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Assendelft, W.J.J.; Bouter, L.M.

#### ***published in***

Journal of Manipulative and Physiological Therapeutics  
1993

#### ***document version***

Publisher's PDF, also known as Version of record

[Link to publication in VU Research Portal](#)

#### ***citation for published version (APA)***

Assendelft, W. J. J., & Bouter, L. M. (1993). Does the Goose Really Lay Golden Eggs - A Methodological Review of Workmens-Compensation Studies. *Journal of Manipulative and Physiological Therapeutics*, 16(3), 161-168.

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## Reviews of the Literature

# Does the Goose Really Lay Golden Eggs? A Methodological Review of Workmen's Compensation Studies

WILLEM J.J. ASSENDELFT, M.D.\* AND LEX M. BOUTER, Ph.D.†

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### ABSTRACT

*Objective:* To assess the value of workmen's compensation (WC) studies to determine the effectiveness of chiropractic. Therefore, the results of the available WC studies are summarized and the methodological quality of WC studies is discussed.

*Data Sources:* All studies were eligible without time restriction. Studies were identified by a Medline search from 1966 to 1990 (key words: chiropractic, and manipulation-orthopedic in combination with comparative studies, follow-up studies, evaluation studies) by manual examination of the most important chiropractic reference systems (CRAC and Index to Chiropractic Literature), by tracking the reference lists of identified (reviews of) WC studies and by correspondence with researchers.

*Study Selection:* Studies were regarded as WC studies if by means of databases of WC boards, a comparison was made between claimants treated by chiropractors and those treated by other health care professionals. At least one of the following outcomes should be reported: compensated days, compensation paid or treatment costs.

*Data Extraction:* Relevant data (authors, year, state, study population, number of patients, days compensated, compensation paid, number of treatments, consultation costs, additional treatment costs and total cost

per case) were extracted by one nonblinded observer. The methodological value was reviewed narratively.

*Data Synthesis:* The retrospective character of WC studies and the use of large WC databases harbor severe methodological problems like incomparability of study groups, absence of information on prognostic indicators, insufficient outcome measures and missing data. The results of older WC studies (before 1980) and the more recent WC studies, which were of better methodological quality, are presented separately. The older studies are in favor of chiropractic. Two of the six more recent WC studies challenge chiropractic effectiveness.

*Conclusions:* WC studies in general report positive results for chiropractic. Recent results are more ambiguous. Because of the methodological drawbacks identified, WC studies are insufficient to enable a valid study made of chiropractic effectiveness. Therefore, chiropractic (cost-) effectiveness is not yet convincingly proven. More effort should be directed at establishing randomized clinical trials including the question of (cost-) effectiveness. (*J Manipulative Physiol Ther* 1993; 16:161-168).

Key Indexing Terms: Workmen's Compensation, Review Literature, Chiropractic.

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\* Department of Epidemiology, University of Limburg, Maastricht, The Netherlands. † Institute for Extramural Medical Research, Free University, Amsterdam, The Netherlands.

Submit reprint requests to: Lex M. Bouter, Ph.D., Institute for Extramural Medical Research, Free University, Van de Boechorststraat 7, 1081 BT Amsterdam, The Netherlands.

Paper submitted January 14, 1992; in revised form July 23, 1992.

The project "Chiropractic in the Netherlands" supported by grant no. 89-15 of the Dutch Ministry of Welfare, Public Health and Cultural Affairs.

### INTRODUCTION

In the United States, a great number of studies using the archives and computerized databases of workmen's compensation (WC) boards have been conducted to investigate the (cost-) effectiveness of chiropractic care. The WC reimburses an employee with work-related injuries for lost wages and medical costs (1). The data from the WC boards permit the amount of time-loss compensation and treatment costs paid for claimants

attending a chiropractor (DC) to be compared with that for claimants attending a different therapist, mainly a medical doctor (MD) or an osteopath (DO). In most states, the patients are free to choose their own therapist (2). The WC legislation differs from state to state. This has important consequences for the freedom of choice of therapist, the amount of compensation paid and the tolerated absence from work (2).

WC studies are retrospective studies using (computerized) databases of state WC departments. A WC study has the advantage of accessibility, convenience and organization, but is limited by the fact that the data were gathered and computerized for administrative purposes rather than for research needs. Therefore, these studies have severe methodological drawbacks. However, WC studies are still frequently used to support the effectiveness of chiropractic care (3-5). Recently, two well-described WC studies appeared, one in a chiropractic journal (2, 6, 7) and one in a medical journal (8).

To enable the chiropractic practitioner to make a critical evaluation of the evidence supplied by existing WC studies, we first present the results of these studies. Subsequently, we discuss the methodological considerations. Finally, we will give suggestions for improvement of the quality of proof for chiropractic (cost-) effectiveness.

## METHODS

Potential relevant studies were identified with a Medline search from 1966 to 1990 (key words: chiropractic, and manipulation-orthopedic in combination with comparative studies, follow-up studies, evaluation studies), by manual examination of the most important chiropractic reference systems [CRAC (9) and Index to Chiropractic Literature (10)], by tracking the reference lists of identified (reviews of) WC studies and by correspondence with researchers.

Studies were regarded as WC studies if by means of databases of WC boards, a comparison was made between claimants treated by DCs and those treated by other health care professionals (mainly MDs). At least one of the following outcomes should be reported: compensated days and paid compensation of treatment costs. [The WC study by Kane et al. (11) will therefore not be discussed because neither research methodology nor outcome measures apply to these criteria.] The mean values were extracted by one nonblinded observer (W.J.J.A.). If studies present results from both patients who had operations and those who did not, only the nonoperated patients are presented for reasons of comparability. Results from different publications dealing

with the same study were amalgamated and condensed under the name of the most likely principal investigator (see Tables 1 and 2).

## RESULTS

In Tables 1 and 2, the outcomes of the 16 WC studies are presented (for references, see tables). The studies conducted before 1980 and those performed after 1980 are presented separately (Tables 1 and 2, respectively). There are several reasons to place greater emphasis on the more recent studies. First, they are better documented regarding calculation of compensation and treatment costs. For example, from seven of the older studies, only descriptions in review articles [especially from the American Chiropractors Association (12, 15, 21)] are available (see Table 1). In addition, opinions on optimal diagnosis and treatment, and, consequently, resulting costs change in time. Finally, recent changes in the American health care system, especially regarding the position of chiropractic (32), make it more useful to emphasize the results of the more recent studies (Table 2).

The older studies (Table 1) are all in favor of chiropractic; DC patients have fewer compensated days, and compensation and treatment costs are lower.

The results of the more recent studies (Table 2) are less consistent. The results of Jarvis (30, 31), Johnson (22-24) and both studies by Wolk (27-29) report results similar to the older studies. In the studies by Wolk (27-29), the consultation costs of DCs are higher than those claimed by MDs. If, however, additional treatment costs (like transportation, drugs, diagnosis by others, etc.) are also incorporated, the resulting total treatment costs turn out to be lower for DCs.

Greenwood (8) and Nyiendo (2, 6, 7, 25, 26) report less favorable results. Both studies show higher total treatment costs for DC patients compared to MD patients. Nyiendo found that consultation costs are much higher for DCs. Also, the number of compensation days and related costs in both studies are higher for DC patients than for MD patients.

Four of the six studies presented in Table 2 also included patients treated by a DO [Greenwood (8), Johnson (22-24), Wolk (27-29)]. DOs in the United States have roughly the same competence as MDs (32). Greenwood (8) simply added the results of the few DO patients to the results of MD patients. Since the other three studies report on only relatively few DO patients, the results of DOs are not presented separately. Johnson (22-24) reported more compensation days for DO patients, with a relatively high amount of paid compensation. The consultation costs, on the other hand, were

TABLE 1. WC studies before 1980

First Author (ref) Year, <sup>a</sup> State	Description of Patients	Patients Excluded	Number of Patients DC/MD	Days Compensated DC/MD	Compensation Paid DC/MD	Number of Treatments DC/MD	Consultation Costs DC/MD	Additional Treatment Costs DC/MD	Treatment and Compensation Costs DC/MD
Am Chir Assoc (3, 12) 1949, Colorado	-	-	1,389/354	3/5	-	-	-	-	21/34
Flor Chir Assoc (13, 14) 1956, Florida	Back and neck sprains or strains	-	19,666 DC/MD?	3/9	9/37	9/6	51/65	-	60/102
Am Chir Assoc (15) 1966, Iowa	-	-	-	-	-	-	68/119	-	-
Am Chir Assoc (15) 1969, Iowa	-	-	-	-	-	-	79/211	-	-
Am Chir Assoc (12) 1971, Kansas	-	-	-	6/13	-	-	68/118	-	-
Am Chir Assoc (12) 1971, Oregon	Back sprains or strains	-	-	-	-	-	-	-	73/299
Wolf (8, 12, 16) 1972, California	Back injury	-	296/333	16/32	-	-	-	-	-
Bergeman (17, 18) 1975, Oregon	Back sprain or strain	Operation; chronic complaints	113/114	19/41	404/902	-	181/327	-	-
Am Chir Assoc (8, 19) 1977, Iowa	Neck and back injuries	Operation	247/543	22/25	262/360	11/12	-	-	-
Duffy (20) 1978, Wisconsin	Back sprain or strain	Fracture	212/430	13/22	286/443	-	146/268	-	-
Am Chir Assoc (21) 1978, Montana	Back strain or sprain	-	46/52	14/20	316/464	-	-	-	-

<sup>a</sup> Year of data collection; -, data not presented; DC = doctor of chiropractic; MD = doctor of medicine; all costs in U.S. \$; presented outcome are means.

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TABLE 2. WC studies after 1980

First Author (ref) Year, <sup>a</sup> State	Description of Patients	Patients Excluded	Number of Patients DC/MD	Days Compensated DC/MD	Compensation Paid DC/MD	Number of Treatments DC/MD	Consultation Costs DC/MD	Additional Treatment Costs DC/MD	Treatment and Compensation Costs DC/MD
Greenwood (8) 1981 W. Virginia	Back and neck sprain or strain	Operation	200/200	58/39	1887/1100	<sup>b</sup>	1276/545 <sup>c</sup>		-
Johnson (22-24) 1984 Iowa	Back and neck sprains or strains	-	266/494	12/14	264/618	-	223/352	-	-
Nyendo (2, 6, 7, 25, 26) 1985 Oregon	Low back pain with/without transient sciatica	Neurological deficit	94/94	41/39	1686/1421	41/10	1451/854	496/421	-
Wolk (27, 28) 1986 Florida	Diagnostic related group: back problems open and closed claims	Operation	9,298/39,703	-	-	-	486/276	72/538	-
Wolk (29) 1986 Florida	Diagnostic related group: back problems closed claims	Operation	1,296/8,684	39/58	1159/1483	-	1003/1558	DC < MD <sup>d</sup>	-
Jarvis (30, 31) 1986 Utah	6 selected ICD 9 codes (back pain)	Operation	769/837	2/21	68/668	13/5	1204/2213 <sup>c</sup>	525/684 <sup>c</sup>	-

<sup>a</sup> Year of data collections.

<sup>b</sup> - = data not presented.

<sup>c</sup> Consultation costs and treatment costs together.

<sup>d</sup> Data not condensable to one figure, for all these cases: DC < MD; DC = doctor of chiropractic; MD = doctor of medicine; all costs in US \$; presented outcomes are means.

lower than for DCs and MDs. Finally, Wolk reported in his studies (27–29) that DOs accomplished the most favorable results regarding the number of compensation days, compensation costs, as well as treatment costs.

## DISCUSSION

### Sources of Bias

**Prognostic Comparability:** From a methodological point of view, the possibility of (self) selection in the choice of treating physician is the most serious objection to WC studies. The choice of therapy is often related to factors which influence treatment result, such as risk factors, clinical condition and severity of the injury. These determinants are sometimes subtle and difficult to quantify (2, 33). Several authors of WC studies explicitly state in their discussion that they assume no major differences in the characteristics of DC patients compared to MD patients (22, 27, 30). It is doubtful whether this claim is warranted. Few studies enable a direct comparison between patients of DCs and MDs. In Utah, Phillips (34) studied DC and MD patients at their first visit. He found no difference on most demographic and psychological variables. In addition, a difference in pain score on a visual analogue scale could not be detected. However, the score on the Oswestry scale [multidimensional back pain scale (35)] was less favorable for patients treated by MDs. Ferguson and Johnson (36) studied the occupation and social status of WC claimants attending DCs and MDs in Iowa. They concluded there was no difference in the distribution of white vs. blue collar workers between the groups. Kane et al. (11) found that patients preferring treatment by an MD were more disabled at the time of their first visit than were DC patients. The WC study by Nyiendo (2, 6, 7, 25, 26) is alone in identifying prognostic factors through manual examination of patient records. There were some remarkable differences between patients from DCs and MDs. DC claimants were more likely to have a history of chronic, recurrent low back pain and had suffered exacerbation episodes more often. Patients of MDs more frequently had an affected nerve root at presentation. For the WC study, Jarvis (30, 31) selected 12 back-related International Classification of Diseases codes. Six of these diagnoses were so heavily overrepresented in the MD provider group that they later had to be excluded from analyses.

In Europe, the pilot study for the randomized clinical trial by Meade et al. (37) in Great Britain offered the possibility of comparing the baseline characteristics of patients preferring hospital treatment to treatment by a DC. Table 3 presents some of the differences between these two populations.

**TABLE 3. Differences between patients of a chiropractic clinic and hospital outpatient clinic in Great Britain [source: Meade et al. (37)]**

	Chiropractic Referrals (N = 41)	Hospital Referrals (N = 197)
Duration of complaints (in weeks)	5, 5	16, 7
Previous treatment for same complaint	85%	65%
Oswestry score at baseline	27, 4	22, 1
Improvement in Oswestry score during treatment*	10, 7	3, 0

\* After referral, the patients were allocated at random to physiotherapy treatment and chiropractic treatment; the referring professional was, therefore, not the same as the therapist.

These data show that in Great Britain, patients with low back pain treated by DCs have relatively more acute complaints than hospital patients. Initially, the symptoms of chiropractic patients seem to be more severe, but they also seem to improve more rapidly. During the natural course of low back pain, spontaneous recovery during the first 6 weeks is high (about 80%) (38, 39). The percentage of patients excluded for medical reasons both from the pilot study (37) and from the later full scale study (40) indicate that hospital patients more often have serious underlying pathology than DC patients. Bronfort provides us with a comparison of DC and MD patients in Denmark (41). DC patients more often had symptoms for longer periods, and more of them had been unable to work.

The studies comparing relevant characteristics of DC and MD patients show that on some they can differ considerably. Even on occasions where measured characteristics turn out to be similarly distributed, the possibility of unequal distribution of prognostic factors that are not measured remains.

In more recent studies, an attempt was made to achieve more comparable groups. Therefore, authors used specially selected diagnostic homogeneous groups to compare DC and MD patients. Wolk used a so-called "diagnostic related group," still consisting of 165 different diagnoses (27–29). Jarvis (30, 31) finally analyzed six different groups formed using the International Classification of Diseases-9 diagnoses most prevalent in the WC records. Nyiendo (2, 6, 7, 25, 26) clustered the patients in her study into three relatively detailed described groups. However, the authors of these studies doubt whether they succeeded in forming diagnostically homogeneous groups.

**Retrospective Character:** The retrospective character of the WC studies also limits validity. It is not usually possible to collect missing or additional data from the patients. In most studies, incomplete records are ex-

cluded from analysis. The direction of the resulting bias cannot be predicted. Most WC studies only report on global diagnosis, compensated days, duration and frequency of treatment and the connected costs (time loss compensation and treatment costs). For a proper analysis of the effectiveness of chiropractic care, more information is needed: for example, the age of the patients, a detailed description of diagnosis (inclusion and exclusion criteria), severity and duration of complaints, previous episodes and previous treatment for the same complaint (42). The absence of a description of these potential confounders makes a balanced interpretation of the results of WC studies impossible.

A number of studies tried to expand the information recorded in the WC archives. Johnson (22–24) conducted a mail survey of claimants of the previous year to obtain additional information on treatment costs. Unfortunately, the response rate turned out to be very low (37%). In Nyiendo's study (2, 6, 7, 25, 26), patient records were examined manually by a nonblinded researcher in order to obtain additional data. As a result, Nyiendo seems to use the available WC data most thoroughly. However, even in this WC study, the operationalization of the variables and the completeness of registration are still insufficient.

**Selection of Study Population:** A patient can always decide to change therapists. Reasons can be several: the patient might not be satisfied with the initial treatment or the therapist might not be able to provide the treatment needed. On the other hand, changing therapists for follow-up treatment after a (partial) recovery is possible as well. A proper description of these "cross-overs" is therefore important. Most WC studies do not address this issue explicitly, while some authors exclude "cross-overs" from analysis [Wolk (27–29), Jarvis (30, 31), Nyiendo (2, 6, 7, 25, 26), Bergeman (17, 18), Johnson (22–24)]. This last procedure contravenes the idea of "intention-to-treat" analysis, an important principle in effectiveness research (43, 44), which requires that results of all patients be analyzed and that results of treatment should be accounted to the therapist initially treating the patient.

Duration and costs of time-loss, as well as the total costs of treatment, are different for closed claims and those that are still open. Open claims generally represent the longer running claims of the more chronic patients. A WC study using open cases will, therefore, not resemble the real number of work days lost and costs made per case. The choice for analysis of closed cases only, however, means the exclusion of relatively more long-term and consequently more costly cases of work-related injury. A comparison of both studies by Wolk (27–29) reveals that adding open cases means

more days lost and higher costs. There is no consensus on which approach should be preferred. Of the more recent WC studies, Greenwood (8), Wolk (29) and Johnson (22–24) selected closed claims, while Jarvis (30, 31), Nyiendo (2, 6, 7, 25, 26) and Wolk (27, 28) used both open and closed cases.

**Compensation and Treatment Costs:** For a proper analysis of the effectiveness of chiropractic in WC studies, all treatment and compensation costs should be reported. Only in some of the more recent WC studies have adjunctive costs (e.g., transport, drugs and diagnosis by others) also been reported [Nyiendo (2, 6, 7, 25, 26), Wolk (27, 29), Jarvis (30, 31)]. Most of the older WC studies only reported direct treatment costs (see Table 1).

It can be questioned whether the effectiveness of a therapy can adequately be expressed in treatment and compensation costs. WC studies do not supply any information on relevant outcome measures like pain, a global measure for improvement and functional status or spinal mobility (42). For policy makers, information on costs related to the choice of certain therapists can be of great importance. Nevertheless, it seems more important to us to know the impact on patient well-being.

Most studies only reported the mean of the costs and compensated days. Few studies also reported the median of the outcomes [Greenwood (8), Johnson (22–24) and Nyiendo (2, 6, 7, 25, 26)]. The median is the value that comes half-way when the data are ranked in order. Mean and median are both measures of central tendency (simply "average"). If a study population contains a relatively small proportion of patients with extraordinary high costs or high number of compensated days, the outcomes of these few patients will not affect the median, but will seriously increase the mean costs or day reported. Therefore, to enable a proper interpretation of a distribution of data that is potentially skewed, both mean and median should be reported.

**Generalizability:** The generalizability of the results of WC studies to the whole population is limited, since the study population consists of workers with a WC claim for work-related neck and back injuries. In addition, even the generalizability within the domain of work-related injuries is restricted, since in most studies, patients are excluded for various study-related reasons. Often, patients undergoing surgery, patients treated by both a DC and MD ("cross-overs") and patients with very short or very long running claims are excluded. Johnson (22–24), for example, excluded 699 of 1750 cases, since they had been treated by both a DC and an MD.

The duration and costs of time loss and disability are

probably heavily influenced by legislation regarding compensation and health insurance (45). Because this legislation differs from state to state, the different WC studies cannot be compared. Therefore, these studies can not be extrapolated to the entire United States (2, 8).

## CONCLUSION

In general, most studies show that the results of DCs seem to be better than the results of MDs. However, the older results from Table 1 are poorly documented and the results do not seem to fit today's health care system anymore. The results of the six more recent studies (see Table 2) are ambiguous. In two of these studies, treatment by a DC turned out to be more expensive and led to longer absenteeism than MD treatment. The authors of these studies tried to identify some plausible explanations for these findings. Greenwood (8) observed that the higher consultation fee claims could be accounted to relatively few DCs. She theorizes that the liberal regulations in West Virginia gave the DCs opportunity to claim these large sums. The MDs in this study did not make such extraordinary claims. The opposite was found by Jarvis (30, 31). The author reports that the differences in treatment costs (in this case to the disadvantage of MDs) only appeared in the highest quartile of the total treatment costs, so only for the highest treatment costs. In addition, both Greenwood (8) and Nyiendo (2, 6, 7, 25, 26) suppose that the greater percentage of chronic patients in the DC study population contributed to the less favorable results for DCs.

The retrospective character of WC studies and the use of large databases not specifically meant for research harbor severe methodological problems. The comparability of the study groups is not guaranteed. The absence of data in the WC records might cause information bias. The databases give insufficient information on important prognostic indicators. The outcome measures used (compensation and treatment costs) are related to factors other than simply effectiveness (for example, insurance legislation), and, therefore, are not fully accurate. The different studies vary in their selection of study subjects from the WC databases. The impact of selection of patients with open compared to closed claims is difficult to quantify, but seems to be of importance as well. Because the study population comprises only patients with work-related back and neck injuries with rewarded claims, the extrapolation of the results of WC studies beyond this scope is limited. In addition, application of inclusion and exclusion criteria for the selection of subjects in a WC study just for research purposes even limits application of WC study

results within the field of treatment of work-related injuries.

WC studies are still regarded as valuable proof of the effectiveness of chiropractic (3-5). Although the results of WC studies are mainly positive for DCs, the evidence is not as convincing as it appears to be. The derivation of the data from the large existing WC databases and the related retrospective nature of the studies are irreparable methodological drawbacks. The only acceptable valid way to determine the effectiveness [and also the cost-effectiveness (43)] of chiropractic is the conduct of a randomized clinical trial (RCT) (7, 30, 33, 43, 46, 47). The recently published British randomized clinical trial by Meade et al. (40) was the first chiropractic randomized clinical trial studying cost-effectiveness as an explicit part of the research question. In this randomized clinical trial, the treatment costs from DCs were higher than those from hospital outpatient clinics. Because in this study chiropractic treatment was more effective than hospital outpatient treatment, the authors finally concluded that chiropractic care was a (cost-) effective treatment. Since the validity of this conclusion was doubted in an earlier publication (48), we think the chiropractic profession needs more randomized clinical trials to supply additional evidence of high methodological quality (49) to confirm the (cost-) effectiveness found in most WC studies and the randomized clinical trial of Meade et al. (40).

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