

Association Between Compensation Status and Outcome After Surgery

A Meta-analysis

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COMPENSATION STATUS IS OFTEN associated with poor outcome after therapeutic intervention. This association has been noted since the late 19th and early 20th centuries in conditions compensated through litigation, such as “railway spine,”^{1,2} and with the introduction of workers’ compensation laws in industrialized countries.³⁻⁵ The association has been investigated in meta-analytic reviews regarding outcomes after head injury⁶ and treatment for chronic pain⁷ but not for outcome after surgery.

Diversity of opinion exists: some authors^{8,9} believe that seeking compensation is not a major predictor of outcome, yet others¹⁰⁻¹⁴ have found that compensation is the strongest predictor of poor outcome. Since it is not possible to perform a randomized controlled trial for compensation, conclusions can be drawn only from observational data. This may allow selection bias and confounding due to, for example, differing demands and expectations in patients who receive compensation.

However, any association between compensation status and outcome is important, not only clinically, as it may influence clinical decision making, but

Context Compensation, whether through workers’ compensation or through litigation, has been associated with poor outcome after surgery; however, this association has not been examined by meta-analysis.

Objective To investigate the association between compensation status and outcome after surgery.

Data Sources We searched MEDLINE (1966-2003), EMBASE (1980-2003), CINAHL, the Cochrane Controlled Trials Register, and reference lists of retrieved articles and textbooks, and we contacted experts in the field.

Study Selection The review included any trial of surgical intervention in which compensation status was reported and results were compared according to that status. No restrictions were placed on study design, language, or publication date. Studies were selected by 2 unblinded independent reviewers.

Data Extraction Two reviewers independently extracted data on study type, study quality, surgical procedure, outcome, country of origin, length and completeness of follow-up, and compensation type.

Data Synthesis Two hundred eleven studies satisfied the inclusion criteria. Of these, 175 stated that the presence of compensation (workers’ compensation with or without litigation) was associated with a worse outcome, 35 found no difference or did not describe a difference, and 1 described a benefit associated with compensation. A meta-analysis of 129 studies with available data ($n = 20\,498$ patients) revealed the summary odds ratio for an unsatisfactory outcome in compensated patients to be 3.79 (95% confidence interval, 3.28-4.37 by random-effects model). Grouping studies by country, procedure, length of follow-up, completeness of follow-up, study type, and type of compensation showed the association to be consistent for all subgroups.

Conclusions Compensation status is associated with poor outcome after surgery. This effect is significant, clinically important, and consistent. Because data were obtained from observational studies and were not homogeneous, the summary effect should be interpreted with caution. Compensation status should be considered a potential confounder in all studies of surgical intervention. Determination of the mechanism for this association requires further study.

JAMA. 2005;293:1644-1652

www.jama.com

also economically, as workers’ compensation and insurance costs form a significant part of the costs of government and business.

We hypothesize that patients who receive compensation are more likely to have an unsatisfactory outcome after

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surgery compared with noncompensated patients. This systematic review aims to examine the direction and magnitude of any association between compensation and outcome after surgical intervention and to explore possible causes of heterogeneity.

METHODS

The review included any trial of surgical intervention in which compensation status was reported and results were compared according to that status. A compensated patient was defined as any patient who received workers' compensation payments for his/her condition or who underwent litigation as a result of his/her preoperative condition. Studies must have included at least 1 compensated patient and 1 noncompensated patient and must have ascertained compensation status prior to surgery.

Surgical intervention was defined as any surgery performed, regardless of the specialty of the surgeons. Studies examining the effect of injections of local anesthetic or steroids, application of splints, or rehabilitation were excluded.

The abstracted outcome used, when available, was a region-specific outcome score (eg, Low Back Outcome Score,¹⁵ Harris Hip Score¹⁶). If this was not provided, the following outcomes were abstracted (in order of preference): a general functional score, a general health outcome score (eg, Short-Form 36¹⁷), a patient satisfaction score, or a pain score. Outcome scores measuring time to return to work were excluded because this outcome is influenced by confounding factors such as job characteristics and social factors^{18,19} and has been shown to be a poor measure of outcome for compensated patients.²⁰

Outcome was classified as satisfactory or unsatisfactory as reported by the study investigators. If this information was not provided, outcome scores of "excellent" or "good" were classified as satisfactory, and outcomes labeled as "fair," "poor," or "failure" were classified as unsatisfactory according to usual reporting of surgical studies.

The electronic database search strategy used *compensation* as a text word

or the subject heading *compensation and redress*, combined with *surgery* or *surgical procedures, operative*. Searches were limited to any form of clinical study in any language. Animal studies were excluded. Unpublished studies were not included. The exact search strategy is available from the authors.

Articles were sourced from MEDLINE (1966-2003), EMBASE (1980-2003), CINAHL, the Cochrane Controlled Trials Register, reference lists of retrieved articles and textbooks, and through contact with experts in the field. Duplicate articles were dealt with by inclusion of only the most recent publication. Authors were not contacted.

Two authors (I.H. and J.M.) reviewed all abstracts and selected articles for retrieval. All retrieved articles were reviewed independently by the same authors (for inclusion criteria and data extraction) and differences were resolved by discussion. The reviewers were not blinded to any aspect of the studies (eg, journal type, author names, or institution).

Each article that met the inclusion criteria was reviewed for compensation type (workers' compensation, litigation, or both), publication year, country of origin, procedure, whether the article was designed specifically to detect a compensation effect, length of follow-up (0-6, 7-12, 12-24, or >24 months), and outcome. Methods were examined by recording study type (randomized controlled trial, cohort study, or case series and prospective vs retrospective), completeness of follow-up, randomization concealment, and blinding of outcome assessment. Subgroup analyses according to these variables were planned a priori to explore any heterogeneity. The investigators' conclusions regarding the effect of compensation were also recorded.

The data described herein were selected for extraction because they were possible confounders or causes of heterogeneity in the association under investigation.

Cochrane Review Manager software, version 4.2,²¹ was used to ana-

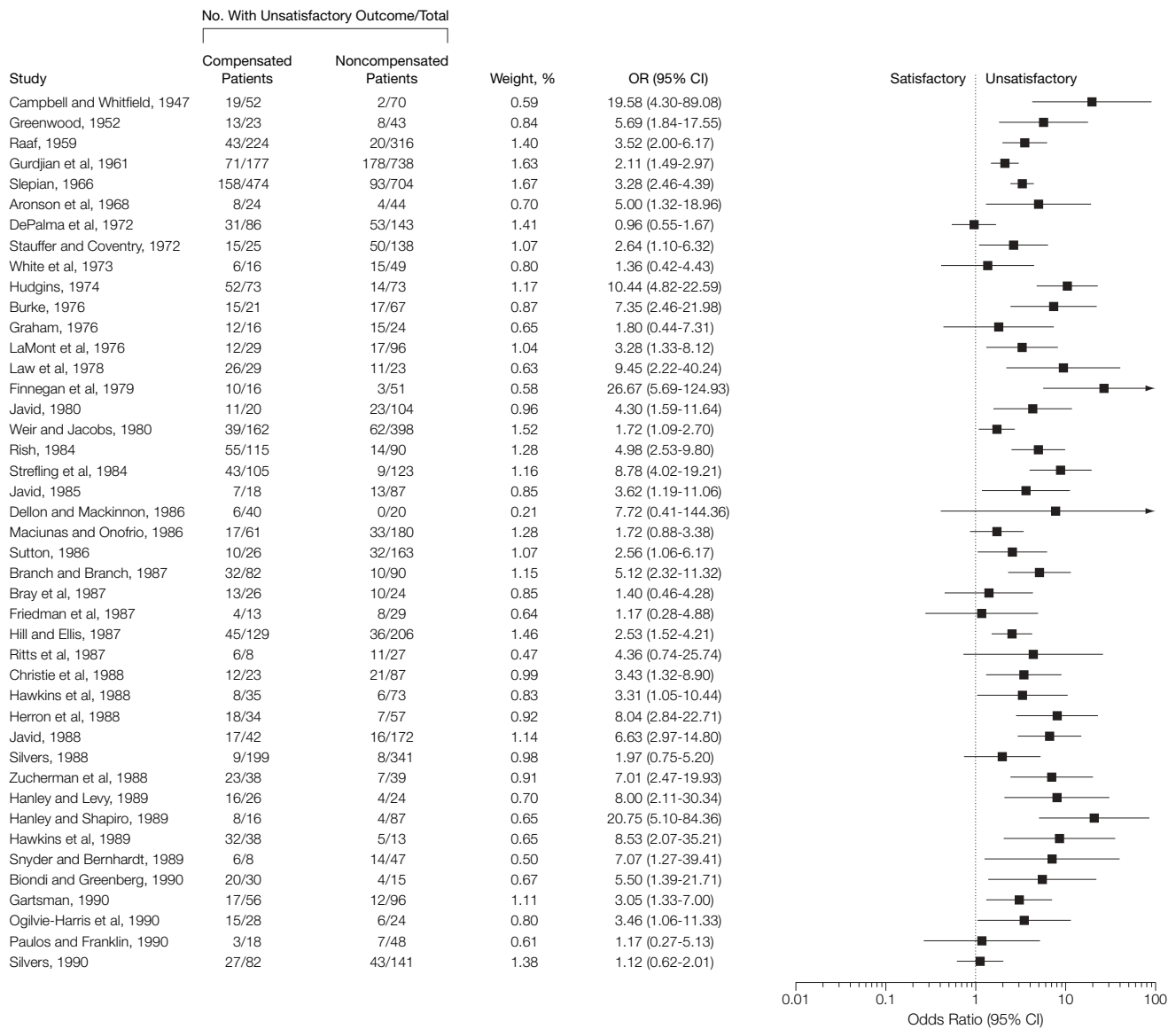
lyze the data. Data were entered by 1 author (I.H.) and checked by another (J.M.). Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for dichotomous outcomes (satisfactory/unsatisfactory). Standard mean difference was given for continuous outcomes and were analyzed separately from the dichotomous outcomes because of the statistical difficulties of combining dichotomous and continuous variables. The results were examined for heterogeneity by examining the forest plot, comparing the summary OR using random- and fixed-effects models, and using statistical tests for heterogeneity. Funnel plots were used to look for publication bias. Meta-regression, to investigate any association between the recorded variables and the effect size, was performed using Bayesian hierarchical methods²² and WinBUGS software, version 1.4.²³ The models used are available from the authors.

RESULTS

The MEDLINE search found 1192 studies, EMBASE found 927, and CINAHL found 159. The Cochrane Controlled Trials Register contained no extra studies. Most studies could be excluded from information provided in the abstract. The final number of complete articles retrieved for review (from all sources) was 305, of which 211 satisfied the inclusion criteria.

There were 4 randomized controlled trials, 45 cohort studies (containing a control group), and 162 case series. None of the randomized controlled trials randomized patients to receive or not receive compensation; therefore, the data from these studies pertaining to the difference in outcome between compensated and noncompensated patients were observational, as for the other studies. Twenty-four of the cohort studies were specifically designed to look at outcomes in compensated vs noncompensated patients. There were no studies in which treatment was allocated according to compensation status. Two studies were excluded because com-

Figure 1. Forest Plot of Random-Effects Odds Ratios (ORs) and 95% Confidence Intervals (CIs) for Each Study in the Meta-analysis



(continued)

compensation was provided only if patients had a poor outcome.

None of the randomized controlled trials stated that randomization was concealed. No study stated that the outcome assessor was blinded to compensation status.

Of the 211 studies, 175 described a worse outcome in the compensation group, 30 described no difference between the groups, 5 did not comment on the difference, and 1 de-

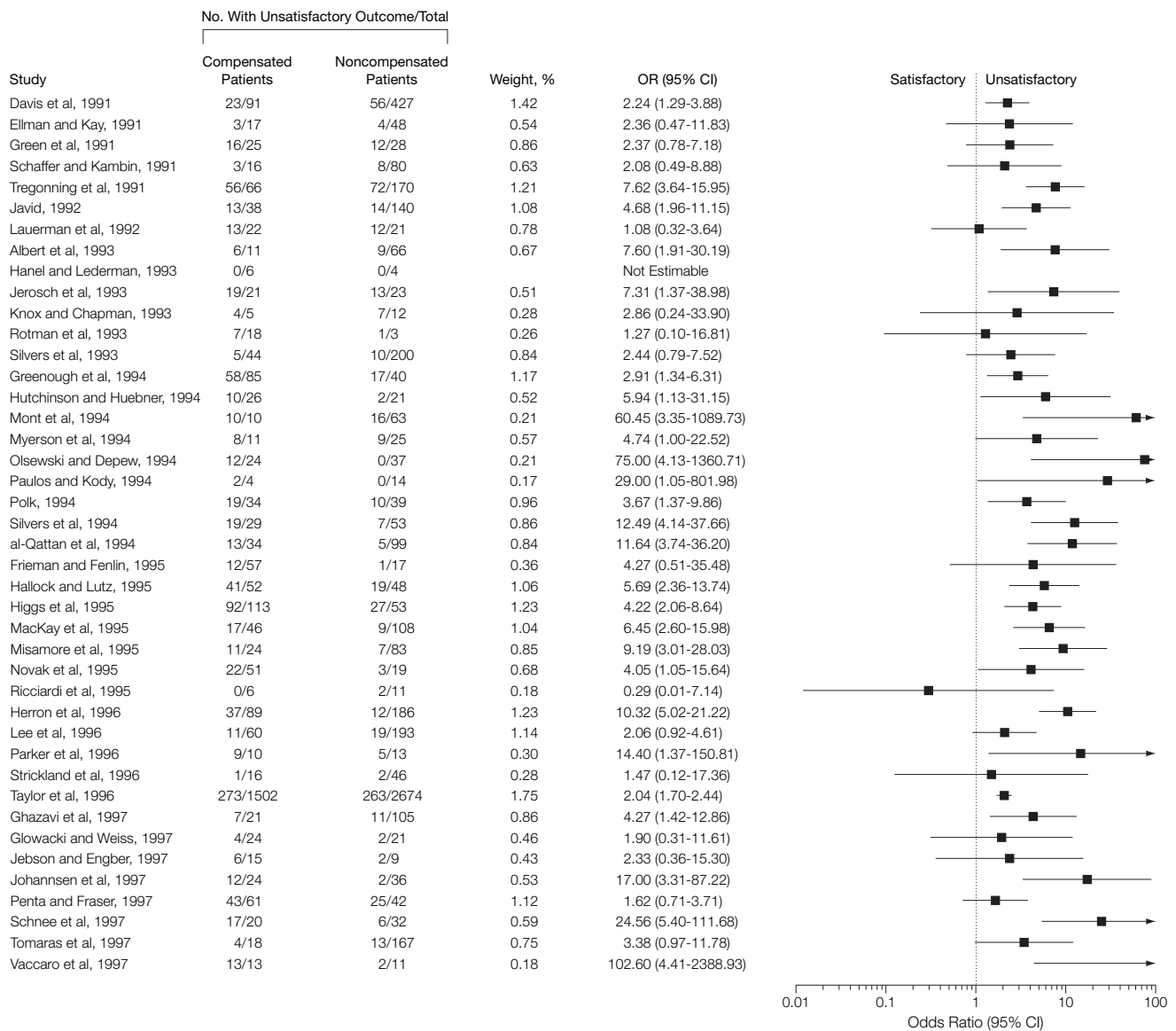
scribed better outcome in the compensation group.

One hundred twenty-nine studies had dichotomous outcome scores available for comparison and were included in the meta-analysis (see <http://www.jama.com> for Appendix of references to the included studies). These studies included information on 7244 compensated and 13 254 noncompensated patients. All but 5 of the included studies showed a positive association between

compensation and poor outcome. None of the results of the 5 studies showing a negative association reached statistical significance. The summary OR for an unsatisfactory outcome in compensated patients was 3.79 (95% CI, 3.28-4.37 by random-effects model). The results for each study and the overall estimate are shown as a forest plot in FIGURE 1.

The OR using a fixed-effects model was 3.12 (95% CI, 2.89-3.36). The dif-

Figure 1. Forest Plot of Random-Effects Odds Ratios (ORs) and 95% Confidence Intervals (CIs) for Each Study in the Meta-analysis (cont)



(continued)

ference in the OR between the random-effects and fixed-effects models indicates some degree of heterogeneity. The χ^2 test for heterogeneity was significant ($\chi^2_{127} = 308.88; P < .001$); however, this test has excessive power in large meta-analyses and the P value does not reasonably describe the extent of heterogeneity in the results.²⁴ The I^2 value, indicating the proportion of the total variation due to heterogeneity, was 58.9%.²⁴

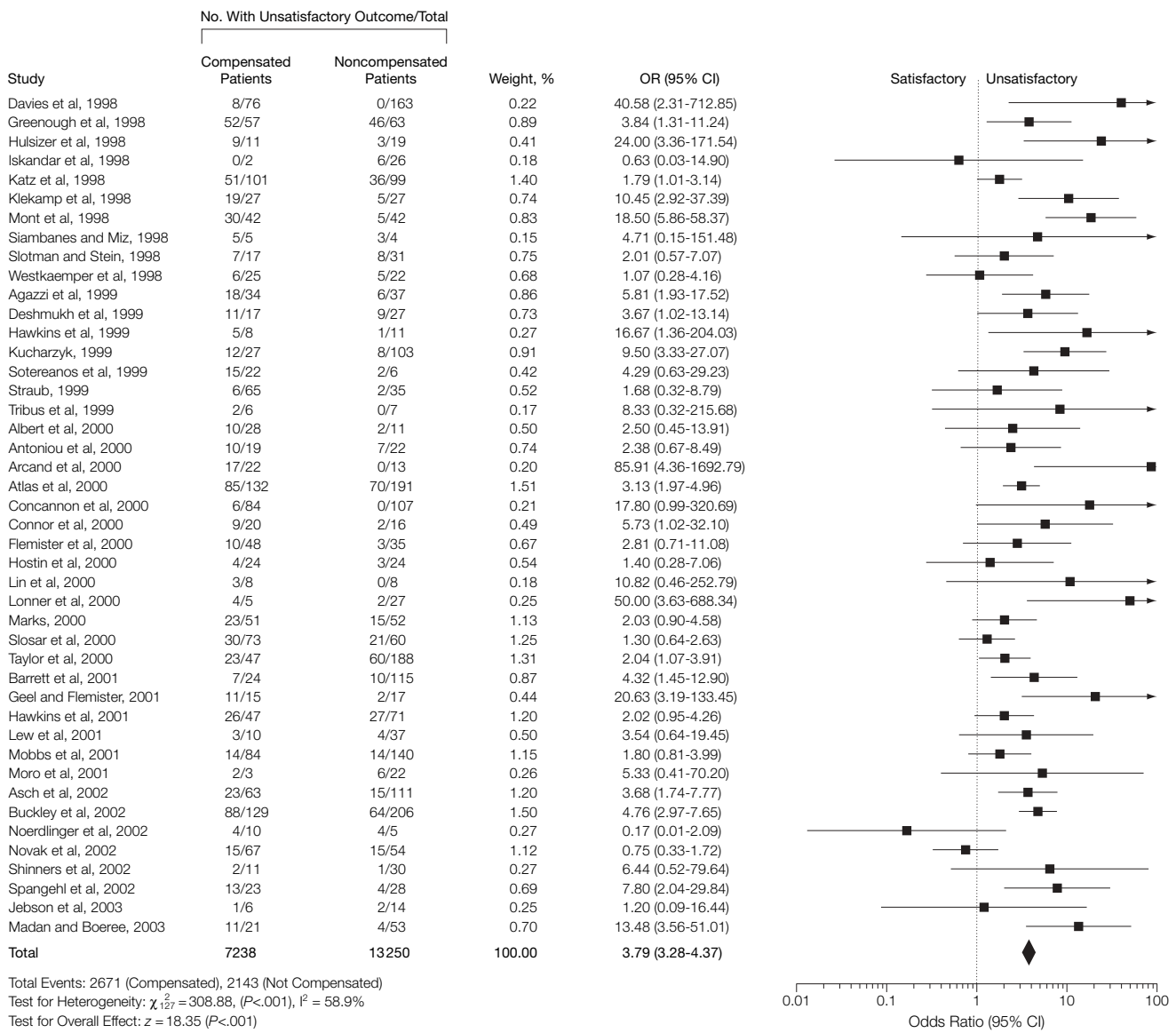
Subgroup analyses were performed to examine possible causes of heterogeneity (TABLE). The positive association between compensation and unsatisfactory outcome was observed in all subgroups, with little variation in the magnitude of the association.

Analysis according to study type, minimum length of follow-up, completeness of follow-up, and prospective vs retrospective design revealed no significant difference in the ORs (Table).

Because of the association between compensation and injury, most studies dealt with orthopedic, plastic, and spinal surgery. The ORs for the 5 most common procedures (shoulder arthroplasty, carpal tunnel release, lumbar discectomy, lumbar spine fusion, and lumbar intradiscal injection of chymopapain) were similar (Table).

Analysis according to geographic origin showed a stronger association in European studies and a weaker associa-

Figure 1. Forest Plot of Random-Effects Odds Ratios (ORs) and 95% Confidence Intervals (CIs) for Each Study in the Meta-analysis (cont)



See <http://www.jama.com> for Appendix of references to the studies included in the meta-analysis.

tion in studies from Australia. Both of these groups, however, contained a small number of studies (Table).

The OR for studies specifically examining the effect of compensation (ie, studies designed as a compensation vs noncompensation cohort) was similar to the OR in studies not specifically designed to examine the effect of compensation (Table).

The OR for studies examining only patients receiving workers' compensa-

tion (not litigation) was similar to studies examining patients treated under workers' compensation or litigation (Table). No studies examined litigating patients exclusively.

In general, the level of heterogeneity decreased in the subgroups. Greater homogeneity was observed in the prospective studies ($P = .03$), randomized controlled trials ($P = .46$), and the European and Australian studies ($P = .68$ and $P = .67$, respectively). Grouping by

procedure also reduced heterogeneity. Heterogeneity remained high for other subgroups.

In univariate meta-regression, the a priori variables (including year of publication) were found not to be remotely significantly associated with the effect of compensation on the risk of an unsatisfactory outcome. The effect of sample size, however, was such that the effect size was significantly smaller in larger studies.

A post hoc analysis was performed to assess the effect of revision vs primary surgery (Table). This showed the association between compensation and poor outcome to be stronger in studies of revision surgery. Analysis of this variable by meta-regression, which included studies with mixed populations according to the ratio of revision to primary cases, showed this association to be highly significant.

A funnel plot of all included studies (FIGURE 2) revealed some asymmetry in studies with larger standard errors.

Of 13 studies reporting continuous outcomes, 10 noted a statistically significant association between compensation status and poor outcome and 3 noted no significant difference, consistent with the findings of the studies with dichotomous outcomes. Because only 4 of these studies provided means and standard deviations necessary to calculate standard mean difference, a meta-analysis was not undertaken for this group.

COMMENT

This systematic review and meta-analysis of the surgical literature shows a strong association between compensation status and poor outcome after surgery. The association is maintained when allowing for type of intervention, type of compensation, country of origin, date of publication, or methodological aspects (length and completeness of follow-up, prospective vs retrospective design, and study type).

In many studies, compensation status was the most significant predictor of outcome compared with all other diagnostic and demographic variables^{10-12,25-46} or treatment variables.^{12,13,26,28,32,45,47-56}

Although the results are not homogeneous, they are consistent; 123 of the 129 studies included in the meta-analysis showed a positive association between compensation status and poor outcome (Figure 1). Some variability in the association was expected considering the differences in the procedures, the compensation systems, the

populations, and the outcome measures. Heterogeneity in the subgroups was less than in the overall analysis, particularly when grouped by procedure or geography.

The findings are consistent with previous meta-analytic reviews of the effect of compensation on outcome after treatment for chronic pain⁷ and recovery from head injury,⁶ which found compensation to be associated with poor outcome.

The exclusion of unpublished studies may result in an increased estimate of effect. This has been shown by McAuley et al,⁵⁷ but Egger et al,⁵⁸ in a similar study, did not find this to sig-

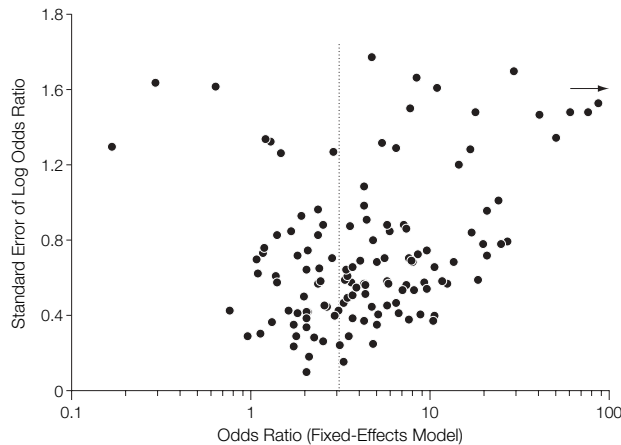
nificantly influence the estimate of effect.

Publication bias may be present, either because of the selective publication of studies showing an association or the selective reporting of an association only when it exists. This may lead to an increase in the estimate of the association.^{59,60} If publication bias were present because of the increased likelihood of the association being reported if it is positive, one would expect an increased effect size in studies not specifically concerned with the association (where reporting is optional) compared with studies specifically designed to examine the

Table. Subgroup Analysis of the Association Between Compensation Status and Unsatisfactory Outcome

Subgroup	No. of Studies	Odds Ratio (95% Confidence Interval)
Study type		
Randomized controlled trial	2	5.03 (3.22-7.86)
Cohort study	30	3.58 (2.74-4.67)
Case series	97*	3.87 (3.25-4.61)
Minimum time to follow-up, mo		
0-6	21	3.81 (2.72-5.34)
7-12	30	4.02 (3.08-5.25)
13-24	34*	4.36 (3.17-6.01)
>24	30	3.44 (2.60-4.55)
Completeness of follow up, %		
≥80	111*	3.84 (3.30-4.47)
<80	18	3.61 (2.39-5.47)
Prospective vs retrospective design		
Prospective	15	3.60 (2.70-4.80)
Retrospective	114*	3.84 (3.27-4.50)
Procedure		
Shoulder acromioplasty	13	4.48 (2.71-7.40)
Lumbar spine fusion	19	4.33 (2.81-6.62)
Lumbar spine discectomy	24	4.77 (3.51-6.50)
Lumbar intradiscal chymopapain injection	9	3.67 (2.45-5.51)
Carpal tunnel decompression	10	4.24 (2.43-7.40)
Country of origin		
United States	106*	3.77 (3.20-4.43)
Canada	12	4.02 (2.65-6.09)
Europe, all	6	7.42 (4.37-12.60)
Australia	5	2.23 (1.49-3.35)
Study designed to assess compensation effect		
Yes	16	3.60 (2.50-5.20)
No	113*	3.85 (3.29-4.51)
Compensation type		
Workers' compensation only	86*	3.89 (3.26-4.64)
Workers' compensation and litigation	43	3.69 (2.88-4.73)
Revision vs primary surgery		
Primary surgery only	81	3.66 (3.07-4.36)
Revision surgery only	19	5.54 (3.47-8.83)

*Includes 1 study with an unestimatable odds ratio (no unsatisfactory outcomes).

Figure 2. Funnel Plot of the Odds Ratios for All Studies in the Meta-analysis

Dotted line indicates summary odds ratio. Arrow at top right indicates outlier odds ratio of 102.6.

association (which would report the association regardless of the direction or magnitude of the effect). This was shown in this meta-analysis (Table), providing some evidence of publication bias; however, the difference was small and not significant in meta-regression, and the association remained strong in both groups. The funnel plot (Figure 2) is also suggestive of some publication bias.

Because this study relies on observational data, confounding should be considered. Confounding may occur because of differences in the 2 patient groups, such as differences in expectations, demands, socioeconomic status, and job description. However, studies incorporating multivariate analysis have shown that the association between compensation and outcome is maintained when allowing for demographic factors, diagnosis, and treatment factors.^{26-28,34}

Selection bias may explain the association if compensated patients had increased disease severity. This has not been shown previously, but the opposite may also be true: that patients who have received compensation are more likely to be diagnosed as having—and undergo treatment for—certain conditions. Previous studies have shown that compensated patients are more likely to be diagnosed as having whiplash, re-

petitive strain injury, and thoracic outlet syndrome⁶¹⁻⁶⁴ and are more likely to undergo surgery.⁶⁴

It should be noted that patients' compensation status was known prior to surgery in the studies included in this analysis. Two studies were excluded because compensation status was dependent on the outcome of the surgery.

A limitation of meta-analysis is that it is dependent on adequate data from the original articles to calculate a summary statistic. This meta-analysis only includes data from 129 of the 211 studies included in the review, introducing the possibility of bias due to underrepresentation. However, if all 211 studies are considered, only 1 of these concluded that compensated patients had better outcomes, and 175 concluded that outcomes were worse in compensated patients.

We also acknowledge that lack of standardized reporting of outcomes is a limitation in this meta-analysis. The majority of studies (114/129) reported the outcome as dichotomous. In the remaining studies, we dichotomized the outcomes. Our method, grouping "excellent" and "good" as satisfactory, was the same as that used by the majority of the investigators who reported dichotomous outcomes. Furthermore, a diverse range of outcome tools were used in the original stud-

ies; this may have led to some inconsistency in classification of outcomes. Unless reporting of surgical outcome becomes standardized, this will always be a problem when combining data from multiple studies.

Previous studies have shown a dose-response relationship by correlating health outcomes with the level of compensation.⁶⁵⁻⁷¹ If compensation causes poor outcome, consideration should be given to the mechanism. The effect of compensation on outcome may be related to psychological factors related to the injury and the compensation process,^{62,72-75} as well as secondary gain (from financial benefits or the benefits of assuming the sick role)^{76,77} and tertiary gain (maintenance of health care utilization to benefit a third party).⁷⁸⁻⁸⁰ The adversarial nature of litigation and compensation insurance may also contribute to the association.⁸¹⁻⁸⁴

Previous studies have shown that compensation for pain and suffering is associated with an increased incidence of illness and prolonged recovery. These studies have shown significant differences before and after the introduction of no-fault injury compensation (replacing tort-based compensation) in Saskatchewan⁸⁵ and have compared different countries with and without no-fault schemes.⁸³ Generally, no-fault schemes make redress through the courts and claims for pain and suffering much more difficult. The improved outcomes in systems that discourage legal redress and compensation for pain and suffering provide evidence for 2 possible mechanisms for the association: the decrease in potential secondary (financial) gain and the decrease in exposure to the prolonged and adversarial tort system.

Attributing the effect to secondary gain implies conscious or unconscious illness exaggeration by patients who receive compensation. This has been explored previously and, although evidence of conscious exaggeration of symptoms exists, it probably only accounts for a small proportion of the difference in outcome.⁸⁶⁻⁸⁸

The association with litigation may be due to a greater tendency to litigate among patients with poorer outcomes. Although this has not been shown previously, it may explain the association observed in many studies between poor outcome and retaining the services of a lawyer for the claim.^{44,89-92} However, there is also some evidence that coaching by lawyers may influence the reporting of symptoms by patients.⁹³

Differences in the effect between subgroups may also provide information about the mechanism for the association. Although most subgroups showed similar estimates of effect, the largest differences were observed between geographic regions (Table), suggesting that disparities in the compensation and legal systems between countries may be important. Because the CIs for the region-specific estimates overlapped, however, these variations may be due to sampling error rather than true differences. Furthermore, meta-regression did not show the country of origin to be significantly associated with the magnitude of the association.

Conclusions regarding cause and effect cannot be drawn from this research; stronger evidence is required from prospective studies with matched controls. Further research may also provide information regarding the mechanism of the association, which, in turn, may guide change in these health systems to improve outcomes. If the findings of this review are borne out in later prospective studies, it may assist in identifying patients who are at risk of a poor outcome. The findings of this review are also relevant to users and providers of compensation-based health systems, since poor outcome after therapeutic intervention for compensated patients affects productivity and business costs, as well as quality of life for the patients involved.

CONCLUSIONS

This systematic review of the literature revealed that patients treated under compensation schemes or undergoing litigation consistently have worse outcomes after surgery than noncom-

pensated patients. Of the 211 studies reviewed, 175 reported a worse outcome in compensated patients. Overall, compensated patients have more than 3 times the odds of an unsatisfactory outcome compared with noncompensated patients.

The findings of this review are based on observational data, and confounding and bias (from selection bias and differences in disease severity and illness reporting) may account for part of the effect. Further prospective research controlling for these factors is required to confirm the findings of this review and to determine the mechanism for any association between compensation status and outcome.

Author Contributions: Dr Harris had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Harris, Mulford, Solomon, Young.

Acquisition of data: Harris, Mulford.

Analysis and interpretation of data: Harris, Solomon, van Gelder, Young.

Drafting of the manuscript: Harris, Mulford.

Critical revision of the manuscript for important intellectual content: Harris, Mulford, Solomon, van Gelder, Young.

Statistical analysis: Harris, van Gelder, Young.

Administrative, technical, or material support: Harris, Mulford.

Study supervision: Harris, Solomon, Young.

Financial Disclosures: The authors declare no financial interests relating to this article and no conflict of interest.

Additional Materials: The complete meta-analysis reference list is available at <http://www.jama.com>.

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