Asia-Pacific Chiropractic Journal

Identifying medical attitudes and inclinations towards Chiropractic:

A Review of the Literature

Ben Taylor

Purpose: The purpose of this study was to investigate medical practitioner attitudes towards chiropractic, and uncover major themes which may influence practitioners' attitudes.
Design: This research was conducted as a narrative review.
Methods: A systematic search of online electronic databases identified twenty eligible relevant studies. Critical appraisal of these was completed using the STROBE and PRISMA checklists.
Results: A broad variety of medically orientated attitudes towards chiropractic were uncovered from the period of 1998-2018. Twenty studies represented locations across Australia, New Zealand, Europe, South Africa, America and North America. Study participants were practising general practitioners or speciality physicians.
Synthesis: Attitudinal trends towards chiropractic ranging on a scale from negative, to neutral, or positive were revealed. Lack of evidence, concerns of safety, lack of knowledge, redundancy (due to physiotherapy), scepticism and low-referral rates are likely factors associated with negative clinician attitudes. Subjective beliefs that chiropractic is effective, high referral rates, interest in learning more about chiropractic, openness to communication, value of patient preferences, and belief that chiropractic is safe are likely factors facilitating neutral-positive clinician attitudes.
Conclusions: A representative medical attitude consensus is not currently definitive in the literature due to heterogeneity across studies and limited data of varying quality. Medical attitudes towards chiropractic appear to be multivariable in nature. Additionally, reoccurring themes which may influence attitudes have been established which warrant future research in these domains to allow improved inter-professional relationships and impact patient management in the healthcare system.

Indexing terms: Medical Attitude, Chiropractic, Complementary Alternative Medicine, Attitudes

Clinical question

What are the primary medical attitudes (General practitioners and Physicians) towards chiropractic across a global scale, and what are the common themes influencing perceived attitudes?

... the global data demonstrates a heterogeneity of attitudes which range on a spectrum from negative, to neutral, to positive. Secondarily, mounting evidence suggests that chiropractic may yield more positive medical perceptions in comparison to other forms of CAM.

Introduction

The term complementary and alternative medicine (CAM) represents a broad range of therapies which exist outside of western medicine. (1, 2, 3) Chiropractic is a primary healthcare profession which is involved with the diagnosis, treatment, and management of neuromusculoskeletal conditions and is universally considered a form of CAM in health science literature. (2, 4) Chiropractic constitutes a large consumer driven health care choice, both in Australia and globally, with an estimated annual expenditure ranging from $750-988 million within Australia. (5) In the medical system, registered doctors are generally either General Practitioners (GPs), or speciality Physicians, therefore these two groups constitute a considerable majority of medically based attitudes to represent the profession as a whole.

Although GPs are considered the gatekeepers universally within the healthcare system, relatively few studies have assessed their attitudes towards CAM or chiropractic, with this subgroup not receiving as much attention as specialist physicians receive. (6, 7, 8, 9, 10) CAM utilisation is on the rise, and its influence on medical profession is increasing. (11) Specific medical views on chiropractic may have the potential to influence patients' treatment with these practitioners. (10) Improving the understanding of medical views regarding chiropractic is warranted as the demand for chiropractic is on the rise, as well as a healthcare system which is becoming increasingly reliant on allied healthcare teams and patient-centric care. (10)

The objective of this study was to report underlying medical attitudes towards chiropractic. In particular, examine medical attitudes across a global scale and where possible isolate common themes in the literature which contribute to either positive or negative clinician attitudes. The motivation behind this review originates from a chiropractic driven agenda to improve inter-professional relationships with medicine, as a means to improve shared patient management and outcomes.

Methods

An online literature search was performed through the Central Queensland University electronic library portal, using health science data bases PubMed and Medline. Key search terms used included [Chiroprac*] and [Medical Attitude], separated by a Boolean search operator [AND]. The initial search yielded n = 425 results before inclusive and exclusive filters were applied. All data was searched, extracted, and filtered by a single reviewer.

Inclusion criteria

Inclusion criteria consisted of a preference for peer-reviewed articles from a reputable publication journal, publication date within 15 years, subject matter which represented the clinical question and journals that satisfied critical appraisal vetting.

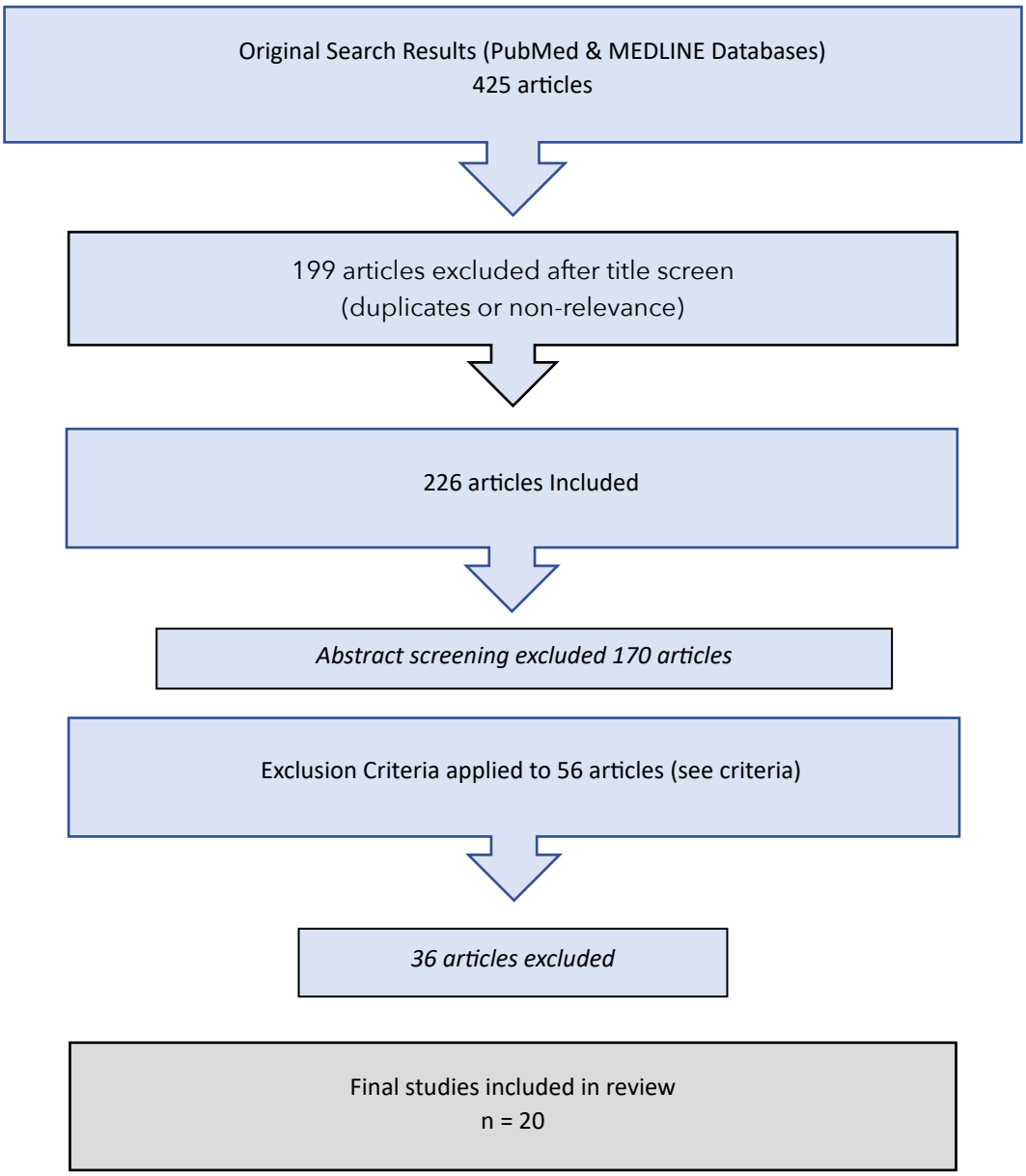
Exclusion criteria

Exclusion criteria consisted of non-English written literature, publication date over fifteen years, not satisfying critical appraisal, and subject matter irrelevant to the clinical question.

Results

A flowchart outlining the selection process used for articles in this review is shown in Figure 1. The original searches of electronic databases PubMED and MEDLINE identified 425 results. After an initial title screening, 199 were excluded due to irrelevance, or duplication. The abstracts of 226 articles were scanned, further excluding 170 articles due to non-relevance to the scope of the study. This left 56 articles, to which the exclusion criteria were applied, resulting in 36 articles being excluded. This resulted in a final 20 articles included in this review.

Figure 1: Process flow



Study selection

Twenty studies were selected to include in this review which were aligned with the research question. Of the twenty articles, nineteen were of primary questionnaire methodology (cohort/ cross-sectional) and one was systematic review design.

Analysis of results

All articles included in this review shared a questionnaire style methodology, apart from the stand-alone systematic review. The questionnaires amongst the studies were a mix of hard-copy or digital survey format. The majority of studies utilised either qualitative, quantitative, or mixed style questioning. Question formatting included closed (Likert scale) measurement or open (descriptive) measurement of outcomes to qualify responses. The studies ranged in publication date from 1995 - 2018. The participation rates ranged from 14 - 74%. The selected studies represented eleven locations; Australia, New Zealand, Canada, USA, Norway, Sweden, Poland, Holland, Netherlands, Germany, and South Africa. Eleven studies directly investigated medical

attitudes towards chiropractic. Nine Studies indirectly addressed medical attitudes towards chiropractic through the umbrella-term 'CAM. Table 1 (Evidence summary) summarises the significant components of each article included in this review.

Critical appraisal of results

The combined STROBE checklist (version 4) statement was used to critically appraise the quality of the relevant studies (Appendices, 1). The PRISMA checklist (Appendices, 2) was applied to the one systematic review included. As displayed, all studies have been rated from fair to good quality for the purposes of this review, with individual study strengths and limitations commented on throughout this review.

Table 1: Summary of evidence

General Practitioners (GPs)				
Author/Year	Sample size/ characteristics	Outcome measure	Study design	Results
Verhoef & Sutherland (1995)	*n*400 Canadian GPs (Ontario & Alberta)	Perceived attitude towards alternative medicine (chiropractic included)	Mailed questionnaire	50% respondents. 56% of GPs believed that chiropractic was beneficial, 54% referred to chiropractors, and 16% practiced alternative medicine themselves.
Dated Canadian study to show early endeavours in this field. *Strengths: Peer-reviewed* *Limitations: Risk of generalisability and selection bias*				
Brussee et al (2001)	*n*252 GPs in 84 cities in the Netherlands.	Perceived attitudes towards chiropractic	Mailed questionnaire. Open and closed ended questions.	115 responses, 46% response rate. Majority of GPs have heard of chiropractic, with a large amount of information coming from patients who were treated by chiropractors (78%). Only 10% GP's referred to a chiropractor regularly. Factors surrounding referrals to chiropractors included; perceived knowledge of chiropractors, and positive held beliefs. 80% of GPs commented that they were interested in receiving feedback reports from chiropractors.
Dated Danish study to show early research endeavours in this field. *Strengths: Peer-reviewed* *Limitations: Risk of generalisability and selection bias.*				

Schmidt et al (2002)	n97 GPs in the UK and 99 GPs in Germany.	Perceived attitude to CAM (Chiropractic included)	Mailed 13 item questionnaire Open and closed questions.	133 responses received, 68% response rate. German GPs held a more positive view towards CAM compared to British GPs. British GPs referred to CAM more frequently, and chiropractic being one of the most popular referral options between GPs. A high rate of German GPs reported a history of practising and supporting CAM personally. 70% of British GPs and 76% of German GPs agreed that CAM is safe for patients.
Dated European study but shows contrast between European GPs and was the first study to cross-cultural attitudes of GPs towards CAM. *Strengths: High response rate. Peer-reviewed.* *Limitations: Risk of Generalisability and selection bias. Small sample size. Non-randomised participant selection.*				
Greene et al (2006)	n 1561 GP's and DO's in Iowa, USA	Referral behaviours and attitudes to chiropractors	Mailed questionnaire	517 responses, 33% response rate. GP's were unlikely themselves to make formal referral relationships with chiropractors, even in light of patient interest. GPs in private practice showed higher chances of referral to chiropractors.
Strengths: Peer-reviewed Piloted study *Limitations: Generalisability risk due to sample location and size*				
Wardle, Ibbitt, Adams (2013)	n1486 regional and rural based NSW GPs	Perceived attitude of chiropractic	27 item mailed questionnaire	585 responses. 64.1 % of Gps referred to a chiropractor, 21.7% refrain from referral to a chiropractor. Factors influencing referrals; patient preference, GPs favouring CAM, lack of other treatment options, positive previous results from chiropractor(s).
Original research assessing regional and rural based GPs *Strengths: Peer-reviewed* *Limitations: Risk of selection bias, Data was self-reported*				

Westin, Tandberg, John, Axén (2013)	*n*800 Norwegian and Swedish GPs	Perceived attitude of chiropractic	Mailed 13 item close ended questionnaire	359 respondents. 44.8% Swiss response rate, 45.3% Norwegian response rate. 50% of Swedish GPs have poor knowledge of chiropractic, 10% of Norwegian stated the same. Almost all Norwegian GPs have had experience with chiropractic treatment, yet a large number of Swedish GPs mentioned no experience at all. Norwegian GP referrals to chiropractors was double to that of Swedish GPs. Both groups of GPs believed that chiropractors are suitably trained practitioners.
Dual European study assessing Norwegian and Swedish GPs. *Shows European GP perspectives* *Strengths: Peer reviewed* *Limitations: Self-reported data,* *Risk of selection bias*				
Engel, Beirman, Grace (2016)	n650 GPs across Australia	Perceived attitude of chiropractic	Online Cross-sectional Questionnaire	630 respondents. 70% of GP's believed that chiropractic education was not evidence based, 60% of GP's have never referred to a chiropractor, and 68% of GP's were not interested in learning more about chiropractic education.
Australian study assessing GPs. *Strengths: Peer reviewed, Recent publication* *Limitations: Risk of generalisability and selection bias*				
Kier et al (2013)	n385 Welsh GPs	Perceived attitudes and referral patterns towards practitioners who perform SMT (chiropractic included)	Mailed Questionnaire. Open and closed question.	182 respondents, 50.8% response rate. 72% had referred out to SMT, with a preference for Physiotherapy, Osteopathy, and Chiropractic. 21% who had never referred out for SMT would not consider it for themselves. A small subgroup trend was apparent – 5 individuals who had not referred to SMT either had or would consider SMT for themselves, whereas 23 of respondents to referred out to SMT haven't and would not seek it themselves.
Strengths: Peer-reviewed, Pre-piloted survey, Recent publication *Limitations: Risks of generalisability and selection bias, Small sample size, and borderline response rate.*				

Grace, Engel & Jalsion (2018)	*n*630 Australian GPs	Perceived attitude towards chiropractic and osteopathy	43 item Qualitative open-ended questionnaire	184 GP responses. Negative attitudes were uncovered from GPs towards chiropractors and osteopaths. Five strong themes responsible for these attitudes include lack of safety, efficacy, and inadequacy of training. Negative views towards chiropractors outweighed those towards osteopathy
Strengths: Recent publication, Peer-reviewed *Limitations: Small sample size* *Risk of selection bias – many GPs who participated in the survey had never referred to chiropractor and did want to learn more regarding chiropractic, thus results may have been based on opinion rather than experience or fact.*				
Wardle, Sibbritt, Adams (2018)	n1486 regional and rural based NSW GPs	Perceived attitude of GPs to CAM (chiropractic included)	Mailed Open and closed ended qualitative cross-sectional questionnaire	Themes of opposition, resistance, and inappropriateness towards CAM.
Australian study (rural & regional) assessing GPs. Follow up study on a previous attempt by authors. *Strengths: Peer-reviewed* *Limitations: Risk of selection bias*				
Poyton et al (2006)	n500 New Zealand GPs	Perceived attitude towards CAM (chiropractic included)	Nation-wide cross-sectional postal questionnaire	300 responses, response rate 60%. 20% of GPs practiced some form of CAM. 95% referred patients to one or more CAM practitioner(s). Chiropractic was the most popular CAM referred to by GPs. 32% of GPs had formal training in CAM, 29% had self-education in CAM. 67% of GPs felt that CAM should be included in conventional medical training.
Strengths: New Zealand perspective of GPs towards CAM. Provides a comparison to previous 15 years of NZ GP/CAM research, Peer-reviewed *Limitations: Risk of selection bias and generalisability.*				

Louw J & Myburgh (2007)	n596 South African GPs	Perceived attitude towards chiropractic (measuring 5 themes)	32-item open and closed style questionnaire.	77 responses, response rate 17%. 85% had a knowledge of chiropractic, 19% had no knowledge of chiropractic. 59% of GPs received their information on chiropractic from patients, whilst 9% received information on chiropractic in their training. 32% of GPs had been treated by a chiropractor. 43% of GPs have communicated with a chiropractor, 4% doing so on a regular basis. 51.5% of GPs reported positive communication experiences. 46.8% GPs referred to chiropractors based a combination of personal and patient preference. The Majority of GPs indicated they would like referral reports from chiropractors. 44% of GPs were in favour of regular chiropractic visits. 15% of GPs perceived chiropractors market share to be low, and 51.6% believed more patients should see chiropractors: factors for these believes included; chiropractic is useful, chiropractic is under-utilised, and chiropractic reduces reliance on medications. Factors that made GPs oppose chiropractic included; subjective belief of non-effectiveness, lack of knowledge, redundancy due to physiotherapy, and overtreating.
Strengths: Piloted study, Peer-reviewed *Limitations: Low-response rate, Risk of generalisability and selection bias*				
Jarvis et al (2015)	n536 UK GPs	Perceived attitude towards CAM (chiropractic included)	Qualitative semi-structured in-depth telephone interviews	19 participants. A thematic analysis showed three major attitude trends towards CAM - Limited evidence - Low patient demand - Regulation concerns
Strengths: Original study analysing non- academic GP's views regarding CAM's role in clinical practice,Peer-reviewed *Limitations: Indirectly addresses chiropractic, Low-response rate, Risk of generalisability and selection bias*				

Perry et al (2013)	n242 UK GPs.	Perceived attitude towards CAM (chiropractic included). 10 year follow up (1999 / 2010)	Posted Questionnaire.	79 participants, 32% response rate. Lower response rate than previous 1999 survey (52%) Overall, GPs were less likely to positively support CAM in comparison to the previous survey (38% vs 19%). The most faverouble CAM's were acupuncture, hypnotherapy and chiropractic. Chiropractic effectiveness rating was 44.4 %. Least faverouble therapies were reflexology, aromatherapy, and medical herbalism.
Strengths: follow up study, Peer reviewed *Limitations: Low response rate and sample size, Risk of selection bias and generalisability*				

Physicians

Author/Year	Sample size/ characteristics	Outcome measure	Study design	Results
Busse et al (2009)	*n*1000 Canadian and American Orthopaedic Surgeons	Perceived attitude towards chiropractic	Faxed 43 item questionnaire (Likert scale, plus one open question)	49% response rate, with 487 responses. 44.5% held negative opinion to chiropractic, 29.4% held faverouble views, and 26.1% were neutral. Half of respondents referred to chiropractic each year. The majority of surgeons believe that chiropractors provide effective relief for some musculoskeletal conditions (81.8%), and did not believe chiropractors could provide relief for non-musculoskeletal disease (89.5%). The majority believed that chiropractors provided nessacery treatment (72.7%), partake in overly aggressive marketing (63.1%), and create patient dependency (52.3%).
Canadian study assessing Orthopaedic surgeons. *Strengths: Peer-reviewed* *Limitations: Risk of selection bias. Limited generalisability of results*				

Weis et al (2016)	*n*659 Canadian Obstetricians	Perceived attitude towards chiropractic (for pregnant patients with LBP)	38-item cross-sectional questionnaire (5-point likert scale) and one open question	91 responses, response rate 14%. 30% of Drs held positive views toward chiropractic, 37%- neutral, 33%- negative views. Most believed chiropractic was effective for some musculoskeletal complaints (77%), but 74% disagreed chiropractic has a role to play in non-musculoskeletal conditions. 40% of Drs referred to chiropractors, 50% Of Drs were interested in learning more about chiropractic.
Original Canadian study assessing obstetricians' attitudes towards chiropractic in reference to pregnant females with LBP. *Strengths: Peer-reviewed, Pre-piloted Questionnaire* *Limitations: Generalisability and selection bias due to lower than average response rate.*				
Kotala & Barański (2016)	*n*220 Polish junior and senior physicians	Perceived attitude towards CAM (chiropractic included)	12-tiem Descriptive questionnaire (five-point Likert scale)	170 respondents, 74% response rate. Senior doctors held more positive beliefs towards CAM than junior doctors. In general, scepticism was apparent in all sampled. In light of this, physicians are open to researching CAM and having conversations about CAM with patients. 26% of Physicians recommended chiropractic, 34% accept chiropractic, and 41% discourage it's use. 60% of physicians held a general positive view towards chiropractic.
Strengths: Peer-reviewed, High response rate *Limitations: Small sample size, Risk of generalisation* *Specific answer style "I agree/disagree" may not represent the wide range of views held by physicians as opposed to open based questioning.* *Study did not define CAM so answers may be biased to respondent's own interpretation.*				
Garner et al (2008)	All Physicians and Nurses from two Canadian community health centres.	Perceived attitude and perceptions towards chiropractic. Chiropractor introduced into two healthcare teams	Item qualitative and quantitative questionnaire before, mid-way, and after study (18 months)	Twelve practitioner participants were followed over 18 months, 6 of these were medical doctors. On conclusion of the study, the participants showed increasingly positive attitudes in reference to trust, legitimacy, and effectiveness of chiropractic within multidisciplinary health care setting.
Strengths: Peer-reviewed, Pre, middle and post study questionnaires. *Limitations: Small sample size and settings, therefore Inherent risk of generalisability and bias.*				

Grainger & Walker (2013)	4713 sample size across all studies from USA, Canada, and Holland.	Rheumatologists attitudes towards CAM (chiropractic included)	Systematic review. 6 studies. All studies analysed in the review used a questionnaire methodology.	2170 participants, response rate ranging from 48-70%. Overall, Rheumatologists attitudes towards CAM varied according to CAM modality. In regard to chiropractic; One Canadian study showed that chiropractic was viewed as useless/ harmful. One USA study showed 52% of rheumatologists perceiving chiropractic very/or moderately beneficial, with 39% willing to recommend. A USA study showed 58% of rheumatologists have recommended chiropractic. Another study showed 49% of participants viewing chiropractic as positive.
Strengths: Systematic review, Peer-reviewed *Limitations: Specific inclusion criteria of studies, Risk of response bias, Risk of generalisability* *Heterogeneity across surveys (especially in regard to methodology and limited access to full data, one study's data was only available through an abstract)*				

Hamilton & Marietti (2017)	*n*18 Australian (Queensland) psychologists	Attitudes towards CAM (chiropractic included)	Qualitative Sem-structured interview. Thematic analysis.	18 participants, 100% response rate. Major themes based off results included; Knowledge toward CAM - Majority believed CAM lacks scientific evidence - Majority had limited knowledge of CAM modalities. Attitude toward CAM - 50% positively endorsed CAM and wanted to learn more. - A more favourable attitude towards CAM was held in presence of that individual therapies research. A more negative attitude towards a CAM modality was held due a perceived lack of research. - Some psychologists commented on being wary of "quacks", questioning the training and education of CAM therapists. - Many psychologists reported that they would not use or mention CAM to patient, unless the patient showed an interest. - 50% psychologists reported CAM was ideal as a complement to evidence-based care and not to be used in isolation. - Majority of psychologists commented that the level training and knowledge of a particular CAM therapy influences their use in practice. - Majority of psychologists commented that colleague/ professional acceptance of CAM validates it's use in practice.
Strengths: Peer-reviewed, High response rate *Limitations: Sample size small and mostly females* *Does not address chiropractic exclusively, limiting conclusions to CAM as a whole.*				

Discussion

This narrative review is the first known attempt to critically examine the current body of research investigating medical attitudes towards chiropractic across a universal scale. Throughout the twenty articles included for this review (Table 1), significant themes have been identified based on the individual analysis of each studies results. The discussion of this review has been structured both thematically (Table 2) and geographically for context in line with the research question.

Major Themes Influencing Negative Dr Attitudes	Mentioned in Study
Safety of chiropractic	Grace et al (2016) Schmidt et al (2006)
Lack of knowledge of chiropractic	Hamilton & Marietti (2017) Westin et al (2013) Brusse et al (2001) Louw & Myburgh (2007)
Chiropractic is not evidence based	Engel et al (2016) Grace et al (2018) Hamilton & Marietti (2017) Schmidt et al (2006) Jarvis et al (2014)
Low referral rates/utilisation of chiropractic	Engel et al (2016) Greene et al (2006) Brusse et al (2001)
Scepticism	Perry et al (2013) Kotala & Baranski (2016)
Redundancy due to physiotherapy	Grace et al (2018) Kier et al (2013) Louw & Myburgh (2007)
Major Themes Influencing Positive Dr attitudes	Mentioned in study
Believe that chiropractic is effective for MSK conditions	Busse et al (2009) Weis et al (2015) Garner et al (2008) Grainger et al (2013) Westin et al (2013) Kier et al (2013) Louw & Myburgh (2007)
High referral rates	Wardle et al (2013) Poynton et al (2006), Grainger et al (2013) Schmidt et al (2006)
Interest in learning more about chiropractic	Weis et al (2015) Kier et al (2013) Kotala & Baranski (2016)
Open to communication with a chiropractor	Louw & Myburgh (2007)
Patient interest	Wardle et al (2013) Busee et al (2009) Louw & Myburgh (2007)
Chiropractic is safe	Schmidt et al (2002)

Australian and New Zealand attitudes

Available Australian & New Zealand research investigating medical attitudes towards chiropractic is of low volume with contrasting attitudes. In Australian rural and regional research Wardle et al (6) has demonstrated that within a surveyed sample of non-metropolitan general practitioners in New South Wales, positive attitudes towards chiropractic have been identified. Within this study, the authors have demonstrated results showing that the majority of GPs

(64.1%) had referred to a chiropractor and a minority of GPs (21.7%) refrained from referring to a chiropractor.

In light of these results, it is reasonable to conclude that the majority of non-metropolitan GPs held positive attitudes towards chiropractic (by ways of referral rates), with a minority of GPs holding negative attitudes towards chiropractic. These conclusions cannot be representative of the Australian GP population as the sample size and response rate have inherent limitations.

New Zealand research by Poyton et al (7) has also been able to elicit positive GP attitudes towards chiropractic, in a cross-sectional nationwide questionnaire. Significant results revealed that within a sample of GPs, a proportion practiced one form of CAM (20%), the majority referred to CAM practitioners (95%, with chiropractic being the most popular referral option), and a majority believed that CAM should be a part of medical training (67%). The authors of this study argued whilst an evident decline in GPs practising CAM is apparent, an increase in referrals, especially chiropractic, is distinctive. This study has demonstrated positive attitudes of a select sample New Zealand based GP's, but has limitations such as generalisability of results and potential selection bias.

Researchers Hamilton & Mariette (8) in a 2017 study investigating Australian Psychologist attitudes towards CAM have uncovered varying attitudes towards CAM modalities within qualitative semi-structured interviews. Significant results, thematically analysed, show this sample of psychologists positively endorsed evidence-based CAM and wanted to learn more (50%); believed that CAM compliments evidence-based care (50%). In variance, within the same sample, the majority believed that CAM lacks an evidence base, some are weary of non-suitably trained practitioners, and many would not mention CAM to a patient unless the patient showed an interest. These results demonstrate that approximately half of psychologists in this sample are generally open to CAM, yet certain factions within the sample reveal caveats towards CAM which therefore may have influenced negative attitudes. The authority of this study is limited by a small sample size (n18), consisting of mostly females.

In contrast to research demonstrating positive attitudes, Australian based research published within the last five years; Engel et al, (9) Grace et al, (10) and Wardle et al (11) argue the theory that GP attitudes towards chiropractic are increasingly negative. Results of a 2016 cross-sectional, descriptive survey by Engel et al (9) showed within the GPs sampled Australia-wide the majority held negative attitudes towards chiropractic; chiropractic education has no evidence base (70%), GPs never referred to a chiropractor (60%) and not interested in learning more regarding chiropractic education (68%). The authors concluded that these results reveal unfavourable GP attitudes, and negative media towards chiropractic at the time may have influenced these attitudes.

Two years later, the same researchers, Grace et al (10) using a similar methodology, were able to demonstrate negative GP attitudes towards chiropractic on a second occasion, thus reinforcing original conclusions made. An analysis of results revealed negative attitudes primarily around themes of safety and evidence laxity, redundancy (due to physiotherapy), unethical financial motivations and improper training. The authors concluded that GP attitudes towards chiropractic remain negative, maintaining their previous hypothesis In the same year, research by Wardle et al (11) examining GP knowledge and attitudes towards CAM (chiropractic included), methodically through a questionnaire, were also successful in demonstrating negative attitudes with opposition, inappropriateness and resistance to CAM prevalent across participants. The credibility of this study is limited due to the low-response rate and risk of selection bias.

American and Canadian attitudes

Early Canadian research by Verhoef & Sutherland (12) has proposed considerable acceptance of alternative medicine (AM), chiropractic included. Significant results of a mailed survey revealed; AM has ideas and methods which medicine could benefit (56%), Over half referred to alternative practitioners (54%), and some GP's practiced a form of AM themselves (16%). Additionally, the authors have commented that attitudes towards AM vary dependant on individual doctor variables such as sex, age, type of practice, training and knowledge in AM. This study, whilst demonstrating early research is outdated, and given attitudes may have changed.

Research by Garner et al (13) has demonstrated a positive change in medical attitudes from six doctors and six nurses towards chiropractic after chiropractors were introduced to medical teams in Canada. Results extracted from questionnaires before, during and after the chiropractic intervention revealed increasingly positive attitudes in regard to trust, legitimacy, and effectiveness of chiropractic. These results, as the authors have suggested, are indicative that medical acceptance and integration of chiropractic is feasible, which contradicts previous research. This study has provided a framework for future research inquires, yet it would be beneficial is these results were substantiated with replication in larger sample sizes, across multiple locations.

Subsequent research by Weis et al (14) has shown diverse attitudes when Canadian Obstetricians were queried on chiropractic relevant to female lower back pain patients. In a cross-sectional questionnaire, obstetricians attitudes to chiropractic varied (30% positive, 37% neutral, and 33% negative). Furthermore, the majority believed chiropractic was effective for musculoskeletal pain (77%), indicting agreement of the effectiveness of chiropractic, yet the majority disagreed that chiropractic played a role in non-musculoskeletal conditions (74%), revealing significant caveat to opinions raised. This study showed themes which indicate the role of educating physicians on the safety, efficacy, and training within chiropractic in order to foster better inter-professional relations.

In similar findings, Busse et al (15) have also argued diverse attitudes towards chiropractic in a cross-sectional survey sampling Canadian orthopaedic surgeons. Results demonstrated diversity of attitudes pertinent to chiropractic; negative attitudes (44.5%), positive attitudes (29.4%) and neutral attitudes (26.1%). In similarity, this study was able to replicate common findings seen in the literature by Weis et al, (14) Brussee et al, (15) and Kier et al (17) whereby all studies showed doctors agree chiropractic is effective for some musculoskeletal conditions (77% Weis et al, 81.8% Brussee et al, Kier et al, majority). Additionally, Busse et al (15) was able to replicate similar attitudes uncovered in aforementioned research, whereby in both studies, half of doctors would like to learn about CAM or Chiropractic (Hamilton & Marietti (8) 50% CAM, Weis et al (14) 50% chiropractic). The low-response rate (14%) is limiting factor when validating these results from Busse et al. (15)

In a systematic review by Grainger & Walker, (18) assessing rheumatologist attitudes towards CAM, this Canadian based study demonstrated that the majority rheumatologists regarded chiropractic as '*useless/ harmful*'. In contrast, American based studies included in the same review demonstrated over half of respondents are open to chiropractic; chiropractic is very/or moderately beneficial (52%) and would recommend chiropractic (58%). The insights gained from this review demonstrate diversity of attitudes between Canadian and American rheumatologists in regards to chiropractic, showing American attitudes are more positive than Canadian attitudes sampled. Overall, in spite of this studies limitations (limited quality of data, and heterogeneity), the review favours neutral-positive attitudes towards chiropractic from rheumatologists when combining American and Canadian based studies. In contrast to these studies showing neutral-positive attitudes, American research by Green et al (19) found that

General Practitioners in Iowa likely hold negative attitudes towards chiropractors. Study results via a mailed questionnaire revealed participant GPs rarely referred to chiropractors. The authors concluded the perception towards chiropractic from GPs within Iowa was negative, as evident in referral trends. Whilst this particular study offers a fair insight, the low response rate (33%), risks of bias and sample size limit generalisability of results.

European and South African Attitudes

Multiple dual national comparative studies exist demonstrating General Practitioner attitudes towards CAM (Schmidt et al, 2o) or chiropractic (Westin et al, 21) between European nations.

Early research by Schmidt et al (2002) investigated the difference in attitude towards CAM amongst GPs in the United Kingdom (UK) and Germany. Significant results, from a mailed survey showed a commonality, whereby the majority of both nations GPs agreed CAM is safe for patients (UK GPs 70%, German GPs 76%). Additionally, some differences were evident, whilst German GPs were more positive towards CAM, UK GPs referred to CAM more frequently, with chiropractic being the most preferred referral option. Overall, the authors have concluded that both groups of GPs are positive towards CAM, although both groups of GPs raised concerns regarding lack of scientific evidence and information available on CAM when prompted. In similar research scope and methodology published ten years later by Westin et a, (21), Norwegian and Swedish GPs attitudes towards chiropractic was explored. Significant results revealed the majority of Swedish GPs had poor knowledge and experience of chiropractic, whilst the majority of Norwegian GPs had some form of knowledge and experience with chiropractic.

Additionally, GP referrals to chiropractors was double in Norway when compared to Sweden. In agreement, both groups of GPs believed that chiropractors are suitable trained to manage musculoskeletal conditions. These results demonstrate contrasting differences between a sample of Norwegian and Swedish GPs. The findings suggest that participant Swedish GPs hold more favourable views towards chiropractic in comparison to Norwegian GPs. Both comparative studies are valuable indicating GP attitudes and themes across different European nations, yet limitations exist in both studies such as limited sample sizes, self-administered questionnaires, and risks of selection bias.

An individual Danish study by Brussee et al (16) has indicated neutral-positive attitudes from GPs towards chiropractors. According to results, the majority of GPs had heard of chiropractic (78%), with information predominately sourced from patients. Furthermore, the majority of GPs (80%) were interested in communicating with chiropractors. Whilst positive attitudes were uncovered, additional data showed only 10% of GPs regularly referred to chiropractors, indicating a significant laxity of referrals. In similar agreement, multiple aforementioned studies, Greene et al. (19), Engel et al, (9), have also isolated low referral trends from GPs to chiropractors in the United States and Australia.

Various single population European studies, Jarvis et al, (22) Perry et al, (23); Olchowska-Kotala & Baranski (24) have addressed GP attitudes to CAM directly, with chiropractic being addressed indirectly. UK based research by Jarvis et al, (22), investigating GPs attitudes towards CAM has demonstrated negative attitudes. A thematic analysis of survey results uncovered three major themes facilitating negative attitudes of CAM which included limited evidence, low patient demand, and regulatory concerns. In similarity, the concern of limited evidence has been a re-occurring theme across two similar studies governing GPs attitudes towards CAM (Schmidt et al, 20) and chiropractic (Engel et al 9). Additional UK research published in the previous year by Perry et al (23) has generated similar negative GP attitudes towards CAM. In this follow up study to research published in 1999, significant comparative results have demonstrated a decreased

response rate (32% vs 52% previously) and GPs less likely to positively support CAM (14% vs 38% previously).

In spite of these statistics, chiropractic was the third most popular CAM modality after acupuncture and hypnotherapy. These results show that whilst a comparative decline in support of CAM is evident, chiropractic is still held in high favour, which suggest that chiropractic garners more positive attitudes compared to other CAM modalities.

A 2016 Polish based study from Olchowska-Kotala & Baranski (24) has argued contrasting medical perceptions of CAM (chiropractic included). Significant results showed that doctors were skeptical in general to CAM, yet the majority of doctors (60%) held a positive view towards chiropractic. This preference of favouring chiropractic over other CAM modalities is a reoccurring theme in the literature as studies Perry et al, (23) Schmidt et al. (20) Poynton et al (7) all demonstrate.

This trend suggests that medical attitudes towards chiropractic are relatively positive in comparison to other forms of CAM. In similar light, recent Welsh research by (Kier et al, 17) argues chiropractic appears to be one of the preferred referral options after physiotherapy. Results of this study revealed the majority of GPs (72%) have referred patients for spinal manipulative therapy, with the majority favouring physiotherapy as their preferred choice. Interestingly, just over 40% of GPs mentioned a preference for chiropractic or osteopathy.

These results suggest that chiropractic may appear redundant to the majority of participant GPs due to physiotherapy, yet a subgroup exists demonstrating a direct preference towards chiropractic. South African research by Louw & Myburgh (25) proposes relatively positive attitudes towards chiropractic. This was evident in survey results which indicated the majority of GPs would appreciate referral reports from chiropractors and have had positive communication with chiropractors in the past (51.5%). In light of these results, further themes were uncovered such as lack of chiropractic knowledge and physiotherapy making chiropractic redundant, which may contribute to opposing attitudes. Multiple studies, (10, 17) also suggest the presence of physiotherapy rendering chiropractic redundant in GPs views, thus influencing clinicians' attitudes towards chiropractic.

Limitations of this Review

As this review was completed as a part of the CQU Master of Chiropractic program, a limitation of time to complete this review may have impacted the quality of this study. This review was solely conducted by a single author, therefore, a risk of unintentional bias may be pertinent. This review excluded any non-english articles, such articles may have otherwise influenced the narrative of this review. The majority of studies utilised in this review used questionnaire-style methodology, which inherently has its own risks such as selection bias (due to low participation rates) and generalisability (due to small sample sizes).

Recommendations

Various recommendations are proposed in light of this review. A growing, yet small body of evidence has been completed pertinent to the medical attitudes of chiropractic. Future research should aim to further clarify individual factors which correlate to negative or positive medical attitudes towards chiropractic. This may inform strategies that global and regional chiropractic associations can pursue in order to better improve inter-professional relations with medicine.

Additionally, future research with larger sample sizes will address limitations of generalisability and better representative of a definitive medical consensus per geographical territory.

Furthermore, mixed qualitative and quantitative methodology and pre and post interventional studies assessing attitude change over time are highly valuable to identify catalysts for attitude changes and therefore may be of interest to relevant stakeholders within chiropractic and medicine.

Conclusion

Investigating medical attitudes towards chiropractic and the factors governing these attitudes is essential to improve inter-professional relationships, which may ultimately impact patient management within the healthcare system.

The evidence synthesised in this review suggests that no representative medical attitude towards chiropractic can currently be reported and however remains inconclusive.

The global data demonstrates a heterogeneity of attitudes which range on a spectrum from negative, to neutral, to positive. Secondarily, mounting evidence suggests that chiropractic may yield more positive medical perceptions in comparison to other forms of CAM.

Furthermore, multiple recurring themes have been encountered which indicate the likelihood to influence individual clinicians' attitudes towards chiropractic. Multiple studies indicate that a lack of evidence, concerns of safety, lack of knowledge, redundancy (due to physiotherapy), scepticism and low-referral rates maybe factors associated with negative clinician attitudes.

In contrast, multiple studies also indicate that clinicians subjective belief that chiropractic is effective, high referral rates, interest in learning more about chiropractic, openness to communication, value of patient preferences, and belief that chiropractic is safe maybe factors facilitating neutral-positive clinician attitudes.

Ben Taylor
BHealthSc, MClinChiropr
Private practice of chiropractic, Sydney
ben_4259@hotmail.com

Cite: Taylor B. Identifying medical attitudes and inclinations towards Chiropractic: A Review of the Literature. Asia-Pacific Chiropr J. 2021;1.3. URL apcj.net/taylor-review-medical-attitudes/

References

1 Leach M. Profile of the complementary and alternative medicine workforce across Australia, New Zealand, Canada, United States and United Kingdom. Complementary Therapies in Medicine [Internet]. 2013 [cited 10 May 2020];21(4). Available from: https://www.sciencedirect.com/science/article/abs/pii/S0965229913000836.

2 Xue C, Zhang A, Lin V, Myers R, Polus B, Story D. Acupuncture, chiropractic and osteopathy use in Australia: a national population survey. BMC Public Health [Internet]. 2008 [cited 10 May 2020];8(1). Available from: https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-8-105.

3 Barnes P, Powell-Griner E, McFann K, Nahin R. Complementary and alternative medicine use among adults: United States, 2007. Seminars in Integrative Medicine [Internet]. 2008 [cited 10 May 2020];2(2). Available from: https://www.ncbi.nlm.nih.gov/pubmed/19361005.

4 The World Federation of Chiropractic: Definition of chiropractic [Internet]. Wfc.org. 2020 [cited 10 May 2020]. Available from: https://www.wfc.org/website/.

5) Adams J, Lauche R, Peng W, Steel A, Moore C, Amorin-Woods L et al. A workforce survey of Australian chiropractic: the profile and practice features of a nationally representative sample of 2,005 chiropractors. BMC Complementary and Alternative Medicine [Internet]. 2017 [cited 10 May 2020];17(1). Available from: https://bmccomplementmedtherapies.biomedcentral.com/articles/10.1186/s12906-016-1542-x.

6 Wardle J, Sibbritt D, Adams J. Referrals to chiropractors and osteopaths: a survey of general practitioners in rural and regional New South Wales, Australia. Chiropractic & Manual Therapies [Internet]. 2013 [cited 27 March 2020];21(1). Available from: https://chiromt.biomedcentral.com/articles/10.1186/2045-709X-21-5.

7 Poynton L, Dowell A, Dew K, Egan T. General Practitioners' Attitudes toward (and Use Of) Complementary and Alternative Medicine: A New Zealand Nationwide Survey. The New Zealand Medical Journal. [Internet]. 2006. [cited 9 April 2020]. Available from: https://pubmed.ncbi.nlm.nih.gov/17195854/.

8 Hamilton K, Marietti V. A qualitative investigation of Australian psychologists' perceptions about complementary and alternative medicine for use in clinical practice. Complementary Therapies in Clinical Practice [Internet]. 2017 [cited 26 April 2020];29. Available from: https://www.sciencedirect.com/science/article/abs/pii/S1744388117302797?via%3Dihub.

9 Engel R, Beirman R, Grace S. An indication of current views of Australian general practitioners towards chiropractic and osteopathy: a cross-sectional study. Chiropractic & Manual Therapies [Internet]. 2016 [cited 27 March 2020];24(1). Available from: https://chiromt.biomedcentral.com/articles/10.1186/s12998-016-0119-6.

10 Grace S, Engel R, Jalsion I. Themes Underlying Australian General Practitioner Views towards Chiropractic and Osteopathy: An Assessment of Free Text Data from a Cross-Sectional Survey. Evidence-Based Complementary and Alternative Medicine [Internet]. 2018 [cited 27 March 2020];2018. Available from: https://www.hindawi.com/journals/ecam/2018/2786106/.

11 Wardle J, Sibbritt D, Adams J. Primary care practitioner perceptions and attitudes of complementary medicine: a content analysis of free-text responses from a survey of non-metropolitan Australian general practitioners. Primary Health Care Research & Development [Internet]. 2018 [cited 27 March 2020];19(03). Available from: https://doi.org/10.1017/S1463423617000664.

12 Verhoef MJ, Sutherland LR. Alternative medicine and general practitioners. Opinions and behaviour. Complementary Therapies in Medicine [Internet]. 1998 [cited 1 April 2020];6(2). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2146582/

13 Garner M, Birmingham M, Aker P, Moher D, Balon J, Keenan D et al. Developing Integrative Primary Healthcare Delivery: Adding a Chiropractor to the Team. EXPLORE [Internet]. 2008 [cited 14 April 2020];4(1):18-24. Available from: https://doi-org.ezproxy.cqu.edu.au/10.1016/j.explore.2007.10.003.

14 Weis C, Stuber K, Barrett J, Greco A, Kipershlak A, Glenn T et al. Attitudes Toward Chiropractic. Journal of Evidence-Based Complementary & Alternative Medicine [Internet]. 2015 [cited 6 April 2020];21(2). Available from: https://journals.sagepub.com/doi/10.1177/2156587215604073.

15 Busse J, Jacobs C, Ngo T, Rodine R, Torrance D, Jim J et al. Attitudes Toward Chiropractic. Spine [Internet]. 2009 [cited 5 April 2020];34(25). Available from: https://journals.lww.com/spinejournal/Abstract/2009/12010/Attitudes_Toward_Chiropractic__A_Survey_of_North.18.aspx.

16 Brussee W, Assendelft W, Breen A. Communication between general practitioners and chiropractors. Journal of Manipulative and Physiological Therapeutics [Internet]. 2001 [cited 6 April 2020];24(1). Available from: https://www.jmptonline.org/article/S0161-4754(01)62762-3/fulltext.

17) Kier A, George M, McCarthy P. Survey based investigation into general practitioner referral patterns for spinal manipulative therapy. Chiropractic & Manual Therapies [Internet]. 2013 [cited 7 April 2020];21(1). Available from: https://chiromt.biomedcentral.com/articles/10.1186/2045-709X-21-16.

18 Grainger R, Walker J. Rheumatologists' opinions towards complementary and alternative medicine: A systematic review. Clinical Rheumatology [Internet]. 2013 [cited 26 April 2020];33(1). Available from: https://link.springer.com/article/10.1007/s10067-013-2379-z.

19. Greene B, Smith M, Allareddy V, Haas M. Referral patterns and attitudes of Primary Care Physicians towards chiropractors. BMC Complementary and Alternative Medicine [Internet]. 2006 [cited 8 April 2020];6(1). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1456998/.

20 Schmidt K, Jacobs P, Barton A. Cross-cultural differences in GPs' attitudes towards complementary and alternative medicine: a survey comparing regions of the UK and Germany. Complementary Therapies in Medicine [Internet]. 2002 [cited 7 April 2020];10(3). Available from: https://www.sciencedirect.com/science/article/abs/pii/S0965229902000560?via%3Dihub.

21 Westin D, Tandberg T, John C, Axén I. GPs opinions and perceptions of chiropractic in Sweden and Norway: a descriptive survey. Chiropractic & Manual Therapies [Internet]. 2013 [cited 27 March 2020];21(1). Available from: https://chiromt.biomedcentral.com/articles/10.1186/2045-709X-21-29

22 Jarvis A, Perry R, Smith D, Terry R, Peters S. General practitioners' beliefs about the clinical utility of complementary and alternative medicine. Primary Health Care Research & Development [Internet]. 2014 [cited 26 April 2020];16(03). Available from: https://www.ncbi.nlm.nih.gov/pubmed/24892506.

23 Perry R, Dowrick C, Ernst E. Complementary medicine and general practice in an urban setting: a decade on. Primary Health Care Research & Development [Internet]. 2013 [cited 27 April 2020];15(03). Available from: https://doi.org/10.1017/S1463423613000182.

24 Olchowska-Kotala A, Barański J. Polish physicians' attitudes to complementary and alternative medicine. Complementary Therapies in Medicine [Internet]. 2016 [cited 29 March 2020];27. Available from: https://www.sciencedirect.com/science/article/abs/pii/S0965229916300577?via%3Dihub.

25 Louw J, Myburgh C. The knowledge and perception of general practitioners about chiropractic as a factor that may influence inter-professional communication: A South African perspective. Journal of Interprofessional Care [Internet]. 2007 [cited 13 April 2020];21(2). Available from: https://www.tandfonline.com/doi/full/10.1080/13561820600991546.

26 Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)statement: guidelines for reporting observational studies. J Clin Epidemiol.[Internet]. 2008. [cited 29 May 2020] Available from: https://www.strobe-statement.org/index.php?id=available-checklists.

27 Moher D, Liberati A, Tetzlaff J, Altman D. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. BMJ [Internet]. 2009 [cited 29 May 2020];339(jul21 1). Available from: http://prisma-statement.org/.

Appendices

Strobe Checklist V4	Verhoef & Sutherland (1995)	Brussee et al (2001)	Schmidt et al (2002)	Greene et al (2006)	Wardle, Ibbitt, Adams (2013)	Westin et al (2013)	Engel, Bierman, Grace (2016)	Kier et al (2013)	Grace, Engel & Jalsion(2018) 222222(2018)	Wardle et al (2018)	Poyton et al (2006)	Louw J & Mybugh (2007)	Jarvis et al (2015)	Perry et al (2013)	Busse et al (2009)	Weis et al (2016)	Kotala & Baranski (2016)	Garner et al (2008)	Hamilton & Mariotti (2017)
Indicate the study's design with a commonly used term in the title or the abstract																			
Provide in the abstract an informative and balanced summary of what was done and what was found																			
Explain the scientific background and rationale for the investigation being reported																			
State specific objectives, including any prespecified hypotheses																			
Present key elements of study design early in the paper																			
Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection																			
Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up																			
Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable																			
For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group																			
Describe any efforts to address potential sources of bias																			
Explain how the study size was arrived at																			
Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why																			
Describe all statistical methods, including those used to control for confounding																			
Describe any methods used to examine subgroups and interactions																			
Explain how missing data were addressed																			
If applicable, explain how loss to follow-up was addressed																			

Describe any sensitivity analyses	
Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	
Give reasons for non-participation at each stage	
Consider use of a flow diagram	
Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	
Indicate number of participants with missing data for each variable of interest	
Report numbers of outcome events or summary measures over time	
Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	
Report category boundaries when continuous variables were categorized	
If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Summarise key results with reference to study objectives	
Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	
Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	
Discuss the generalisability (external validity) of the study results	
Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	

PRISMA Checklist	Study – Grainger & Walker (2013)
Identify the report as a systematic review, meta-analysis, or both.	
Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	
Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	
Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	
Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	
Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	
Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	
State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	
Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	
List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	
Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	
State the principal summary measures (e.g., risk ratio, difference in means).	
Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	
Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	
For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	
Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	
For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	
Present results of each meta-analysis done, including confidence intervals and measures of consistency.	
Present results of any assessment of risk of bias across studies (see Item 15).	
Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	

Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	
Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	
Provide a general interpretation of the results in the context of other evidence, and implications for future research.	
Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	
Key: Green = Identified in study, Red = Not identified in study, Amber = cannot tell *Table reproduced under the creative commons license.*	

Strobe Critical appraisal tool original template (26)

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed Case-control study—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group

	Item No	Recommendation
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses