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Comparison of active versus passive surveillance adverse event reporting in a paediatric ambulatory chiropractic care setting: a cluster randomised controlled trial

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ABSTRACT

Objectives This pragmatic, cluster, stratified randomised controlled trial (RCT) compared the quantity and quality of adverse event (AE) reports after chiropractic manual therapy in children less than 14 years of age, using active versus passive surveillance reporting systems.

Method Data were collected between November 2014 and July 2017 from 60 consecutive paediatric patient visits to participating chiropractors. Those allocated to active surveillance collected AE information with three paper-based questionnaires (two from patients, one from chiropractors) to identify any new or worsening symptoms after treatment. Passive surveillance involved AE information reported by chiropractors on a web-based system. To assess quality of reporting, AE reports greater than mild were reviewed by content experts. The primary outcome was the cumulative incidence of AE reports in active versus passive surveillance.

Results Ninety-six chiropractors agreed to participate and enrolled in the study: 34 chiropractors in active surveillance with 1894 patient visits from 1179 unique patients and 35 chiropractors in passive surveillance with 1992 patient visits from 1363 unique patients. In the active arm, AEs were reported in 8.8% (n=140, 95% CI 6.72% to 11.18%) of patients/caregivers, compared with 0.1% (n=2, 95% CI 0.02% to 0.53%) in the passive arm (p<0.001). The quality of AE reports was not evaluated because the five AE reports reviewed by the content experts were determined to be of mild severity.

Conclusion We found that active surveillance resulted in significantly more AE reports than passive surveillance. Further prospective active surveillance research studies should be conducted with children receiving chiropractic manual therapy to understand mechanisms and risk factors for moderate and severe AEs, and to further explore how and when to solicit patient safety information.

INTRODUCTION

The Institute of Medicine (IOM) urges providers across healthcare settings to monitor adverse events (AEs) so as to help identify risks and prevent avoidable injury.[1–4] Active and passive surveillance AE reporting systems have been evaluated for hospital AE reporting[2]; however, because of the distinct differences in ambulatory care settings, these systems warrant additional evaluation in this environment.

Doctors of chiropractic are licensed, ambulatory care providers who commonly use manual therapy.[5] On average, children and youth (18 years of age and younger) represent 17% of a general chiropractic practice; this increases to 39% for chiropractors who specialise in children.[5 6] Children most commonly receive care from chiropractors for musculoskeletal complaints, such as neck and back pain; some children are seen for other health conditions, such as attention defict hyperactivity disorder (ADHD) or asthma, or for 'wellness'.[6 7] The most common health professionals to refer patients to chiropractors specialising in paediatrics include massage therapists, midwives and family physicians, although referral is not needed to seek chiropractic care.[6] Although the volume of children seen by chiropractors is reported to be high, there is minimal information about the safety of paediatric chiropractic manual therapy. Harms related to paediatric chiropractic care identified in systematic reviews are largely based on retrospective case reports; these reviews have called for further high-quality prospective evaluation on this topic.[8 9] This high volume and lack of prospective safety information make paediatric chiropractic offices an ideal ambulatory healthcare setting to better explore AE reporting systems.

This study is a cluster randomised controlled trial (RCT) comparing the quantity and quality of AE reports after chiropractic manual therapy in children less than 14 years of age, using active versus passive

surveillance reporting systems. The study's hypothesis was that the active surveillance system would identify more AEs and would have better quality narrative reports than the passive surveillance system. In this context, quality is defined as ability to meaningfully adjudicate moderate, severe or serious reported AEs with regard to causation, preventability and patient disposition.

METHODS

Design, unit of randomisation and analysis, and study definitions

A pragmatic, cluster, stratified RCT with modified enrolment involving a two-step consent process (described in detail in the next section) was conducted. Cluster randomisation was used since chiropractic offices may consist of multiple participating practitioners. Chiropractic offices were the unit of randomisation, and unique patients and/or patient visits were the units of analysis. After being enrolled into the study, chiropractic offices were randomly allocated in a 1:1 ratio to active or passive surveillance reporting systems. Randomisation was performed using the Research Electronic Data Capture (REDCap) Randomisation Module.[10] Randomisation was stratified based on the chiropractor's self-reported proportion (<20% or≥20%) of paediatric patients. If more than one chiropractor in an office participated, stratification was based on the chiropractor who made initial contact with the study coordinator. To maintain allocation concealment, a biostatistician who was not involved in recruitment provided computer-generated random-variable permuted block sizes used in the REDCap Randomisation Module.

Study data were collected between November 2014 and July 2017 on 60 consecutive paediatric patient visits with each participating chiropractor. For purposes of this study, the age cut-off to be considered a paediatric patient was less than 14 years, as those 14 years of age or older can consent to medical treatment without parental permission in some jurisdictions where the trial took place.[11] All paediatric patients were eligible, whether they were new or established patients, being seen for one-time-only or repeated visits. The operational definition for the study's primary outcome, reported AEs, was developed by an international multidisciplinary team based on literature review and consensus with multiple stakeholders, that is, any unfavourable sign, symptom or disease temporally associated with the treatment, whether or not caused by the treatment; specifically, any new or pre-existing symptom that is worse after treatment.[12 13]

Recruitment and consent

Chiropractic offices in the USA and Canada were recruited for this study through announcements at paediatric chiropractic events and communications through North American paediatric chiropractic organisations, as well as social media, professional newsletters/magazines and referrals from colleagues or past study participants. A two-step consent procedure was implemented. In the first step, interested chiropractors agreed to participate in a study to evaluate safety of paediatric chiropractic manual therapy by completing AE reports. During the second step, participating chiropractors were randomised and provided with a second consent document that informed them of the detailed procedures for the study arm to which they had been allocated but did not provide information on the alternative study arm. This consent procedure was implemented as both surveillance methods were additions to usual practice and some providers may have assumed active surveillance would pose too large a burden and not be feasible to implement in their practice. Failure to blind participants about the comparison arm could have influenced participant's perceptions of how difficult their assigned reporting system was to implement.

Intervention (active surveillance) versus control (passive surveillance)

Offices were randomised to either active or passive surveillance to collect AE reports. In the intervention arm (active surveillance), reporting of AEs was conducted through paper-based questionnaires completed by the patient/caregiver and chiropractor for each appointment. In the control arm (passive surveillance), the Chiropractic Patient Incident Reporting and Learning System (CPiRLS) web-based programme (https://cpirls.org/) was used by participating chiropractors to report any AEs that occurred in their 60 consecutive paediatric patient visits.

Data collection

Intervention (active surveillance)

Information on AEs was collected by three questionnaires, two completed by the patient/caregiver (ie, forms were completed by either the paediatric patient or by the patient's caregiver) and one completed by the chiropractor (also referred to as the provider), with all questionnaires assessing symptoms the patient was currently experiencing. These symptoms were: pain/discomfort, stiffness, weakness, fatigue/tiredness, headache, dizziness, numbness/tingling, irritability/crying and 'other'. The patient/caregiver completed a pre-treatment questionnaire immediately prior to the patient being seen and handed this to his or her chiropractor to review and return to the study team after completing the provider section. Patients/caregivers were also given a post-treatment questionnaire to complete up to 1 week following treatment. The post-treatment questionnaire asked patients/caregivers whether a reported symptom was new, better, worse or unchanged since treatment, as well as satisfaction with care (1-very satisfied to 3-very unsatisfied).[14] To establish pre-treatment and post-treatment symptom severity (mild, moderate, severe or serious), patients/caregivers were asked a series of questions on symptom-related limitations based on the operational definitions. The post-treatment questionnaire was sent by the

patient/caregiver directly to the study team in a pre-addressed and stamped envelope; it was not reviewed by the chiropractor. Consent was implied from completion and return of these questionnaires.

The provider questionnaire was completed immediately after treatment. In this questionnaire, the presence or absence of any observed AE was reported, and AEs were rated by the provider as mild, moderate, severe or serious using the provided study operational definitions.[13] Any AEs assessed as moderate, severe or serious by the provider required the provider to complete a longer secondary questionnaire that captured more detailed information about the event and associated factors. These secondary questionnaires were sent for review by two independent content experts (described below in Adjudication). The content validity, which has been described as the most important measurement property for patient-reported outcome measures,[15] was evaluated for these instruments by a larger team of investigators.[13 16]

Control (passive surveillance)

Information on AEs was submitted from chiropractors participating in the control arm (passive surveillance) through an existing web-based system called 'CPiRLS', which was established in 2005 for the surveillance of patient safety incidents among the British Chiropractic Association members.[17 18] Using CPiRLS-established methodology, providers with access to this system can anonymously report a suspected AE. With the intent not to change the existing methodology, patient opinion or feedback was not sought in the passive surveillance arm. Information collected on CPiRLS consists of patient demographics, what happened, explanation of why/how it happened, actions taken by the chiropractor, if the event was avoidable, and any other information the chiropractor wished to share. In addition, for all 60 consecutive paediatric patient study visits, data were collected on whether patients were new or established, had a one-time-only or repeated visits during the study period, reason for visit, patient's date of birth and appointment date. There was no patient involvement in AE reporting in the passive surveillance arm.

Adjudication

As above, providers randomised to the active surveillance group completed a short questionnaire after each of the 60 patient visits and a longer secondary questionnaire if a moderate, severe or serious AE became known to them; while the passive surveillance group logged into the CPiRLS website to complete an online report if an AE of any severity became known to them during the study period.

For those AE reports sent for adjudication from either group, further independent assessment was done by two blinded content experts: an experienced chiropractor who specialised in paediatrics; and an academic paediatric neurologist. The content experts first reviewed the report to evaluate severity of the AE. If their assessment found that an AE was moderate, severe or serious, then the report was further evaluated for the ability to assess causality/relatedness, preventability and patient disposition from the material received from the AE report. Operational definitions for all terminology were based on previously published definitions developed by an international multidisciplinary team and have been described in detail elsewhere.[12 13 19] If consensus could not be reached by the two independent adjudicators, then the final report would include both assessments.

Patient and public involvement

Paediatric patients (unit of analysis), their caregivers and/or the public were not involved in the design, or conduct, or reporting or dissemination plans of this research. Chiropractors (unit of randomisation) were involved with the development of the data collection instruments and study design,[12] as well as assisted with recruitment of fellow chiropractors. All participating chiropractors will receive publication(s) that result from this data collection.

Sample size calculation

The sample size was calculated based on the primary outcome: number of AE reports. For 0.80 power, a 0.05 one-sided significance level, intraprovider cluster correlation of 0.13, and anticipated 11% lost to follow-up, 35 chiropractors, each collecting data from 60 consecutive paediatric patient visits, were needed in each group. Based on previous research, assumed AE reporting rates were 4.3% for the active surveillance group and 0.5% for the passive surveillance group.[8 12 19] The estimated incidence of moderate, severe or serious SMT-related AE in the active surveillance arm was based on pilot data collected from a similar study in the general population.[12]

Statistical analysis

The primary analysis compared the quantity of AE reports in active vs passive surveillance through cumulative incidence. In the active surveillance group, an AE was identified as described in table 1. Where a symptom was reported on the post-treatment questionnaire, but the severity rating was missing, that symptom was considered worsened (ie, an AE). Additionally, the incidence of AEs per patient visit and incidence of AEs per unique patient were calculated. In the passive surveillance group, any symptom report submitted to CPiRLS was considered an AE. All analyses were conducted using Stata V.14.2 (StataCorp).

Quality of AE reports was to be evaluated by the adjudicators' ability to determine causality/relatedness, preventability and patient disposition based on adequacy of information provided in the AE report versus 'insufficient information'.

Assessment of bias due to non-participation by chiropractor

An assessment of chiropractor participation bias was conducted using a series of univariable logistic regression models to identify possible bias due to non-participation

Table 1 Findings of multivariable logistic model describing characteristics associated with response to the post-treatment questionnaire: ORs and 95% CIs

	Crude OR	95% CI	Adjusted OR	95% CI
Pre-form completed by, mother	1.00	1.00 to 1.00	1.00	1.00 to 1.00
Numerical Pain Rating Scale, mean (SD)	**0.92**	**0.88 to 0.96**	**0.92**	**0.87 to 0.97**
Child gender, female	1.00	1.00 to 1.00	1.00	1.00 to 1.00
Child age, mean (SD)	**1.04**	**1.02 to 1.07**	**1.04**	**1.01 to 1.07**
Pre-symptom, none				
1	0.88	0.71 to 1.12	1.04	0.80 to 1.34
2 or more	**0.73**	**0.59 to 0.90**	0.95	0.71 to 1.26
No of prior treatment, first visit				
1–9 prior visits	**0.78**	**0.63 to 0.96**	0.85	0.67 to 1.07
10 or more prior visits	0.95	0.72 to 1.26	0.94	0.70 to 1.27
Medication use, none	1.00	1.00 to 1.00	1.00	1.00 to 1.00
Natural health product use, none	1.00	1.00 to 1.00	1.00	1.00 to 1.00
Visit fees covered by, self-pay	1.00	1.00 to 1.00	1.00	1.00 to 1.00
Study repeat visit, 1				
2–4 visits	0.99	0.82 to 1.21	1.03	0.84 to 1.28
5+ visits	**1.69**	**1.26 to 2.26**	**1.94**	**1.40 to 2.68**

R^2-1.1%.
Items in bold print were statistically significant (p<0.05).
*If patients were seen more than once, response status was determined by whether they returned their first visit's post-treatment questionnaire.

by chiropractors after random assignment to intervention arms. Variables considered to be potentially related to non-participation were drawn from the demographic survey conducted with chiropractors. These were: age (continuous), gender, years in practice (continuous), paediatric diplomate status and professional organisation affiliations.

For the intervention group (active surveillance), a multivariable logistic regression model was built to identify possible bias due to patients/caregivers not returning the post-treatment questionnaire. Candidate explanatory variables were drawn from the patient's pre-treatment questionnaire. All variables were included in the multivariable model, and crude and adjusted ORs are reported in table 1

Two sensitivity analyses were conducted in order to assess the effect of non-response on the incidence of AEs in the active surveillance group: (1) 'worst-case scenario' assumed all non-responders would have reported an AE, (2) 'best-case scenario' assumed no non-responders reported an AE.

Publication of protocol and registration of trial

A detailed study protocol has been published.[13] The trial was registered at ClinicalTrials.gov (NCT02268331).

RESULTS

Study participant flow is shown in figure 1. There was no evidence of differential postrandomisation attrition between the two groups. Overall, the units of analysis for the intervention group (active surveillance) was 1894 patient visits from 1179 unique patients, whereas the control group (passive surveillance) had 1992 patient visits from 1363 unique patients. Participating chiropractors and their patients are described in table 2.

The incidence of AEs was 8.8% (n=140, 95% CI 6.72% to 11.18%) for the active surveillance group and 0.1% (n=2, 95% CI 0.02% to 0.53%) for the passive surveillance group (p<0.001). Of the 1894 patient visits in the active surveillance group, post-treatment patient-reported questionnaires were returned for 1056 (55.8%) patient visits. Of the 1179 unique patients, post-treatment patient-reported questionnaires were returned by 662 (56.1%) patients. Parent/caregiver reported 65.9% (n=89) of AEs and chiropractors reported 33.3% (n=45). Of the 135 reported AEs, 56.3% were mild (n=76), 25.9% were moderate (n=35) and 17.8% were severe (n=24). Over 90% of the moderate or severe AEs reported were from patient/caregiver and there was a positive association with pre-existing symptoms (p<0.001) (ie, AEs were more likely to be reported as moderate or severe if they were worsening symptoms, than if they were new). Figure 2 displays the severity of AEs by age groups; the highest numbers of moderate or higher AE reports were from children less than 1 year of age.

Table 3 shows the incidence of AEs (ie, new or worsening symptoms) as reported by providers, patient/caregivers or both for patient visits and unique patients (as

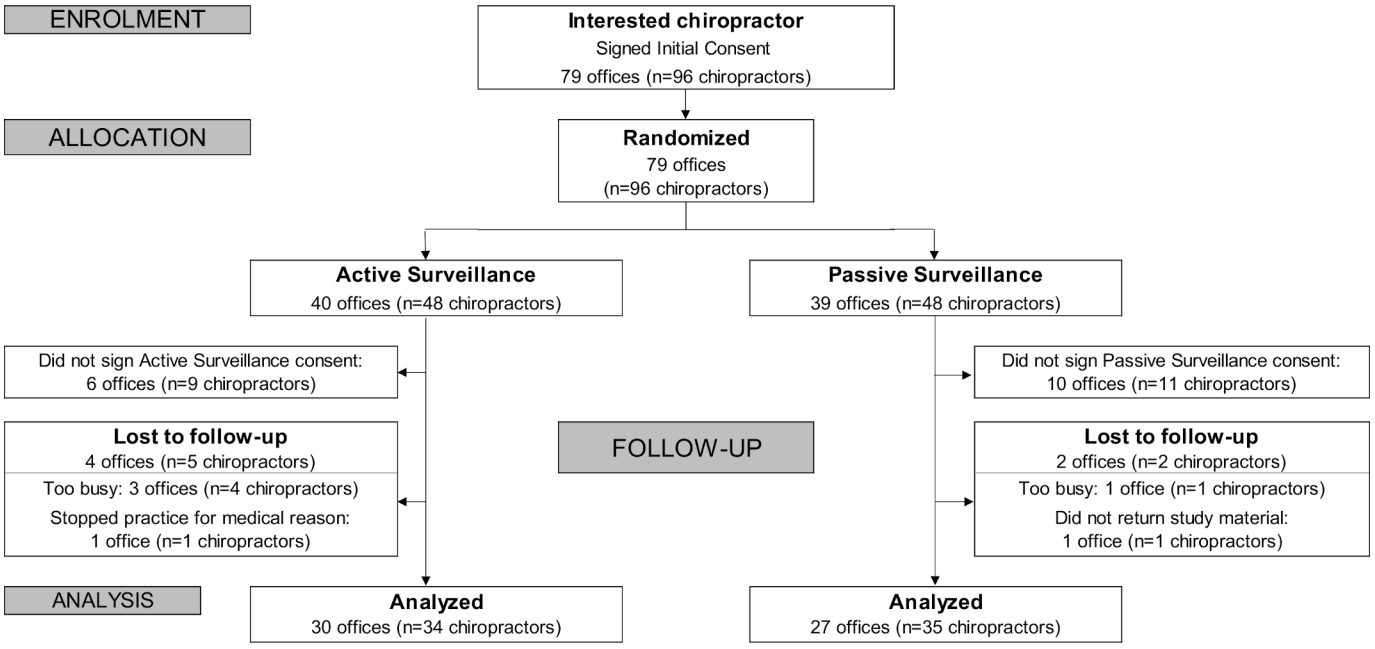

Figure 1 CONSORT flow diagram of participants in this cluster randomised trial.

each of these may have had multiple AE reports within them). The most common symptoms were irritability/crying (37.9%, n=53/140) and pain/discomfort (29.3%, n=41/140). All moderate or severe AEs reported by the provider only (n=5) were for irritability/crying. The majority of the moderate or severe AEs identified on the patient/caregiver forms as worsening were irritability/crying (n=15, 37.5%) and pain/discomfort (n=12, 30.0%); however, the moderate or severe AEs reported as a new symptom by the patient/caregiver were: pain/discomfort (n=4, 30.8%), irritability/crying (n=3, 23.1%) and fatigue/tired (n=3, 23.1%). Of the 34 chiropractors in the active surveillance arm of the study, 19 (55.9%) did not report any AEs, 7 (20.6%) reported one AE, 2 (5.9%) reported two AEs, 2 (5.9%) reported four AEs, 1 (2.9%) reported 6 AEs and 1 (2.9%) reported seven AEs.

Of the 32.7% (n=345) patient visits that did not have any pre-treatment condition or symptom (they sought care only for 'wellness/preventative' reasons), 4.6% (n=16) reported an AE following treatment. Of the 67.3% (n=711) patient visits that did report a pre-treatment condition and/or symptom, 9.8% (n=70) reported an AE following treatment.

Providers in the passive surveillance group submitted a total of two AE reports (both worsening of pain/discomfort) on the CPiRLS web-based programme for an incidence of 0.1% (95% CI 0.0% to 0.1%) for the 1992 patient visits and 0.1% (95% CI 0.0% to 0.1%) for the 1363 unique patients. Because of the small number of reports in the passive surveillance group, no regression analyses were conducted.

From the active surveillance group, the three secondary questionnaires were all completed by the same treating chiropractor for symptoms they had rated as moderate or severe (two were for increased irritability/crying and one was for increased pain/discomfort). All three were judged by the content experts as mild and not warranting further assessment. Providers in the active surveillance arm identified another four AEs as moderate or severe AEs but failed to complete the secondary questionnaire; therefore, no adjudication could be done.

From the passive surveillance group, both AE reports were submitted to CPiRLS and sent for adjudication were judged as mild, therefore, not warranting further assessment. In the absence of symptoms judged by the adjudicators as moderate or severe, no report quality comparison was conducted.

There was no evidence of differential post-randomisation attrition between the two groups. Table 1 reports the findings of the multivariable model describing the assessment of bias from patient/caregiver response (vs non-response) to the post-treatment questionnaire. Factors associated with greater return of the post-treatment questionnaire were: more pain; younger age of the child; more symptoms reported before treatment; having 1–9 prior chiropractic treatment visits; and having seen the chiropractor more than five times during the active data collection period. The overall satisfaction (scale: 1-very satisfied to 3-very unsatisfied) with the visit for those who reported AEs (mean=1.1, SD=0.77) was no different than those who did not (mean=1.1, SD=0.46).

The worst-case scenario sensitivity analysis found incidence of AEs would increase to 49.4% (582/1179; 95% CI 46.6% to 52.3%) and best-case scenario would decrease to 5.5% (65/1179; 95% CI 4.4% to 7.0%). Under both assumptions, active surveillance yielded a significantly higher incidence of AE reports than passive surveillance ($p<0.001$).

Table 2 Demographics of participating chiropractors and their paediatric patients

	Active surveillance (n=34)	Passive surveillance (n=35)
Chiropractors		
Female, n (%)	27 (79.4%)	23 (76.7%)
Mean years in practice (SD), (range)	11.6 (8.46), (1–32)	11.8 (9.17), (1–39)
Patient visits/week, n (%)		
<50	9 (28.1%)	7 (22.6%)
50–99	7 (21.9%)	10 (32.3%)
100–149	7 (21.9%)	4 (12.9%)
150–199	5 (15.6%)	4 (12.9%)
200+	4 (12.6%)	6 (19.4%)
Highest non-chiropractic degree, n (%)		
Bachelor's degree	29 (90.6%)	24 (77.4%)
Master's degree	1 (3.1%)	2 (6.5%)
Others (licensed massage therapist)	1 (3.1%)	0
Paediatric specialty certifications*, n (%)		
None	17 (53.1%)	20 (66.7%)
Diplomate/fellowship	11 (34.4%)	9 (30.0%)
Certification	4 (12.5%)	1 (3.3%)
Patients		
Reason care sought (by first visits)†	**Active surveillance (n=1179)**	**Passive surveillance (n=1363)**
Wellness/preventative/no symptoms	686 (58.2%)	735 (53.9%)
Musculoskeletal	328 (27.8%)	271 (19.9%)
Colic/digestive	150 (12.7%)	101 (7.4%)
Respiratory	116 (9.8%)	27 (2.0%)
Neurological/developmental/behavioural	48 (4.1%)	75 (5.5%)
Feeding concerns	48 (4.1%)	69 (5.1%)
Trauma	40 (3.4%)	77 (5.7%)
Otitis media	52 (4.4%)	44 (3.2%)
Allergy/asthma/immunology	26 (2.2%)	30 (2.2%)
Sleep concerns	24 (2.0%)	21 (1.5%)
Miscellaneous	18 (1.5%)	17 (1.3%)
Mouth/teeth/adenopathy	16 (1.4%)	8 (0.6%)
Nocturnal enuresis	8 (0.7%)	15 (1.1%)
Influenza/sickness	8 (0.7%)	11 (0.8%)
Age (years)		
Less than 1	343 (25.3%)	297 (25.7%)
1–5	527 (38.9%)	459 (39.7%)
6–10	332 (24.5%)	290 (25.1%)
11–13	154 (11.4%)	110 (9.5%)

*Within the chiropractic profession, additional paediatric training can be obtained to receive either a diplomate/fellowship (approximately 360 hours) or a certification (approximately 120 hours).
†More than one condition could have been marked by the caregiver.

DISCUSSION

While the IOM urges healthcare providers to monitor for AEs after treatment,[1–4] there is not yet consensus on how that monitoring should best occur or its impact on making healthcare safer.[20 21] Providers and patients, and in the case of children, their parents or caregivers, need to know the safety profile of treatments they are considering in order to make informed decisions about treatment options and to set appropriate expectations.[22] Although AE reporting has been described as essential

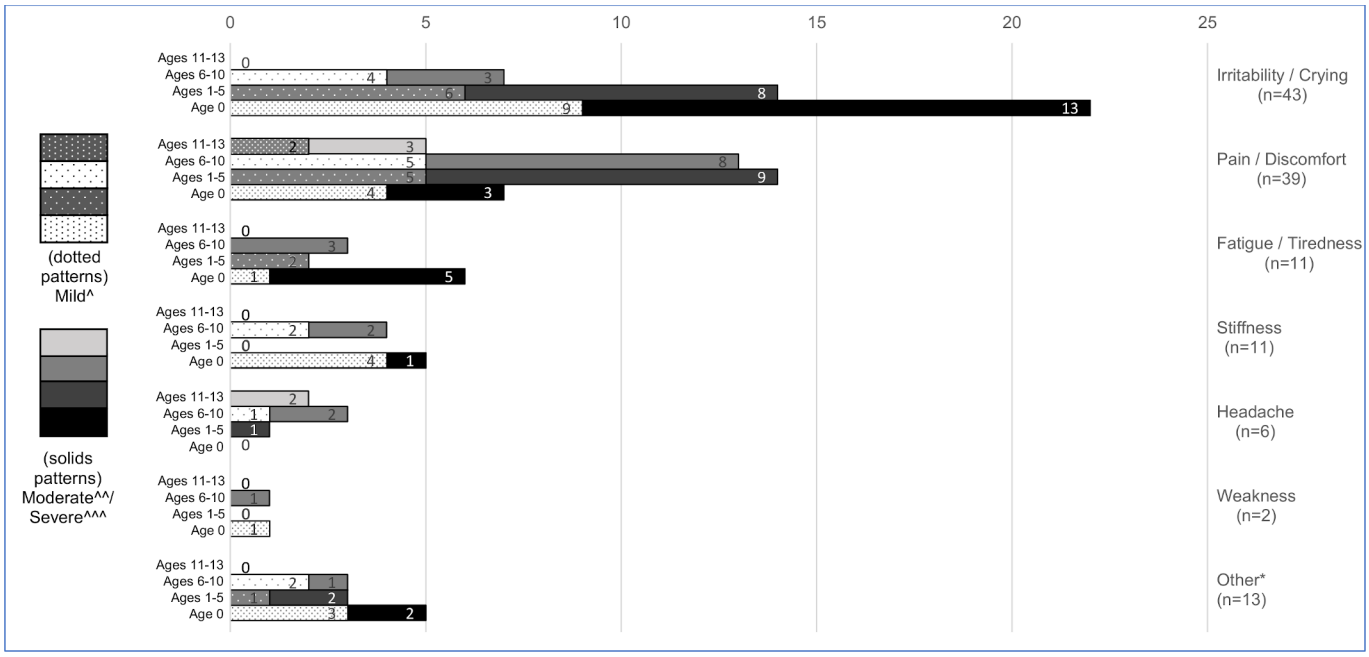

Figure 2 Total number of AE reports by symptom, severity (mild^- solid; moderate^^/severe^^^ - dotted pattern) and age groups. ^ Mild: the AE required self-care only (no further treatment sought/needed). ^^ Moderate: temporary limitation of age-appropriate activities of daily living (n=24), care was sought from a medical doctor (n=7), or both temporary limitation of age-appropriate activities of daily living and care was sought from a medical doctor (n=24). ^^^ severe: limitation in self-care (eg, bathing, eating, dressing) (n=24) or need for urgent medical assessment (n=0). *- other symptoms reported by parent/caregiver: balance, blocked tear duck/eye blinking, eye pain, hoarseness, daytime enuresis, speech. AE, adverse event.

to patient safety, it is important to point out that it is not known if it can achieve its goal of greater levels of safety in healthcare.[23] In addition, providers and patients, and in the case of children, their parents or caregivers, should know the incidence of AEs after chiropractic manual therapy in order to make informed decisions about their treatment options and to set appropriate expectations.[22] In this cluster RCT comparing AE reports collected through active versus passive surveillance in paediatric patients receiving care from a chiropractor, more AEs were reported through active surveillance than passive surveillance (8.8% vs 0.1%). Active surveillance is able to be successful conducted in ambulatory care settings; sensitivity analyses confirm our study findings (4.4%–46.6%) are robust. Active surveillance can be successfully conducted in ambulatory care settings.

Other observational studies assessing active versus passive surveillance have also demonstrated that active surveillance is more effective in identifying AEs. A large 2009 observational study evaluating the safety of a mass vaccination programme for an influenza virus in China showed that the incidence of symptoms using active vs passive surveillance was 23.4% vs 0.2%.[24] In another study, active surveillance of postimmunisation studies identified

Table 3 Incidence and percentages of AEs (ie, new or worsening symptoms) from chiropractor, patient/caregiver and both in the active surveillance group, stratified by patient visit and unique patients

Active surveillance AE report*—responders only		AEs per patient visit (n=1056 patient visits), %	AEs per unique patient (n=662 unique patients), %
Patient/caregiver reported only	**Self-assessed as worse or new symptom only**	6 (0.6)	6 (0.9)
	Pre-difference and post-difference found worsening symptom only	24 (2.3)	24 (3.6)
	Symptom reported by both self-assessment and predifference and postdifference	2 (0.2)	2 (0.3)
Chiropractor reported only		33 (3.1)	25 (3.8)
Both patient/caregiver and **chiropractor reported**		1 (0.1)	1 (0.2)
Totals		**65 (6.2)**	**58 (8.8)**

*Where a given AE was reported by more than one source, it was counted only once.
AE, adverse event.

over six times as many symptoms as passive surveillance.[25] This signifies that active surveillance systems may provide a more accurate estimate of incidence of AEs, including serious AEs, which is necessary when appraising/managing overall risk.

Active surveillance has also been successfully implemented to study the safety of complementary therapies in ambulatory settings. For example, when an active surveillance system was used to measure AEs in 2.2 million acupuncture treatments, 8.6% of the patients reported at least one adverse effect.[26] When active surveillance was implemented for adults receiving cervical spinal manipulation therapy, differences were found between patient-reported and chiropractor-reported events (680 vs 1 AE per 10 000 treatment consultations).[27]

Our study has provided the first prospectively gathered safety data on chiropractic manual therapy of children. This is of high relevance as many chiropractors see children, although concern often expressed about the safety of chiropractic manual therapy for the paediatric population.[8 9 28] AEs were defined as new or worsening symptoms after chiropractic manual therapy. In this study, AEs were reported per patient visit (as children were often seen more than once during the course of this study) and per child seen. This study found that there were AEs reported in 6.2% of patient visits and in 8.8% of children seeing chiropractors. The most common AEs were pain/discomfort and irritability/crying. Of those visits in which the patient presented with no pre-treatment condition or symptom (ie, wellness/preventative care), 4.6% resulted in an AE. These findings highlight the need to actively monitor for AEs, as the risk:benefit ratio appear different compared with when symptoms prompt the visit to a chiropractor. Future research should explore modifiable risk factors for AEs occurring after children receive chiropractic manual therapy, especially for vulnerable populations such as young children or those receiving care for wellness only.

While this RCT and the other studies described above demonstrate active surveillance's clear superiority to collect AE reports, the implementation of such a reporting system to a large population of ambulatory providers has not been conducted or assessed for feasibility. An obvious barrier to such implementation is potential implications for time and resources, especially as this was a paper-based model. Participating chiropractors reported that completing the forms required an average of 3–10 min per appointment. Future research could evaluate an electronic version with real-time alerts and standardised scripts, as has been successfully implemented in hospital settings.[29] Reassuringly, participating providers in this study found active surveillance to be feasible and did not take up too much time from their practice.

A key to implementing active surveillance reporting systems found in this and other studies is patient involvement.[24] Patients (and in the case of children, their parents and/or caregivers) are in the best position to know their own health and report how they are feeling; however, as shown in a 2014 systematic review, effective patient engagement processes in patient safety research are still limited. A caveat found in this study was that we did not expect parents to report limitations in self-care for children under 5 and further exploration is needed as to what was meant by this.

A strength of this study was the modified enrolment process, which was first discussed by Zelen, who proposed randomisation of participants before obtaining consent, in order to enhance clinical trial recruitment.[25] A 2006 systematic review of trials that used postrandomised consent found that the most common intent was to reduce bias by reducing 'resentful demoralisation' and avoiding the Hawthorne effect.[30]

Several limitations are important to consider with the interpretation of our results. First, this study did not allow for comparison of patient/caregiver and provider AE reports in the active surveillance arm, as they were measured at different time points.[12 13] Second, the study did not allow for a comparison between patient feedback from the groups, as the passive surveillance did not seek this information. Evaluation of patient feedback in passive surveillance systems in future studies is warranted. Additionally, not all patients provided adequate information to allow for AE severity to be determined. Notably, patients who were younger or who had more pre-existing symptoms were most likely not to return post-treatment questionnaires; these are the same populations who had the most AE reports, suggesting that our findings may underrepresent AE reports from these populations. Finally, our study was limited by the use of proxy reporting by parent/caregiver, a common limitation in paediatric healthcare and research. In the literature, parent/caregiver assessment of child health may be contradictory, with both overestimates and underestimates reported.[31 32] Further research is needed to better understand the effect of proxy reporting of paediatric AE.

CONCLUSION

This cluster RCT found active surveillance collected more AE reports than passive surveillance following chiropractic manual therapy in children less than 14 years of age. The two systems yielded an important difference in reported AEs per patient, with incidence of AE reports of 8.8%% in the active surveillance group compared with only 0.1% in the passive surveillance group. Of these AE reports, 76 (56.3%) events were mild; 35 (25.9%) events were moderate and 24 events (17.8%) were severe. The most common symptoms reported as AEs after chiropractic treatment were pain/discomfort and irritability/crying: this was true of all degrees of severity (mild, moderate and severe). The quality of provider AE reports could not be evaluated. Further research is needed regarding how and when to solicit patient-reported AEs, issues of proxy reporting when studying paediatric AE, and understand mechanisms and risk factors of AEs following chiropractic manual therapy in children.

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