Rebbeck et al ^{42*}	Australia	T	Prospective Baseline (3 mo > injury), 6 mo, 2 y	FRI, SF-36, CWOM	114	N/A	114	
Sapir and Gorup ⁴³	USA	T	Prospective Baseline (≥ 20 wk > injury) to posttreatment, 6, 12 mo	VAS	46	18	19	13
Soward et al ⁴⁴	USA	T	Prospective Baseline (24 h > injury), 6 wk	Neck pain intensity during the past week	849	701	148	
Sterling et al ⁴⁵	Australia	T	Prospective Baseline (1 mo > injury), 3, 6, 12 mo	NDI, PDS	155	61	73	
Swartzman et al ⁴⁶	Canada	NF (Tort suing)	Cross-sectional Group comparison between current litigants and postlitigants	Body diagrams, VAS, questions about activities that cause increase in pain	62	N/A	41	21
Williamson et al ^{11*†}	Australia	NF	Prospective Baseline (hospital admission), 6 mo	11-point NRS, SF-12	1290	620	670	
Yang et al ^{47*†}	Australia	NF	Prospective Baseline (hospital admission), 12 mo	VOTOR Database, SF-12, NRS	264	35	229	

*Study aim was not specific to outcomes from compensation.

†Participants were not all injured in MVC.

B indicates Tort and No-Fault; CBIQ, Canadian Back Institute Questionnaire; CES-D, Centre for Epidemiologic Studies Depression Scale; CWOM, Cumberland Whiplash Outcome Measure; ED, emergency department; FRI, Functional Rating Index; HADS, Hospital Anxiety and Depression Scale; IES, The Impact of Event Scale; ISS, Injury Severity Score; NDI, Neck Disability Index; NF, No-Fault; NPOS, Neck Pain Outcome Score; NRS, Numeric Rating Scale; NS, not significant; PCS, Pain Catastrophizing Scale; PDS, Posttraumatic Stress Diagnostic Scale; PSS, posttraumatic stress symptoms; SF-12, Short Form Health Survey (12 items); SF-36, Short Form Health Survey (36 items); T, Tort; VAS, Visual Analogue Scale; VOTOR, Victorian Orthopaedic Trauma Outcomes Registry; WAD, whiplash-associated disorders.

function using a nonvalidated 32-item activity checklist that controlled for time since injury.⁴⁶

Psychological Health and Wellbeing

Tort Compensation

Seeking compensation through the Tort system was found to be negatively associated with psychological outcomes. In particular, those who sought compensation showed higher levels of anxiety on the Hospital Anxiety and Depression Scale (HADS)^{36,55} and it was associated with poorer outcomes in all 3 PTSD symptom trajectories (minor, moderate, and severe) following whiplash injury.⁴⁵ However, Mayou and Bryant³⁷ did not find an association between compensation and psychological outcomes (HADS, Posttraumatic Stress Symptoms, and SF-36 Mental Component Score [MCS]). Consulting a lawyer was associated with poorer self-reported psychological health with SF-36 MCS.³⁶ Claimants whose claim was pending showed slower psychological recovery, compared with those whose claim was settled with respect to global symptom “bothersomeness,” function, well-being, disability, and satisfaction with care.⁴²

Tort Compensation Compared With No-Fault Compensation

Tort claimants, compared with No-Fault claimants, had significantly poorer psychological health on the SF-36 MCS.^{25,26}

No-Fault Compensation

Receiving compensation, under a No-Fault scheme, was found to be negatively associated with self-reported psychological health (SF-12 MCS) compared with those who did not receive compensation.⁴⁷ Swartzman et al⁴⁶ reported that those who were still involved in the compensation process, and suing for damages, were more psychologically distressed than those who had reached settlement as indexed by scores on the Centre for Epidemiological Studies-Depression Scale⁵⁷ and Multidimensional Personality Questionnaire.⁵⁸ However, 2 other studies found that those with shorter claim duration (faster settlement) reported more depressive symptoms.^{25,27}

DISCUSSION

While compensation systems aim to provide financial assistance to aid recovery from injury, none of the studies reviewed found superior outcomes in association with receiving compensation, even in studies that controlled for confounding factors such as injury severity. Rather, the evidence points toward a negative relationship, or no relationship, between compensation and chronic pain following MVC. On the basis of findings from the highest quality studies, we conclude that individuals receiving compensation reported a higher incidence and intensity of pain, poorer physical functioning, and higher rates of depression and anxiety following MVC. Lawyer involvement and/or involvement in a Tort compensation scheme had the strongest associations with negative pain outcomes. Other factors that mediated the association between compensation and recovery that were more inconsistent, or only observed in low-quality studies, included the role of procedural requirements in obtaining compensation and length of claim administration.

Chronic pain at different points in the trajectory of compensation claims, particularly claim settlement, was inconsistent. Individuals who showed improvement at 12 months post injury (ie, report less pain, better physical functioning, and/or better psychological health) were typically those who had faster claim closure.^{27,59} However, just over half of the studies reported negative outcomes that persisted following settlement. A clear limitation of these large-scale analyses is that the analytic approaches do not take into account the fact that the majority of claimants do indeed return to function soon after injury,⁶⁰ and the negative outcomes are predominantly driven by the small proportion of claimants who have a poor recovery.

Although the majority of studies reported a relationship between compensation and pain, the direction of this relationship cannot be assumed and these studies do not show that compensation causes chronic pain and related outcomes. In particular, individuals reporting severe pain or greater losses may be both more likely to seek financial compensation and more likely to report pain, whereas those whose pain has resolved may be more likely to have their claim closed. Alternatively individuals who are more sensitive to the stressful nature of seeking compensation may be at greater risk of chronic pain and secondary psychological trauma. In fact, O'Donnell et al⁶¹ found that when they controlled for differences in subjective stressfulness of compensation system interactions, compensation status itself no longer predicted anxiety following MVC.

Chronic Pain Outcomes Between Tort and No-Fault Compensation Schemes

Most studies examined in this review evaluated Tort compensation scheme outcomes. When directly compared, Tort claimants had poorer recovery compared with No-Fault claimants. Tort schemes were historically recognized as providing insufficient financial recompense to persons injured in road collisions with those at fault having no access to compensation, and those not at fault facing high costs through litigation, and long delays and inconsistencies in claim outcomes. These inadequacies motivated the development of No-Fault schemes in Canada, New Zealand, and some states in Australia and the United States.

Poorer recovery in Tort systems could be due to the fact that individuals who have sustained significant injury and/or losses are more likely to sue for damages than those whose injury and/or losses are minor or appear to be temporary.¹⁷ Alternatively, Tort claimants may develop (or report) increased incidence and severity of chronic pain because this will determine the level of compensation received (ie, leading to pursuit of secondary gain).⁶² Finally, it may arise due to the stressful nature of litigation. For instance, stress arises when claimants must prove that they were not at fault and sue the “at fault” party for damages, which can be a lengthy process with no guarantee of compensation. Having to “relieve” the event and prove the severity of disability following injury when suing for pain and suffering has been proposed to play a role in psychological disturbances in Tort claimants.^{10,59,63} In contrast, No-Fault compensation reduces the requirement for stressful litigation, and provides assured compensation for medical costs; however, claimants must still demonstrate symptom severity and impact. Those who were not at fault in a No-Fault scheme reported poorer psychological recovery compared with those who were at fault.^{56,64} As in Tort schemes, these findings may be attributed to feelings of

TABLE 3. Study Analytic Approach and Results

References	Country	Comp Type	Confounders Controlled	Statistical Analysis and Significance	Adverse Outcomes	Positive or Neutral Outcomes
Abbott et al ²¹	Australia	T	No; baseline confounders not measured	Significance not measured		Compensation was not a major factor in outcomes
Ameratunga et al ²²	New Zealand	NF	No; demographic, health, and injury confounders measured but not included in multivariate analyses	NS (χ^2 test)		Compensation was not associated with neck pain or stiffness at 5 or 18 months following MVC
Bunketorp et al ²³	Sweden	T	No; baseline confounders not measured	$P < 0.05$ (χ^2 test)	42% of WAD with residual symptoms had compensation claims compared with 14% of WAD who had recovered; higher intensity of spontaneous neck pain, radiating pain and headache in group claiming compensation than nonclaiming group	All 25 WAD patients continued to have residual WAD after settlement of claims for damages
Casey et al ²⁴	Australia	T	Yes; confounders systematically evaluated	NS (multiple linear regression models)		Lawyer, previous claim, claim closed at 3 mo, time to lodge claim not significant predictors of adverse outcome
Cassidy et al ²⁵	Canada	B	Yes; confounders systematically evaluated	$P < 0.05$ (Wald test, hazard rate ratio; confidence interval)	Poor prognosis associated with: female sex, baseline pain intensity, depression, lawyer involvement, tort insurance	
Cassidy et al ²⁶	Canada	B	Yes; confounders systematically evaluated	$P < 0.05$ (χ^2 test; Wald test; hazard rate ratio; confidence interval)	Tort claimants reported more intense headaches, neck pain, and percentage of body in pain than No-Fault claimants; Tort insurance and having $\geq 20\%$ of your body in pain resulted in longest time to claim closure and worst prognosis	
Cote et al ²⁷	Canada	B	Yes; confounders systematically evaluated	$P < 0.05$ (Wald test, hazard rate ratio; confidence interval)	Higher neck pain intensity, poorer physical functioning, and depressive symptoms associated with longer time to claim closure and poor recovery from whiplash. Time to claim closure was faster in No-Fault scheme (median 199-227 d) compared with Tort scheme (median 433-447 d)	
Dufton et al ²⁸	Canada	B	Yes; confounders systematically evaluated	$P < 0.05$ (multivariable analysis; odds ratio; confidence interval)	Lawyer involvement predicted negative outcome ($< 10\%$ change in questionnaire score). Effects stronger for patients with less intense pain at time 1	
Giroto et al ³⁰	Croatia	T	No; baseline confounders not measured	Significance not measured	Compensable group reported more medical leave, stiff/painful neck symptoms, neurological deficits, headache and dizziness	
Grushka et al ³¹	USA	T	No; baseline confounders not measured	$P < 0.05$ (Pearson χ^2 Yate's correction; t tests)	Compensated group experienced earache and joint noises (eg, clicking) more frequently; clinical diagnosis of TMJ more prevalent at initial diagnosis in compensated group; disk displacement without reduction more frequent in compensated group	No difference in other symptoms: range of opening, disk displacement or osteoarthritis, bone activity
Gun et al ³²	Australia	T	Yes; baseline function, pain severity, litigation, and whether car still drivable were considered	$P < 0.05$ (linear regression, logistic regression, multivariate regression)	Lawyer involvement predicted longer claim duration, longer treatment, and lower NPOS	No association between lawyer involvement and VAS or return to work
Harris et al ³³	Australia	T	Somewhat; income, education and blame included in univariate analysis. Only sex and education in multivariate test	$P < 0.01$ (univariate ANOVA; multiple linear regression)	Neck pain at 6 mo significantly associated with use of a lawyer, blaming someone else, making compensation claim, and low household income	
Hodgson and Grundy ³⁴	UK	T	No; baseline confounders not measured	Significance not measured		No effect of settlement on symptoms
Joslin et al ³⁵	UK	T	No; did not examine injury severity, preinjury work status in litigating/nonlitigating groups	$P < 0.001$ median scores (nonparametric Friedman 2-way ANOVA; Wilcoxon matched-pairs signed-ranks test)	Those seeking compensation had a significantly higher median NDI score (27/100) than those who were not involved in compensation (6/100) and those who had settled or did not seek compensation (14/100)	
Littleton et al ³⁶	Australia	T	No; socioeconomic factors measured, but not included in multivariate modeling	$P < 0.05$ (multiple linear regression)	Lower SF-36 PCS, greater HADS-anxiety, and worse FRI associated with claiming compensation	
Mayou and Bryant ³⁷	UK	T	Yes; confounders systematically evaluated	$P < 0.01$ logistic regression	Compensation claim at 3 mo predicted pain at 1 y for those with WAD and bone injury but not other soft tissue injuries	

(Continued)

TABLE 3. (continued)

References	Country	Comp Type	Confounders Controlled	Statistical Analysis and Significance	Adverse Outcomes	Positive or Neutral Outcomes
Norris and Watt ³⁸	UK	T	No; examined crash factors only in 3 groups. 1: no physical abnormality, 2: reduced range of movement, 3: reduced range of movement and neurological loss	NS (did not state test used)		No significant differences between groups
Parmar and Raymakers ³⁹	UK	T	No; baseline confounders not measured	Significance not measured		Most patients were free of pain before claim settlement; 4/91 improved after compensation
Pennie and Agambar ⁴⁰	UK	T	No; baseline confounders not measured	NS (Yate's χ^2 test)		No difference between claimants/nonclaimants
Pobereskin ⁴¹	UK	T	Yes; confounders systematically evaluated	$P < 0.005$ (χ^2 test; odds ratio; confidence interval) logistic regression	Compensation claim predicted late whiplash/pain	
Rebbeck et al ⁴²	Australia	T	Yes; systematic evaluation of baseline injury severity, disability, and socioeconomic	$P < 0.001$ (single and multiple linear regression)	Having open or reopened claim reduced recovery (FRI score)	
Sapir and Gorup ⁴³	USA	T	No; baseline confounders not analyzed	NS (ANOVA; χ^2 test, t test)		Resolution of litigation did not affect treatment outcome
Soward et al ⁴⁴	USA	T	Unclear; baseline injury or pain severity recorded, but not clear if included in analysis	Significance not measured	Moderate to severe neck pain was reported by 64% of litigants and 28% of nonlitigants	
Sterling et al ⁴⁵	Australia	T	Yes; considered socioeconomic, pain severity, and crash factors	$P < 0.001$ (Wald χ^2 test)	Mild and moderate NDI trajectories had poorer outcome after claim submission	No difference in chronic-severe NDI trajectory after claim submission
Swartzman et al ⁴⁶	Canada	NF (Tort suing)	Somewhat; did not consider injury severity in analyses and controlled for time since injury	$P < 0.05$ (MANOVA; ANCOVA)	Current litigants reported more body sites in pain, higher intensity, and more activities causing increase in pain than postlitigants, even when covarying time since injury	
Williamson et al ⁴¹	Australia	NF	Yes; confounders systematically evaluated	$P < 0.001$ (odds ratio logistic regression)	Compensation eligibility predicted moderate or severe pain 6 mo postinjury	
Yang et al ⁴⁷	Australia	NF	Yes; confounders systematically evaluated	$P < 0.05$ (univariate ANOVA; logistic multiple regression)	Patients receiving compensation reported worse moderate-severe pain and poorer mental health at 12 mo	

ANOVA indicates analysis of variance; B, Tort and No-Fault; FRI, Functional Rating Index; HADS, Hospital Anxiety and Depression Scale; NDI, Neck Disability Index; NF, No-Fault; NS, not significant; MVC, motor vehicle collision; PCS, Pain Catastrophizing Scale; SF-36, Short Form Health Survey (36 items); T, Tort; VAS, Visual Analogue Scale; WAD, whiplash-associated disorders.

injustice, which make it harder to move on from trauma.⁶⁵ Moreover, although some compensation is typically assured in No-Fault schemes, the process of seeking compensation is still experienced as stressful for at least one third of claimants, particularly in those with preexisting depression or anxiety.⁶⁶

Quality of the Evidence

While this review provides an important synthesis of the evidence on the relationship between compensation and chronic pain after MVC, only half of the studies were of a moderate to high quality. That said, almost all of the high-quality studies reported worse chronic pain outcomes in those seeking or receiving compensation, especially in Tort systems.

The time that has elapsed since injury varied between each of the studies and must be considered when understanding recovery trajectories and drawing meaningful conclusions. For example, studies that assessed individuals within hours of injury showed significant improvement in the majority of individuals,¹¹ whereas studies that first

assessed injured persons 8 to 12 weeks post injury found little meaningful change in symptoms over time.²⁸ Just over half of the studies had a follow-up duration of ≤ 12 months, which may not be sufficient to determine a relationship between compensation and longer-term pain-related outcomes. The compensation claim may not be awarded for at least 6 to 12 months, and long-term claims processes are determined beyond this period. In the meantime, claimants must typically pay an excess on their medical costs before compensation payments commence, or experience uncertainty about ongoing financial or health-care support. Moreover, longer-term impacts of injury and pain on well-being may not be fully realized in the first months, and/or change over time,⁶⁷ particularly when secondary complications arise from serious injury.

The relationship between compensation and recovery from MVC may be influenced by many other factors, such as patient demographics (eg, sex and age),^{28,63} medical history,^{28,61} preinjury psychological status,^{7,61} injury severity,^{28,68} financial situation and occupation,⁶¹ and life stage.^{28,63} However, the majority of studies examining the

association between compensation and recovery were large-scale epidemiological studies, and more than half did not measure and/or account for these potential confounds.

Most of the studies evaluated in this review examined the role of compensation systems using basic descriptors (eg, eligibility or claim status) and sometimes consider additional related processes or factors (eg, fault, medico-legal assessments, and litigation). However, we note that processes and systems for claiming compensation are extremely complex both within and between jurisdictions. Furthermore, a large number of studies did not describe the compensation system adequately or report on any aspect of the compensation process, which has been recognized as a major limitation in this research.⁶⁹ In addition, some compensation scheme designs are complex and were difficult to interpret, particularly with regard to quantitative and qualitative thresholds in No-Fault schemes. For instance, the study by Swartzman et al⁴⁶ involved claimants in a No-Fault setting, who were all seeking additional damages because of serious injury. Decision making by compensation systems is also frequently influenced and constrained by additional factors such as legislature, political climate, health systems, and attitudes and pressure from key stakeholders such as health providers, politicians, and injured persons.⁶⁹ Unfortunately, very little research is able to account for these complexities.

Some additional limitations in the quality of the evidence should be considered. In particular, the included studies varied in terms of the processes involved in seeking and receiving compensation; the type of injuries sustained; the type of crash (eg, single vehicle, multivehicle, stationary, position in the vehicle) injury severity; whether baseline characteristics were recorded at the time of injury, when seeking treatment, or when seeking compensation; the time elapsed since the crash; and the inconsistency in psychometric tools used to assess outcomes. The comparison groups in 5 studies comprised individuals whose injuries did not arise from a MVC, highlighting inherent group differences in baseline trauma experience. Moreover, 60% of the studies investigating outcomes in Tort schemes often compared outcomes with individuals who, although injured in a MVC, were not eligible for compensation because they were at fault, whereas all No-Fault claimants were usually considered together regardless of their role in the accident. Finally, several studies did not set out to explore the direct relationship between compensation and pain but rather included compensation or litigation as one of a number of secondary predictors of recovery, and/or pain as one of a number of outcomes.

Implications for Policy and Practice

The factors driving poor outcomes in injured persons seeking or receiving compensation cannot be determined from these studies, especially the role of factors that are outside of the injured person's control, such as political environment or the attitudes of key stakeholders in health services. That said, the evidence does imply that processes that generate increased stress (eg, engaging in litigation, number of medical assessments) and feelings of injustice (eg, due to fault) play a role in chronic pain outcomes. Tailoring procedures and interactions to reduce the stressful and adversarial nature of seeking compensation for all injured persons is advisable given this evidence. Ensuring that communication style and claim-related processes are clear, accessible and equitable for injured persons,

particularly being sensitive to health literacy, beliefs, and behavior, could reduce the need for involving a lawyer and facilitate recovery.

Although it is important to demonstrate severity and impact of injury to receive compensation, the number of medical assessments was linked to increased health care utilization in general,²⁹ and poor pain outcomes, especially for those with less serious injuries.⁴⁵ These injured persons may be at the greatest risk of perceiving distrust from health and compensation systems due to concerns about malingering, creating secondary victimization. Second, involving a lawyer was associated with poorer recovery and perceptions of procedural injustice.⁶⁸ Lawyers are a more integral part of the process in Tort systems when suing the negligent party for damages. However, many clients in No-Fault systems nonetheless also seek legal representation to assist with their claim. Screening for clients at greater risk of stressful reactions—such as those with greater financial losses due to reduced work capacity or preexisting psychopathology⁶⁶—and perception of injustice may allow more sensitive handling of those clients.

Future Directions and Recommendations

The results of this review indicate a strong need for high-quality research examining the role of compensation systems in long-term recovery following MVC. Future research should adhere to the IMMPACT guidelines and adopt consistent, valid, and sensitive outcome measures for assessing pain.⁷⁰ This will facilitate better comparisons across studies and schemes. Moreover, the trajectory of recovery must take into consideration preinjury characteristics, and follow-up outcomes over time periods that can realistically capture the impact of compensation-related experiences on recovery. We recommend a minimum follow-up period of 6 months, but ideally at least 18 months. Further research is required to identify the complex interactions between factors that are associated with the transition to chronic pain in individuals who are seeking or receiving compensation. These include examining whether socioeconomic demographics (eg, age, education, employment, income) and psychological characteristics (ie, symptoms of anxiety, depression, and PTSD) mediate the relationship between compensation and chronic pain following MVC, and whether changing modifiable aspects of compensation schemes (eg, length and complexity of paperwork or medico-legal assessments) has a meaningful impact on outcomes.

CONCLUSIONS

Road trauma costs billions of dollars annually.⁷¹ A large proportion of this cost is borne by compensation systems, with trickle on effects apparent with reduced participation in society. The current evidence shows that seeking and receiving compensation for MVC-related injuries is associated with more prevalent and severe chronic pain, and poorer functional and psychological health outcomes. Limited evidence suggests that Tort claimants, when compared with No-Fault claimants, report poorer outcomes. Improving claimant health outcomes is a high priority for health and compensation systems, and there remains a need for high-quality evidence on the relationship between compensation and pain.

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