



Integration of Chiropractic Services in Military and Veteran Health Care Facilities: A Systematic Review of the Literature

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Abstract

This literature review examined studies that described practice, utilization, and policy of chiropractic services within military and veteran health care environments. A systematic search of Medline, CINAHL, and Index to Chiropractic Literature was performed from inception through April 2015. Thirty articles met inclusion criteria. Studies reporting utilization and policy show that chiropractic services are successfully implemented in various military and veteran health care settings and that integration varies by facility. Doctors of chiropractic that are integrated within military and veteran health care facilities manage common neurological, musculoskeletal, and other conditions; severe injuries obtained in combat; complex cases; and cases that include psychosocial factors. Chiropractors collaboratively manage patients with other providers and focus on reducing morbidity for veterans and rehabilitating military service members to full duty status. Patient satisfaction with chiropractic services is high. Preliminary findings show that chiropractic management of common conditions shows significant improvement.

Keywords

chiropractic, military medicine, hospitals, veterans, military personnel

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Musculoskeletal disorders account for nearly 7% of the total disability-adjusted life years globally, which, according to the recent Global Burden of Disease studies, is the fourth greatest burden on population health.¹ Low back pain is the leading cause of disability, estimated to be responsible for 83 million years lived with disability,² closely followed by neck pain.¹ Military service members (MSM) and veterans share this burden. In this special population, musculoskeletal injuries are often categorized as either battle or nonbattle injuries.³⁻⁵ Battle-related musculoskeletal injuries include those that arise from small arms fire, missile strike, exposure to explosive devices, and other injuries. These exposures often result in fracture, dislocation, amputation, gunshot wounds, significant soft tissue injuries, and related harms. Nonbattle injuries are those that most people suffer from, such as sprains and strains that occur as part of regular work; such musculoskeletal problems affect the performance of MSMs across a wide spectrum of occupational specialties.⁶ Back pain is one of the leading musculoskeletal causes of disability in MSMs returning home from conflicts in Southwest Asia. This influx of patients is leading to a steady increase in the prevalence of back pain among United States veterans of Operation Enduring Freedom and Iraqi Freedom.^{4,7}

Veterans who sustain musculoskeletal injuries during their military careers may continue to suffer morbidity associated with these disorders and require care. MSMs and veterans with musculoskeletal problems may be referred for chiropractic services that are integrated into military and veteran health care facilities. For example, the Department of Veterans Affairs (VA) and Department of Defense (DoD) have adopted a guideline⁸ to help clinicians manage the complexity of back pain. This guideline includes the use of spinal manipulation and

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therapeutic exercise, often provided by chiropractors working in VA or US Military Health System (MHS) facilities.⁹

The integration of doctors of chiropractic into the US MHS under the DoD and through VA is relatively new and has witnessed rapid growth.¹⁰ Chiropractic care has been offered as a health care benefit within the MHS since 1995,^{10,11} is currently available at 65 military treatment facilities across the United States,¹² and is considered fully implemented by the DoD.¹³ Although VA offered limited chiropractic services on a fee basis for several years, VA began offering integrated chiropractic services in VA facilities in 2004.¹⁴ This occurred after enactment of 3 key public laws, the Veterans Millennium Health Care and Benefits Act,¹⁵ the Department of Veterans Affairs Health Care Programs Enhancement Acts of 2001,¹⁶ and the Veterans Health Care, Capital Asset, and Business Improvement Act of 2003.¹⁷ Currently, chiropractic care is available at more than 51 VA facilities,¹⁸ and continues to expand. The inclusion of chiropractic care in military and veteran health centers in other countries is sparsely reported, with Canada being the only other country reporting such services.¹⁹

Our previous review²⁰ reported on various aspects of inclusion of chiropractic services within military and veteran health care systems. However, few articles were available at the time and we recommended that more research was needed to produce reproducible and robust summaries. The previous article identified needs and potential future research in veteran and military chiropractic care. In particular, it was noted that more publications were needed in the following areas: how often chiropractic services were utilized; if patients receiving chiropractic care reported better outcomes; more studies from countries outside of the United States; descriptions of structure of care; processes of care; provider workload; cost effectiveness.²⁰ It has been 20 years since chiropractic was introduced into the MHS and more than 10 years since the inclusion of chiropractic services in VA. Six years have passed since completion of the previous study. Thus, we felt it was an appropriate time to revisit the literature to identify what new information is available to describe chiropractic inclusion in military and veteran health care internationally. Therefore, the purpose of this study was to provide an updated review of the literature that describes practice, utilization, policy, and research of chiropractic services within military and veteran health care environments worldwide and, based on these findings, to offer suggestions for increasing research capacity within these health care settings.

Methods

Search Strategy

The lead author (BNG) performed PubMed and Index to Chiropractic Literature searches at their respective web sites and the Cumulative Index to Nursing and Allied Health Literature with full text was searched using EBSCOhost Web. The search excluded articles that were cited in MEDLINE to avoid duplication of the PubMed search to the degree possible. Searches for all databases were from the starting dates of each through April 2015. We combined the term

chiropractic with a variety of terms relevant to the topic. *Complementary medicine* and *alternative medicine* were also combined with other terms to broaden the search and capture all relevant publications (Table 1). We identified additional articles by searching the references found in the articles retrieved, searching our personal libraries, and by contacting authors who have published in this area.

Inclusion/Exclusion Criteria

All languages and all types of study designs from any country were included in the search. Articles from non-peer-reviewed sources (eg, trade magazines), and other nonscholarly sources, and writings not specific to the reported use of chiropractic or of chiropractic in military or veteran facilities were excluded. Abstracts of conference proceedings were not included due to the high rate of conference presentations that never reach full publication.^{21,22} Articles were considered for final inclusion if they described or studied chiropractic care within active duty or veteran health care environments. Studies or descriptions of care of MSMs or veterans outside of active duty or veteran health care environments were not included (eg, care of a veteran at a private practice clinic).

Methods of Review

The search process was conducted by the primary author; coauthors were asked to contribute citations with which they were familiar but which might be missing from the formal search. Citations were screened by the primary author for inclusion by reading the title and abstract for each citation. Abstracts of the citations that obviously or possibly met the review criteria were saved. The full papers of each abstract were retrieved and all authors independently reviewed each article to verify that it met the inclusion criteria. All authors reached consensus to include or exclude the articles. Articles that did not meet the criteria were discarded and a note was made as to why they were excluded. Once an article was included, the citation, study design, principal findings, and other pertinent notes were logged in a summary table. Quality scoring was not performed as the articles reviewed were not homogenous.

Results

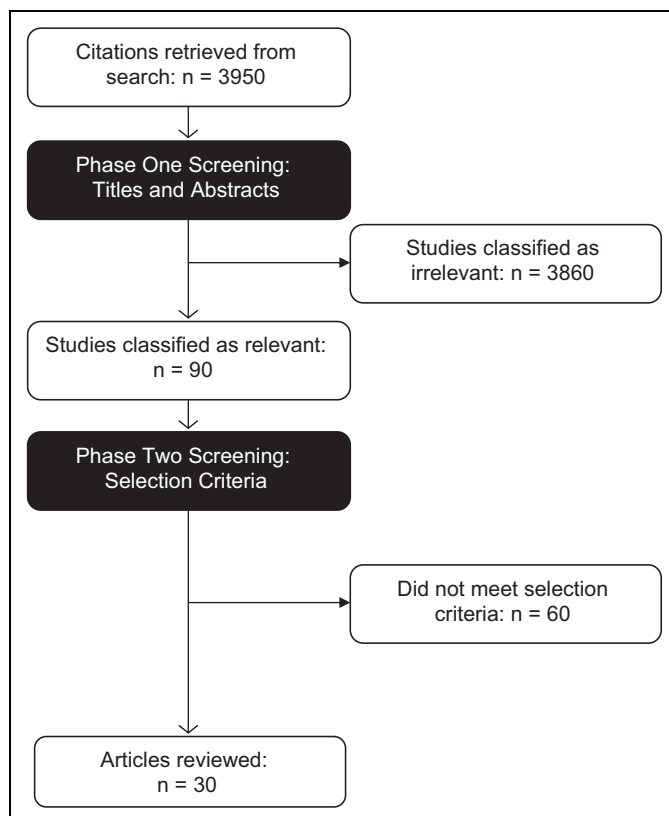
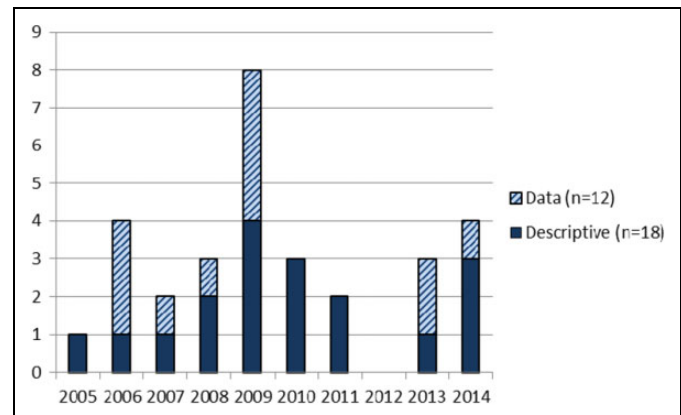
From the search engines, there were 3950 citations for the full search (Table 1), including 988 from the first article and 2962 new citations published since June 2009. As shown in Figure 1, there were 3860 articles screened out as irrelevant, leaving 90 relevant or potentially relevant articles. Of these, 46 were published since the 2009 review, including 41 from literature searches and 5 found by the contributing authors. After applying the exclusion criteria, 17 new articles^{10,18,20,23-36} were acceptable for review and added to the 13 articles^{19,37-48} reviewed in the original study. Thus, the total number of articles included in this updated review is 30.^{10,18-20,23-48}

Inclusion of Chiropractic in Military and Veteran Health Care

Integration of chiropractic care into military or veteran health care systems has been described in 3 systems: MHS, VA, and

Table 1. Search Terms and Results From the Inception of the Database Through April 2015.

Search Terms	PubMed Search			CINAHL Search			ICL Search		
	Total Hits	Potentially Relevant Hits	New Hits	Total Hits	Potentially Relevant Hits	New Hits	Total Hits	Potentially Relevant Hits	New Hits
Chiropractic + military	35	27	26	89	11	3	44	15	0
Chiropractic + navy	6	5	0	4	2	0	3	2	0
Chiropractic + sailor	9	9	0	0	0	0	0	0	0
Chiropractic + marines	9	9	0	0	0	0	0	0	0
Chiropractic + marine	16	13	2	4	1	0	3	3	0
Chiropractic + air force	5	1	0	4	0	0	98	0	0
Chiropractic + airman	1	1	0	1	1	0	0	0	0
Chiropractic + army	11	7	4	13	2	0	7	1	0
Chiropractic + soldier	10	10	1	2	2	0	3	1	0
Chiropractic + coast guard	9	9	0	1	0	0	6	0	0
Chiropractic + Department of Defense	4	3	0	2	1	1	67	9	0
Chiropractic + Department of Veterans Affairs	19	14	9	68	7	1	71	10	0
Chiropractic + veterans	32	24	5	104	9	2	32	13	0
Chiropractic + veteran	32	22	0	9	4	0	9	7	0
Alternative medicine + military	722	30	20	19	6	0	20	2	0
Complementary medicine + military	546	6	1	3	4	0	20	2	0
Alternative medicine + veterans	531	23	10	5	7	2	7	1	0
Alternative medicine + veteran	526	4	2	1	1	0	0	0	0
Complementary medicine + veteran	350	0	0	0	0	0	0	0	0
Complementary medicine + veterans	345	0	0	6	2	1	7	1	0
Total	3218	217	80	335	60	10	397	67	0

**Figure 1.** Flow chart of the literature selection process.**Figure 2.** Number of data and descriptive articles published pertaining to chiropractic in military and veteran health care.

Canadian Forces. All but one of the articles are from the United States. Table 2 provides a breakdown of the study designs reported. Figure 2 shows the number of articles published presenting data, typically representing more complex research designs, and those that are entirely descriptive. A summary of the included articles is presented in Table 3.

Articles Excluded

Sixty articles were excluded according to the selection criteria (Table 4 and Figure 1). Reasons for exclusion are presented in

Table 2. Types of Studies Reported in the Literature Pertaining to Chiropractic Care in Military and Veteran Health Care Settings.

Research Design	Year of Publication										Total
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Explanatory papers	1	0	1	1	1	0	0	0	0	0	4
Case report	0	1	0	1	2	3	2	0	1	3	13
Survey	0	2	1	0	0	0	0	0	1	0	4
Cross-sectional/observational	0	1	0	1	4	0	0	0	0	0	6
Experimental	0	0	0	0	0	0	0	0	1	1	2
Literature review	0	0	0	0	1	0	0	0	0	0	1

Table 3. Summary of Studies Reviewed.

Year, First Author, Reference	Study Design	Setting	Principal Findings
2005, Dunn ³⁸	Descriptive study	VA	<ul style="list-style-type: none"> First article to describe chiropractic training in VA or MHS facilities Described the development and implementation of a chiropractic intern training program at a VA facility
2006, Dunn ⁴⁰	Cross-sectional study	VA	<ul style="list-style-type: none"> First article to describe a VA chiropractic clinic Most consults originated from primary care 82% were seen for lumbar complaint
2006, Boudreau ¹⁹	Survey	MHS	<ul style="list-style-type: none"> First report of Canadian military hospital offering chiropractic care Most referrals for low back pain and axial musculoskeletal complaints Reported high levels of satisfaction from patients (94%) and referring providers (80%)
2006, Dunn ³⁹	Survey	MHS	<ul style="list-style-type: none"> No difference in demographics, income, job satisfaction, or career success were detected between interns participating in a rotation through 2 US naval hospitals compared to interns who did not
2006, Green ⁴¹	Case report	MHS	<ul style="list-style-type: none"> First clinical study about chiropractic care in MHS Case report of coordinated multidisciplinary treatment of a US Marine pilot with low back pain
2007, Dunn ⁴²	Survey	VA	<ul style="list-style-type: none"> Compared academic affiliations, internship programs, staffing, physical plant properties Intern selection, duration, weekly hours, and number of interns at 4 VA chiropractic programs
2007, Dunn ⁴³	Expository paper	VA	<ul style="list-style-type: none"> Proposed 6 strategies that could potentially help reduce wait times for appointments, encourage appropriate consultation requests from gatekeepers, optimize clinic efficiency, and maximize clinical effectiveness in an effort to improve the provision of the chiropractic benefit at VA facilities
2008, Dunn ⁴⁵	Cross-sectional study	VA	<ul style="list-style-type: none"> Follow-up study to Dunn et al⁴⁰ 16% of patients had a diagnosis of posttraumatic stress disorder 72% were seen for a lumbar complaint
2008, Green ⁴⁴	Case report	MHS	<ul style="list-style-type: none"> Described a previously unreported type of sacral synchondrosis and chiropractic methods and multidisciplinary approach used to diagnose and manage a US Marine's low back pain
2008, Johnson ⁴⁶	Explanatory paper	MHS/VA	<ul style="list-style-type: none"> Described integration of chiropractic services and the potential public health opportunities for chiropractors in military and veteran treatment facilities
2009, Dunn ⁴⁷	Cross-sectional study	VA	<ul style="list-style-type: none"> Patients with PTSD experienced significantly lower levels of neck and low back pain and disability score improvement than those without PTSD, suggesting that the success of conservative forms of management for veterans may be limited by the presence of PTSD
2009, Passmore ⁴⁸	Case report	VA	<ul style="list-style-type: none"> Described the use of spinal manipulation for a female veteran with a diagnosis of cervical angina
2009, Green ³⁷	Explanatory paper	MHS/VA	<ul style="list-style-type: none"> Described how health care providers within MHS and VA treatment facilities refer to and work collaboratively with chiropractors who work at the same facility
2009, Green ²⁰	Literature review	MHS/VA	<ul style="list-style-type: none"> Integration of chiropractic care into military/veteran health care is described in MHS, VA, and Canadian forces

(continued)

Table 3. (continued)

Year, First Author, Reference	Study Design	Setting	Principal Findings
2009, Dunn ²³	Case report	VA	<ul style="list-style-type: none"> • Of the 13 articles reviewed, all were descriptive in nature and level 4 and 5 evidence according to the Oxford Centre for Evidence-Based Medicine classification • Chiropractic care in MHS and VA was integrated into each system and as part of interdisciplinary care • High levels of patient satisfaction described • Described chiropractic care of a veteran with low back pain and 2-level lumbar spondylolisthesis that reduced the patient's self-reported disability
2009, Goldberg ²⁴	Descriptive study	MHS	<ul style="list-style-type: none"> • Describes the development of a Comprehensive Combat and Complex Casualty Care program at Naval Medical Center San Diego • This interdisciplinary program included³² 10 different specialties that collaborated to provide musculoskeletal services, including primary care, physical therapy, occupational therapy, vestibular therapy, gait analysis, prosthetics, recreational therapy, chiropractic care • This article provides preliminary descriptive data on the number of patients managed and how this interdisciplinary group of providers work together to care for severely injured military personnel
2009, Dunn ¹⁰	Comparative analysis	MHS/VA	<ul style="list-style-type: none"> • Identified 9 areas within MHS and VA chiropractic clinics where there are potential opportunities and threats to integration • Provided historical comparison of evolution of chiropractic care in MHS and VA • Noted that integrations has advanced in both MHS and VA • Discussed how employee status has positively influenced integration (vs contractor) • Noted collaborative working relationships between providers as opportunities for integration • Noted that academic affiliations and training programs have contributed to integration and further development of these programs would likely strengthen integration in both systems
2009, Lisi ²⁵	Cross-sectional study	VA	<ul style="list-style-type: none"> • First nation-wide description of chiropractors and chiropractic clinics within VA • Used a web-based survey of all VA chiropractors with a 91.6% response rate (n = 33) • Low back pain was the most common complaint referred to chiropractic care (88%) with neck pain being second most common (79%) • 67.6% of consults were from primary care, 9.4% from pain management and 6.2% from psychiatry • Very few respondents had scholarly or academic activities; 67% reported no previous authorship in peer reviewed publications, 36% reported authoring 1 or more; 4 had been principal investigators on a funded research project • Standard evaluation and management procedures were common but there was more variation in treatment procedures than in evaluation • Participation by chiropractors in facility-integrated activities was greatest in training chiropractic students (39%) followed by multidisciplinary rounds (33%), both reported as being done often/always. The least frequent integrated activities were hospital committee work, research, and training other trainees, being done seldom/never by 64%, 64%, and 78% of respondents, respectively • Wide variation in provider characteristics and clinical structures was reported
2010, Lillie ²⁶	Case report	MHS	<ul style="list-style-type: none"> • A-40-year old patient with low back pain and leg pain and lumbar degenerative disease was treated with chiropractic and medical services integrated in a Navy medical setting • The patient improved with chiropractic care and the patient did not require surgical intervention
2010, Lisi ²⁷	Case series	VA	<ul style="list-style-type: none"> • First article to present data on Operation Enduring Freedom or Operation Iraqi Freedom veterans treated in a VA facility; 31 veterans were consulted to chiropractic services during the 6-month study period • All patients reported a decrease in numerical rating scale scores with the group median score at last visit being 4 and the group median change in score being -3

(continued)

Table 3. (continued)

Year, First Author, Reference	Study Design	Setting	Principal Findings
2010, Green ²⁸	Case report	MHS	<ul style="list-style-type: none"> • 14 patients (45%) reported satisfaction with outcome and were discharged; 11 (35%) were referred to other services for continued management; 4 (13%) reported significant remaining pain but declined other treatment options • The most common consultations were to psychiatry and mental health • Described use of manual therapy and therapeutic exercise for a jet fighter pilot with mechanical neck pain and discussed importance of coordinating the care with the unit flight surgeon because of aeromedical concerns
2011, Dunn ²⁹	Case series	VA	<ul style="list-style-type: none"> • Descriptive case series of chiropractic care within a VA facility for 171 veterans with low back pain; the average number of treatments per patient was 8.7 • Outcome measures were numerical pain rating scale and the Back Bournemouth Questionnaire • The minimum clinically important difference was 30% improvement • Mean raw score improvement for numerical rating scale was 2.2 (37.4% improvement) and mean raw score improvement for Back Bournemouth Questionnaire was 13.6 points, thus 92 patients (53.8%) exceeded the minimum clinically important difference
2011, Dunn ³⁰	Case series	VA	<ul style="list-style-type: none"> • Descriptive case series of chiropractic care within a VA facility for 54 veterans with neck pain • Outcome measures were numerical pain rating scale and the Neck Bournemouth Questionnaire • The minimum clinically important difference was 30% improvement • Mean raw score improvement for numerical rating scale was 2.6 (42.9% improvement) and mean raw score improvement for Neck Bournemouth Questionnaire was 13.9 points (33.1% improvement), thus 36 patients (67%) exceeded the minimum clinically important difference
2013, Coulis ³¹	Case series	VA	<ul style="list-style-type: none"> • Described chiropractic management of 3 cases of postoperative spine pain (1 cervical fusion, 1 lumbar discectomy, 1 lumbar laminectomy)
2013, Goertz ³²	Randomized controlled trial pilot	MHS	<ul style="list-style-type: none"> • 91 patients with acute low back pain (43% with radicular symptoms) were randomized to either a standard medical care group or a standard medical care + chiropractic management group • The mean pain severity, adjusted Roland-Morris Disability Questionnaire, back pain functional scale, and patient satisfaction scores in the standard medical care + chiropractic care group were significantly more improved than in the standard medical care group
2013, Khorsan ³³	Qualitative interviews and quantitative data analysis	VA	<ul style="list-style-type: none"> • Reported on the design, methods, and challenges encountered in developing a program evaluation for chiropractic in VA • The primary goal was to identify sources of practice variations across VA chiropractic service locations and causes of variation • Used a "mixed methods" design, relying chiefly on interviews but also included analysis of policy and procedure documents as well as administrative data • The study also sought to develop and refine research methods to conduct a larger study of VA chiropractic services at a later date, as well as studies that in the future might examine the implementation of other new services and disciplines in large health care delivery systems
2014, Dougherty ³⁴	Randomized controlled trial	VA	<ul style="list-style-type: none"> • Utilized sham intervention • No difference in pain scores between spinal manipulation and sham groups at baseline, 5- or 12-week follow-up • Spinal manipulation group had significantly improved Oswestry disability index score compared with sham at 12-week follow-up
2014, Lisi ¹⁸	Descriptive comparison	VA	<ul style="list-style-type: none"> • Characterized the implementation of chiropractic services in a sample of VA facilities, their integration, and variations in these implementations • Describes wide variations in site-to-site chiropractic clinic planning/implementation, structure, and care processes • A facility's willingness to establish a chiropractic clinic, along with perceived evidence-based attributes of the chiropractor were associated with higher and more consistent delivery of chiropractic services and higher perceived quality of those services

(continued)

Table 3. (continued)

Year, First Author, Reference	Study Design	Setting	Principal Findings
2014, Morgan ³⁵	Case report	MHS	<ul style="list-style-type: none"> • A 25-year-old military officer with previous polytrauma and neurogenic heterotopic ossification of the anterior longitudinal ligament in the cervical spine was managed with chiropractic care at a Navy facility • Chiropractic care included manipulation and exercise prescription for use of a spirometer • The patient had a slow recovery of function and decreased pain
2014, Green ³⁶	Case report	MHS	<ul style="list-style-type: none"> • Described interdisciplinary management at a Navy hospital of a US Marine helicopter mechanic with chronic neck and upper back pain, dizziness, and other symptoms in the presence of elongated styloid processes and calcification of the left stylohyoid ligaments • The patient was evaluated for Eagle syndrome, which was ruled out • Integrated care was provided by a chiropractor, physical therapist, otolaryngologist, and radiologist

Abbreviations: MHS, military health system; VA, Veterans Health Administration; PTSD, posttraumatic stress disorder.

Table 4. Reasons for Excluding Articles From This Review.

Reason	Reference Number(s)
Not about chiropractic care	66-69, 71-73, 75-108
Not about chiropractic care in military/veteran setting	49-53, 66, 68, 69, 71-76, 78-81, 85-87, 89-99, 101, 102, 105-107, 109-119
Unable to obtain	120

Table 4. The most common reason articles were excluded was that they described the use of complementary and alternative medicine modalities among military or veteran beneficiaries, but included no breakdown of the utilization of chiropractic care from the larger set of complementary and alternative medicine practices and did not distinguish if chiropractic was provided in the military or veteran setting. Another common reason for exclusion was that a study was not clear whether the chiropractic care included in the complementary and alternative medicine practices was provided at a designated military or veteran health care facility or if chiropractic care was obtained from outside sources. For these studies, we contacted the authors of these articles in question for definitive answers, all of whom responded to our inquiry and provided clarification.

A few articles with apparent US military/veteran and chiropractic relevance were excluded and explanation for their exclusion is provided here. A commentary⁴⁹ predated the inclusion of chiropractic services in the US MHS and was excluded because it was a theoretical article, hypothesizing what might occur should chiropractic services be included in military care and did not discuss actual working settings. An article⁵⁰ was excluded because it did not involve the use of chiropractic care within the VA setting but critiqued chiropractic care provided as part of a pilot fee-for-service model used by VA and this care was provided outside of the VA system. A randomized trial involving chiropractic care with veteran patients⁵¹ was excluded because, while VA patients were included in the study, the setting primarily was a mixture of non-VA physical therapy and chiropractic clinics in the local community and the sample was drawn from a mix of VA and non-VA patients.

An article was excluded for similar reasons; the article was a study proposal that described the study design for a trial in both VA and non-VA facilities but there were no actual subjects yet recruited to the study.⁵² An article that was excluded was a historical commentary⁵³ that discussed the use of chiropractic care in aviation. While there was mention of chiropractic care in selected military environments, the material was mostly taken from articles that were already covered in this review as primary sources; thus, including this article would have duplicated findings.

Discussion

Practice, Utilization, Policy, and Research

Overall, the current literature on chiropractic services within military and veteran health care environments worldwide gives us a glimpse into current practices. Doctors of chiropractic are fully integrated into both the MHS and VA health care settings located in various geographic regions within the United States and in 3 MHS locations outside of the United States. Chiropractic practitioners manage common musculoskeletal conditions, but also see unusual cases that are worth reporting in the literature. These doctors of chiropractic manage complex cases, especially patients with musculoskeletal conditions, and these often include psychosocial factors. Common conditions include back and neck pain, but patients with more severe injuries, such as injuries obtained in combat, are also managed by chiropractors in these integrated settings. Chiropractors manage patients with a team of other providers and they focus on

reduction of morbidity for MSMs and veterans and return to active duty in military settings. As is consistent with other literature, patient satisfaction with chiropractic services is high in MHS and VA settings. Some preliminary research findings show that chiropractic management of common conditions for VA and MHS patients show significant improvement compared to other types of care.

Studies reporting utilization and policy show that chiropractic services can be implemented in various settings and how chiropractors are integrated may vary by facility. Typically, the doctor of chiropractic collaborates with other providers in the management of cases and is referred cases from medical providers and also refers to other providers and specialists. Chiropractic practitioners function in various departments including sports medicine, physical therapy, pain care, physical medicine and rehabilitation, orthopedics, and stand-alone departments.

Currently, research related to chiropractic is being done in military and veteran health care environments. However, the designs are diverse and without an apparent direction as it appears that there is no published agenda for chiropractic research in these settings. Publications are mainly being authored by individual chiropractic providers who are performing studies within their practice settings. The narrow pool of authors limits the scope and design of the studies.

First Publications in Topic Domains

Proposals to integrate chiropractic services into veteran or military health services began more than 60 years ago.⁵⁴⁻⁵⁶ Efforts in the 1940s and early 1950s proposed a bill to

make eligible for appointment in the medical service, Department of Medicine and Surgery, Veterans' Administration, any person who holds the degree of doctor of chiropractic from a college or university approved by the Administrator of Veteran's Affairs, who is licensed to practice chiropractic in one of the States or Territories of the United States.⁵⁷

After many decades, VA conducted the Chiropractic Services Pilot Program Evaluation study (SDR #86-09) as a pilot program to look at providing chiropractic services on a fee-for-service basis, but not in an integrated form.⁵⁰ It is believed that the inclusion of chiropractic into MHS in 1995 was the first integration of chiropractic services into a military or veteran health care system. However, it would be 11 years before any literature emerged from this milieu. VA began integrated chiropractic services in 2004 with publications in the peer-reviewed literature commencing in 2005.

In 2005, Dunn³⁸ authored the first article reporting on any feature of chiropractic care included within VA. This article described an internship at one VA facility. In 2006, Dunn et al⁴⁰ authored the first article to describe the dynamics and demographics of a VA chiropractic clinic. The first article reporting on any aspect of chiropractic in MHS was published by Green et al in 2006 and was a case report of chiropractic care for a jet pilot with low back pain.⁴¹ Shortly thereafter, Dunn

compared variables of career success between interns that participated in a rotation at a naval health clinic and those that did not. This article was the first to describe any aspect of chiropractic student training in MHS.³⁹

Lisi and colleagues published the first system-wide description of VA chiropractors and chiropractic clinics in 2009.²⁵ Lisi also authored the first report of chiropractic services for veterans of Operation Enduring Freedom or Operation Iraqi Freedom veterans in a VA facility.²⁷ The first experimental design evaluating chiropractic care for VA patients was a randomized clinical trial by Dougherty and colleagues, which we discuss in more detail later.³⁴

While a variety of case reports on patients in MHS have been published, larger descriptive or experimental studies are sparse. The first experimental study investigating chiropractic care in MHS is a randomized controlled trial by Goertz and colleagues that evaluated low back pain outcomes for MSMs, discussed in more detail later.³²

The only other country that has reported on the use of chiropractic care in military or veteran facilities is Canada. Chiropractic services were offered at one Canadian forces facility in Halifax, Nova Scotia, as a pilot project for several years. The authors reported that chiropractic referrals were primarily for axial spine pain and that there was high satisfaction among patients and referring providers. The majority of respondents (94% of military personnel and 80% of referring physicians) reported satisfaction with chiropractic services.¹⁹

Integration of Chiropractic in MHS or VA Facilities

Several articles describe the integration of chiropractic services in VA and description of this integration has evolved since Dunn et al's initial descriptions of the chiropractic care consultation system at one facility.^{40,45} In a cross-sectional survey representative of all VA doctors of chiropractic, Lisi et al²⁵ reported the prevalence of common problems referred for chiropractic care, with back and neck pain comprising the bulk of consults. They also described the service lines referring patients to chiropractic care, most of which came from primary care, and the services to which chiropractors typically made referrals. Chiropractic provider characteristics were also reported, including demographics, employment agreements, the level of integration of the chiropractor in the facility, staffing, and compensation. Patient evaluation procedures were consistent across providers with more variation in patient care reported. Participation in research, particularly funded research, was not prevalent among the sample (18% often participating), where training chiropractic students was more common (39% often participating).

Other research further investigated chiropractic integration into VA through the use of a stakeholder and document evaluation model.¹⁸ In this study, 114 people with various levels of involvement in VA chiropractic services were interviewed, including nonchiropractic clinicians, patients, senior and middle-level administrators, chiropractors, support staff, and others. The authors also evaluated 75 policy and procedure

documents. It was found that a wide variety of processes were used among the VA sites that were queried to implement chiropractic services. Numerous clinical structures were employed, ranging from integration of chiropractic services within established departments of physical medicine/rehabilitation to spinal cord services and from colocating chiropractic providers with other health care providers to establishing chiropractic services in isolation. Types of conditions, referring service lines, a trend toward increased utilization, and elements of patient evaluation and management were consistent with the earlier national survey.²⁵ However, wide variation in the utilization of chiropractic services was reported across the 7 sample sites.

How chiropractors are integrated into MHS facilities is described less frequently than in VA. There are no articles that provide cross-sectional data on chiropractic integration nationally in MHS and no studies to report practice utilization or variation in care. A glimpse of integration is afforded by Dunn, Green, and Gilford's system analysis of MHS and VA chiropractic services. They provide a general overview of similarities and differences between VA and MHS chiropractic services in the areas of programmatic growth, leadership, employment status of providers, clinician responsibilities, patient access, patient demographics, academic pursuits, and research.¹⁰ The only other article that describes the integration of chiropractic services into MHS is a description of interdisciplinary care offered at Naval Medical Center San Diego's comprehensive complex casualty care center.²⁴ This descriptive report is also the only article that describes the integration of chiropractic services into the care of combat-injured troops.

Scope of Practice

No articles provided reviews of policies codifying the scope of practice for chiropractors in military or veteran health care systems. Perhaps the best description of chiropractic scope of practice in MHS and VA is offered by Dunn, Green, and Gilford, as follows:

The primary duty is to provide comprehensive chiropractic services as is commonly taught at accredited chiropractic colleges and in further specialty training. Chiropractors in both systems are allowed to use the manipulative techniques that they feel are appropriate for the needs of the patient, as well as other procedures, such as therapeutic modalities and rehabilitation.¹⁰

Several articles, however, provided descriptions of chiropractic care indicating that chiropractors in the DoD and VA employ a broad range of treatment procedures that include spinal manipulation/mobilization in a variety of forms,^{23,25,27-32,35,36,44,45,47,48} extraspinal manipulation/mobilization,^{41,45} therapeutic exercise,^{23,25,27-32,35,36,41,44} passive stretching,^{41,48} muscle energy techniques,^{28,41} cryotherapy,^{32,45} thermotherapy,^{32,41} soft tissue therapy,^{25,27-30,32,36,41,47} ultrasound,⁴⁵ physical modalities,^{25,27} orthoses,²⁵ acupuncture,²⁵ nutrition,²⁵ and patient education.^{25,27,30,32,35,41,44}

Chiropractic Care Outcomes and Effects of Comorbidities

Outcomes of chiropractic care and the potential confounding or moderating effects of various comorbidities in veteran patients are reported with greater frequency than in the initial literature review. Dunn and Passmore first reported a potential association between spine pain and posttraumatic stress disorder (PTSD) in VA chiropractic service in 2008, reporting that 16% of patients had PTSD.⁴⁵ In a follow-up study published 1 year later, the authors showed that veterans with PTSD had worse spine pain outcomes following care than veterans without PTSD. These findings suggest a treatment modifying effect of PTSD on chiropractic care for veterans with back or neck pain.⁴⁷

Outcomes of chiropractic care in back and neck pain patients are reported from several VA facilities. The first of these studies showed that with an average number of 9 chiropractic treatment visits, the average improvement in pain ratings and Back Bournemouth Questionnaire scores indicated approximately 37% and 54% improvement, respectively.²⁹ For veterans with neck pain the average improvement in pain ratings and Neck Bournemouth scores indicated approximately 43% and 31% improvement, respectively.³⁰

Chiropractic outcomes in an observational study of veterans of Operation Enduring Freedom/Operation Iraqi Freedom by Lisi²⁷ were similar to those reported in older veterans in Dunn et al's study.⁴⁷ In younger veterans, comorbid PTSD and traumatic brain injury were frequently reported and suspected to alter patient response to care.²⁷

Dougherty et al conducted a pragmatic randomized clinical trial of spinal manipulative therapy for veterans receiving chiropractic care for low back pain at VA facilities.³⁴ This study focused on older veterans (65 years of age or older), allocated them to either a spinal manipulation or a sham intervention group, and no other interventions were performed aside from providing patients a standardized patient education booklet. Both groups demonstrated significant improvements in pain and disability scores at 5- and 12-week follow-ups and there was no difference in the reporting of adverse events between groups. However, at 12 weeks, while the average pain scores were not significantly different, the spinal manipulation group had improved disability scores over the sham group.

The only study to report outcomes of chiropractic care in a group of MSMs is one reported by Goertz and colleagues.³² This pragmatic randomized comparative effectiveness study reported on MSMs between the ages of 18 and 35 years who had low back pain for 4 weeks or less. Participants were allocated to either a standard medical care group or to a group that received standard medical care and chiropractic care. After treatment, adjusted mean scores on the Roland-Morris Disability Questionnaire, mean numerical rating scale pain scores, and adjusted mean back pain functional scale scores were significantly improved for the group receiving both standard medical care and chiropractic care.

Articles on Education and Training in VA or MHS Facilities

Chiropractic externships exist in both MHS and VA and residencies are available in VA. Three studies report on training programs in these environments and all of these articles^{38,39,42} were summarized in our initial 2009 review.²⁰ Summarily, Dunn reports on VA externship at one facility,³⁸ provides a comparison of VA academic affiliations, programs, facilities, and other parameters at 4 VA hospitals,⁴² and the final study found no difference in a variety of career success variables between externs who participated at 1 of 2 MHS externships at US Navy hospitals.³⁹ No new education research has been reported since 2007.

Descriptive Clinical Studies

A variety of case reports and case series have been published about patients receiving chiropractic care in both MHS and VA. All of the cases focus on the chiropractic management of musculoskeletal conditions. Table 3 describes these studies in more detail.

Growth of the Literature

In our first review of this literature in 2009, there were 13 articles to review.²⁰ These articles had been published over a period spanning decades. In the present review, an additional 17 articles were published in the past 6 years, representing a growth in the interest of research pertaining to chiropractic care within veteran or military integrated health care delivery systems. It is noted that there are more articles published on chiropractic care in VA ($n = 16$) than in MHS ($n = 10$) and few reports from both systems ($n = 4$). While the increase in publications in this area of inquiry is positive, the total number of articles on this topic is still very small and concerning to the sustainment of chiropractic services in these environments. There is still little evidence to inform practice and policy; continued support for research pertaining to chiropractic care in military and veteran health care systems should remain high on the agendas of organizations with interests in this area.

Authorship

The bulk of the articles (20 of 30, 70%) were led by 3 authors: Dunn (11 articles), Green (6 articles), and Lisi (3 articles). The remaining principal authorships were spread across 10 other authors. Dunn, Green, or Lisi served as the lead author or co-contributor on a total of 87% (26/30) of the articles included in this review. This indicates a narrow pool of authors who are contributing to research in this area. Greater diversification of principal and coauthors will be necessary if this evidence base is to continue to grow.

Levels of Evidence

Varying levels of evidence of the literature have increased over time. In the first review, all of the research was descriptive and

ranked as levels 4 and 5 on the Oxford Centre for Evidence-Based Medicine levels of evidence.⁵⁸ With the addition of the 17 articles for this review, there is inclusion of some level 2 and level 1 research studies. This finding is promising as it may mean that research in this area is advancing.

Areas for Further Inquiry

Further reports of outcomes of chiropractic care in VA and MHS are much needed. Trials that evaluate comparative effectiveness are particularly important, as they provide data on which therapies provide the best outcomes for a given condition. To date, there is only one such trial.³² In this era of evidence-based health care and cost containment, comparative trials may help gain insight into cost-effectiveness and improved outcomes. Utilization and practice parameters on MHS clinics have yet to be reported; a profile of even one MHS chiropractic clinic is yet to be reported.

The authors have spoken with people from a variety of countries about the use of chiropractic care in military and veteran environments in countries outside of the United States. However, there are no reports in the literature about these services and reports would aid in providing comparisons among different populations of MSMs and veterans and potentially stimulate research collaborations.

With the publication of studies indicating significant effects of comorbidities on chiropractic outcomes, further studies should investigate which variables are associated with outcomes, such as spine pain, in MSMs and veterans receiving chiropractic care. Cross-sectional studies with magnitudes of association between suspected variables and spine pain could be conducted. Clinical trials should be adjusted to potentially control for influential comorbidities such as PTSD or traumatic brain injury, as well as the effect of deployment to combat theater.

Creating clinical prediction rules for the management of nonspecific spine pain, disc pathology, stenosis, spondylolisthesis, and postsurgical pain, may be fruitful research endeavors with immediate practice relevance.

With this literature growing, it will be desirable in the future to pool data for meta-analyses. However, to do so will require that studies conducted now conform to standardized reporting guidelines. We strongly urge current and future researchers to report their findings using reporting methodologies such as CONSORT,⁵⁹ STROBE,⁶⁰ PRISMA,⁶¹ and others.

Need for Increased Research Capacity

More resources, authors, and advanced studies are greatly needed. Evidence-based practice relies on the higher tiers of evidence to inform practice and more evidence for practice is needed in these military and veteran environments. It is still unknown whether or not chiropractic care is effective in these health care environments, for what conditions this care might be effective, if it represents a good expenditure of funds, and how chiropractic outcomes may be affected by comorbidities. Training chiropractors in military and veteran health care

systems how to do research, allocating time for research to be performed, funding the research, and collaboration need to be remedied as much now as they did in our first review.

Training. As we addressed previously, the majority of chiropractors in MHS and VA facilities do not have training as researchers or authors. If studies are to continue, practitioners need to be trained in the methods of research and scholarly writing and develop mentorships with experienced authors at their facilities. As incentives, health care facilities could allocate part of provider evaluation to research productivity and place priority on research skill sets when evaluating potential candidates as chiropractic providers in these systems. Training in grant writing remains a necessity. As we discussed in our previous review, it is important to secure funding to conduct more complex studies or to secure experienced researchers who can successfully execute advanced research designs. Training in research methods and writing are also necessary to increase the pool of writers contributing to this area of inquiry. While the 30 articles in this review contained several different primary authors, it is concerning that just 3 people served as lead authors on 70% of the articles. The same authors were co-contributors on 12 articles. With these authors well into their mid-careers, it is clearly important that effort needs to be placed on training future researchers in MHS and VA.

Time. Sufficient time needs to be set aside for research activities. Most chiropractors are hired primarily as clinicians to see patients and the majority, if not all, of the practitioner's professional workload is dedicated to duties relating to clinical concerns. Thus, allocating research time to the position description and evaluating research output as part of the performance evaluation system seems imperative. Publication and scholarly activity are elements of the VA Chiropractic Qualification Standards utilized for rank and promotion. Thus, this system offers incentive for chiropractors to engage in the research effort. It will require significant discussion and change to current MHS practices to allocate research time and productivity to chiropractic position descriptions, or to have such changes made on a local level on a case-by-case basis.

Funding. Funding is essential to successfully complete large and complex research studies. As has been shown with some of the articles in this review, intramural funding is available at some facilities and grants from within federal agencies have been secured to conduct recent research. However, attracting the interest of seasoned, nonchiropractic researchers is likely still influenced by the availability of funding. In short, researchers and outside institutions are not likely to dedicate research efforts and institutional resources if there are no positive benefits for them. External funding from government and private foundations must continue to be a priority for research to continue.

Collaboration. As research interests and skill sets of chiropractic researchers in military and veteran setting continue to evolve, it

is likely natural for larger and more complex research designs to be desired. Such studies require the time, money, personnel, and other resources to which most clinicians do not have access. Most MHS and VA hospitals have departments of research and investigation, institutional review boards, medical writers, statisticians, and other assets available to assist in the research effort. Chiropractic providers in these systems need to access these resources in their research efforts. Furthermore, collaboration with universities can provide the means necessary to implement and complete complex endeavors, such as clinical trials and case-control studies. Such collaborations will likely stimulate more research questions that can lead to improved working relationships in the future.

Use of Chiropractic and Complementary and Alternative Medicine Among Military and Veteran Patients

Complementary and alternative medicine can be defined as⁶² "interventions not taught widely at US medical schools or generally available at US hospitals." Popular complementary and alternative medicine practices include herbal remedies, yoga, acupuncture, and chiropractic, among many others.⁶³ In the United States, chiropractic care is used by an estimated 8.5% of the population, as reported in a recent analysis of a large representative sample.⁶⁴ As one of the most popular provider-based complementary and alternative medicine practices in the United States, chiropractic care accounts for approximately 190 million office visits per year and about 30% of all complementary and alternative medicine practitioner visits.⁶⁵ Since US MSMs and veterans represent a subpopulation of Americans it is not surprising that complementary and alternative medicine use is widely reported and may be increasing.

In 2007, Smith and colleagues found that one third of US Navy and Marine Corps personnel utilized at least one form of complementary and alternative medicine, including chiropractic care.⁶⁶ When reviewing the health care use of a large military cohort of more than 86 000 respondents, Jacobson et al reported in 2009 that 41% of MSMs used some type of complementary and alternative medicine, with 30% using at least one provider-based form of complementary and alternative medicine therapy and 27% using at least one self-provided complementary and alternative medicine therapy.⁶⁷ In 2013, Goertz et al reported increasing rates of complementary and alternative medicine use in a large representative sample of MSMs showing that complementary and alternative medicine use is higher among MSMs than the civilian US population with a prevalence of 45%.⁶⁸ Most recently, in 2014 Davis and colleagues reported that complementary and alternative medicine was used by 37% to 46% of active duty and reserve MSMs in the United States.⁶⁹ Collectively, these articles represent a 10% increase in the prevalence in use of complementary and alternative medicine by MSMs in an 8-year time period.

VA has acknowledged the increased use of complementary and alternative medicine by veterans and the need to incorporate complementary and alternative medicine practices for

various disorders and wellness.⁷⁰ Driven by both patient expectations⁷⁰ and reaction from veteran health facilities,⁷¹ the use of complementary and alternative medicine in veterans is increasing. It is known that veterans who use VA health care are more likely to be complementary and alternative medicine users.⁷² Complementary and alternative medicine use has been reported by 27% and 50% of veterans in 2 separate studies^{73,74} and as high as 82% in a recent article by Denneson et al, where the most frequently used therapy was chiropractic care in 56% of veterans surveyed.⁷⁵ Reinhard et al performed a secondary analysis of data from veterans of Operation Enduring Freedom/Operation Iraqi Freedom. This survey includes questions about 12 preselected types of complementary and alternative medicine. They found that approximately 15% of these veterans used one of the forms of complementary and alternative medicine, with chiropractic care being used by approximately 12% of the total sample.⁷²

Authors have hypothesized that reasons for the increased use of complementary and alternative medicine may be because patients were not receiving adequate clinical results with other forms of care,^{75,76} that complementary and alternative medicine services may be a useful method for managing pain without the use of opioid pain medications,⁷⁷ exposure to a wide variety of cultural and health practices as a result of military service,⁷⁸ and that veterans have poorer health status than their civilian counterparts.⁷² Specifically with relation to veterans, Dorflinger and colleagues have noted that VA has implemented a Stepped Care Model of Pain Management that involves increasing nonopioid multimodal pain care and that consults for chiropractic care increased as this model was implemented at one VA facility.⁷⁷

Limitations

This study is limited by the literature available for review. While there has been growth in this area of inquiry in just the past few years, there are still few articles to review and therefore caution should be used in drawing generalizable conclusions from the results. It is possible that unpublished documents exist pertaining to chiropractic services in military and veteran health care. However, this article reports only on literature that is publicly available. We excluded conference abstracts from the study because many conference presentations are never published. Thus, we may have missed some accounts in the "grey literature." However, we feel that our inclusion and exclusion criteria justify this choice. As it was outside of the scope of this research, we did not review each of the policies that guide the implementation, procedures, and protocols at various military and veteran facilities. This would make an interesting study in the future.

Conclusion

Our review of the literature revealed 30 studies pertaining to chiropractic care integrated into military or veteran health care systems. Chiropractors work within a multidisciplinary health

care environment; manage neurological, musculoskeletal, and other conditions; work collaboratively with primary care providers; and have high levels of patient satisfaction. Preliminary findings show that chiropractic management of common conditions for VA and MHS patients show significant improvement. Although there is an increasing body of literature, this study points to the need for additional high-quality documentation. In order to develop a process for evaluating chiropractic services in military and veteran integrated health care delivery systems, more published research is needed. We suggest that in order to develop a greater literature base, additional training, time, funding, and collaboration are needed.

Authors' Note

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Author Contributions

Concept development: BNG, CDJ, CJD. Design: BNG, CDJ. Supervision: BNG, CDJ. Data collection/processing: BNG, CDJ. Analysis/interpretation: BNG, CDJ, CJD, JGN, JAG, DJP. Literature search: BNG. Writing: BNG, CDJ, CJD, JGN, JAG, DJP. Critical review: BNG, CDJ, CJD, JGN, JAG, DJP.

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Ethical Approval

As this was a literature review and not a study using human subjects or animals, no ethics board submission was necessary.

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