Adverse events after age and serverity in Milne et al(1)

All cases in the right 3 columns are only unique cases.

Review references are worked out in de table rows below and only unique items are considered!

= onjuiste indicatie = mild adverse effect = moderate adverse effect = severe adverse effect

Publicatie	Reference	Infant (<1 year)	Child (1 – 10 yrs)	Adolescent (10 – 23 yrs)
Alcantara 2011	Ernst 2009 → ref. to Ernst 2007, Miller + Benfield 2008, Vohra 2007, Alcantara 2009			
Ernst 2007	Only adult cases	No	No	No
Miller and Benfield 2008 (c) [1]		**11**		
Vohra 2007 (c,pp,ns,md)	Shafrif 1992, Jacobi 2001			
Vohra 2007 (c,pp,ns,md)	Ziv 1983, Zimmerman 1978, Ragoet 1969, Held 1966, L Ecuyer 1959, LeBoeuf 1991, Sawyer 1999, Klougart 1996			
Vohra 2007 (c,pp,ns,md)		**Indirect Harm NS 20 Diabetes, osteosarcoma, metastatic neuroblastoma, meningitis, embryonal rhabdomyosarcoma (all death)**		
Alcantara 2009	Fabio 1999, Ernst 2003, Shafrir 1992, Jacobi 2001, Hayes en Bezilla 2006, Vohra 2007, Miller en Benfield 2008			
Fabio 1999 (c, p, div)		**NS 4 mo – 87 yrs n = 177, cases not tracable to age Arterial dissection, brain stem lesion, Wallenberg syndrome, visal- hearing-balanceimpairments, n. Phrenicus lesion. Death n = 32,**		
Ernst 2003	Shafrir 1992, Jacobi 2001			

Shafrir 1992 (c)		**1 Quadriplegia**		
Jacobi 2001 (pp)		**1 various bleedings brain stem & upper cervical spine**		
Hayes en Bezilla 2006 (n=346) (o)		**NS 31**		
Carnes 2018 (n=1308) (o+c) [2]		**9**		
Carnes 2018 (n=97))o+c) [2]		**11 (no- or sham MT)**		
Corso 2020 (c)	Wilson 2012, Shafrir 1992, Sawyer 1999			
Wilson 2012 (c)		**1 posterior rib fractures**		
Sawyer 1999 (c)		**2 (1 in active treatm and 1 in placebo group)**		
Gleberzon 2012 (c)		No adverse effects reported		
Pohlman 2012 (c+o)	Sawyer 1999	No adverse effect reported		
Théroux J 2017	No full text available			
Balon J 1998 (c)		No adverse effect reported		
Borusiak P 2010 (md)			**26 (13 in active treatm. and 13 in placebo group)**	
Evans R 2018 (c) n=185)				**347 (179 in exercise group and 168 in exerc. + SMT group)**
Ellwood J. 2020	Brand 2005 → Jacobi 2001 Driehuis 2019 → Shafrir Driehuis 2019 → Holla 2009 Driehuis 2019 → Jacobi 2001 Driehuis 2019 → Deputy 2004 Driehuis 2019 → Borusiak2010 Driehuis 2019 → Bothelho & Andrade 2012 (c)			

	Driehuis 2019 → LeBoeuf 1991 Driehuis 2019 → Alcantara 2009 Driehuis 2019 → Miller & Benfield 2008 Driehuis 2019 → Balon 1998 Driehuis 2019 → Koch 2002 (m) Driehuis 2019 → Koch 1998 (m) Driehuis 2019 → Wilson 2012 Driehuis 2019 → Marchand 2012			
Holla 2009 (o) case report		**1 vasculair and breathing impairments**		
Deputy 2004 (c)			**1 vasculair impairment**	
Botelho 2012 (c) +				**2**
LeBoeuf 1991	No full text available		**1**	**1**
Koch 2002	No adverse effects			
Koch 1998	No adverse effects			
Marchand 2019 (c)				
Glazener 2005	No full text available			
Green 2019 (Safer Victoria Care)	Jacobi 2001 Klougart 1996 L' Euyer 1959 Alcantara 2009 Alcantara 2007 Awwad 2018			

	Koch 1998 Koch 2002 LeBoeuf 1991 Sawyer 1999			
Klougart 1996 (c)			**1 loss of consciousness in both treatment sessions with quick recovery**	
L'Ecuyer 1959 (c)			**1 neck pain, drowsiness, weakness → hospitalisation**	
Alcantara 2007	No full text available to Green et al			
Awwad 2018 (c)			**2 missed diagnoses (Perthes & HD)**	
Hawk 2007	Sawyer 1999 LeBoeuf 1991 Glazener 2005			
Todd 2015	Shafrir 1992 Ziv (c) Zimmerman (c) L' Ecuyer 1959 Klougart 1996 Wilson 2012 Rageot (c) Jacobi Simonian and Stahele (p) Held (md) Holla 2009 Struewer (o) Alcantara 2007 Alcantara 2006 Alcantara 2009			

	Alcantara 2007 Marchand Rowe (c) Sawyer LeBoeuf Miller and Benfield Koch 1998 Koch 2002 Philippi (o) Hayes and Bezilla			
Ziv 1983 (c) 1	(Vohra 2007)			**1 paraplegia**
Zimmerman 1978 (c)	(Vohra 2007)			**1 vertebral and basilar occlusions**
Rageot 1968 (c)	(Vohra 2007)			
Simonion and Stahele 1995 (p)	Leg fractures not on spinal manipulation		**2 (1 amyoplasia, 1 normal)**	
Held (md)	(Vohra 2007)			**1 acute respiratory decompensation, tracheotomy, neurologic deficits at C6 & C7 vertebrae**
Struewer 2013 (o)				**1 massive haemathorax**
Alcantara 2006 (c)		**NS 2**		
Marchand 2012(c) n=19821		**NS 534**		
Marchand 2012 (c) n=19821		**NS 23**		
Rowe 2006 (c)				**2**
Philipi 2006 (o)		**6 control group excess. crying 4 in treatm. Group excess. crying**		
Totals		n=210 mild, n = 570 NS mild, n = 4 NS moderate, n = 39 servere (6 in infants after chiropractic of osteopathic care)		

c = chiropractic o = osteopathic m = manual therapy p = physiotherapy pp = pediatric physiotherapy md = medical doctor div = diverse ns = not stated

The evidence based statement of Olson and al is casuistically build on Corso 2020, Green 2019, Milne 2022, L' Ecuyer 1959, Ziv 1983, Borusiak 2010, Zimmerman 1978, Koch 1998(2). See tables 2 & 3 in the study and cited paragraph on adverse effects down here below.

- *Adverse event analysis*

We recommended and require systematic reporting of mild or severe adverse events in future research [57]. The relative risk of a severe adverse event could not be determined from reported data and incidence of mild transient symptoms ranges from 0.3% (95% CI 0.06 to 1.82) to 22.22% (95% CI 6.32 to 54.74) [4,17]. It was not possible to provide an overall conclusion about the safety of spinal manipulation or mobilisation; small, randomised trials will not pick up uncommon events [17]. Adverse events were reported [17] as *severe* in infant torticollis [33,34] child neck-back pain [31,32], child headache [35,36]; and reported as *moderate* for infant colic [39]; and child/adolescent nocturnal enur-

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Table 1. *Descriptions of reactions from PSMT reported by parents*

Number	Sex	Age at time of reaction (wk)	Description of reaction
1	Male	8	After the first treatment of cervical spine SMT for the treatment of infant colic, the parents telephoned to say the infant was not feeding well and was mildly distressed. The tutor told the parents to monitor the infant closely and to take him to the general practitioner for examination if he did not begin to feed normally within a few hours. The next day the parents called to say that the infant was fine and they resumed care at the clinic for their child.
2	Female	8	After the fourth treatment of cervical and thoracic SMT for the treatment of infant colic, the mother called the clinic to say the baby had been crying since the treatment. The intern spoke to the mother and stated that it as unlikely that the treatment had caused any harm, but if she was concerned, she should seek the advice of her general practitioner. The mother was satisfied with this and said that the crying was probably because of constipation. That evening, the baby slept better than usual, and the mother returned and completed the course of care for her child.
3	Female	6	The parent's returned to the clinic a few hours after the first treatment with cervical spine SMT (in treatment of infant colic) stating that they thought that the baby had a "head tilt" since the adjustment. The tutor examined the child and found full cervical range of motion with no antalgic posture. The parents were satisfied with this, did not feel there was any reaction from treatment, and continued care.
4	Female	7	The mother reported that the baby cried a lot after the first visit for cervical spinal SMT for the condition of infant colic, went to sleep for 2 hours, and awoke and continued to cry. She attended the clinic for 3 more visits and then self-discharged. When telephoned, she said the baby was "doing fine" and did not require more care.
5	Male	5	The parents told the intern that they would not attend the next (7th) visit because after the 6th visit of SMT for the condition of infant colic, the baby was restless and crying for almost 8 hours. They stated they did not wish to continue with treatment.
6	Male	17	On the 25th visit of a child who had been closely monitored since birth trauma, the intern adjusted the pelvis and the baby began to cry instantly. The mother felt that this was a cry of pain. The intern brought a tutor in to examine the infant. The tutor performed a corrective adjustment to the ileum and the baby stopped crying. The mother telephoned later that day to say that the child was fine. The mother continued to bring her child for monitoring and care when required for the next several months.
7	Female	12	At the 11th visit consisting of cervical spine manipulation for the condition of kinematic imbalance due to suboccipital strain (KISS), the baby cried during the treatment and continued to cry upon returning home. The intern telephoned the mother the following day. She said that the baby was better, but she wished to stop treatment.

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after manual therapy[39 43] and three reported adverse events (worsening symptoms) in the control group.[33 34 37]

Using data from all the studies reporting adverse events, there were 1308 infants exposed to manual therapy and nine non-serious adverse events recorded, giving an incidence rate of seven non-serious events per 1000 infants. Conversely, there were 11 non-serious adverse events in the infants not exposed to manual therapy (n=97), giving an incidence rate of around 110 per 1000 infants.

Figure 3 shows the meta-analysis for the RCTs, which was possible for four studies.[33 34 37 38] There was an overall RR of 0.12 (95% CI 0.12 to 0.66); that is, those who had manual therapy had an 88% reduced risk of having an adverse event compared with those who did not have manual therapy.

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1. Milne N, Longeri L, Patel A, Pool J, Olson K, Basson A, et al. Spinal manipulation and mobilisation in the treatment of infants, children, and adolescents: a systematic scoping review. BMC Pediatr. 2022;22(1):721.
2. Gross AR, Olson KA, Pool J, Basson A, Clewley D, Dice JL, et al. Spinal manipulation and mobilisation in paediatrics - an international evidence-based position statement for physiotherapists. The Journal of manual & manipulative therapy. 2024:1-23.