Appendix 5

Summary of findings bruising in relation to child abuse

Subgroups: age /development, disability

Outcomes bruising:

- 1. Prevalence
- 2. Number of bruises per child
- 3. Distribution by site
- 4. Patterns of bruises

Subgroup: Infants (0-9 months)

	No studies	Study type	Abused	Non-abused	Statistical association Abused versus non- abused	QoE
1. Prevalence	4 (Labbé ¹) (Peters ²) (Sugar ³) (Carpenter ⁴)	Non- comparative (Labbé) n=246 examinations (Peters) n=192 (Sugar) n=473 (0-8 months) n=973 (total) (Carpenter) n=177	41.8% children with fractures (Peters)	1.2% (Labbé) Overall 0-8 months: 1.3% Precruisers 0-8 months: 1.3% Cruisers 0-8 months: 25.0% (Sugar) 12.4% (95% BI 7.2-16.7%) Boys: 13.1% (95% BI 8.0-18.2%) Girls: 11.8% (95% CI 7.0-16.7%) Sits: 4/101 = 4.0% Crawls: 9/52 = 17.3% Walks: 9/24 = 37.5% (Carpenter)		Very low – Because of study limitations (definition non- abused) and indirectness (children with fractures and indirect comparison)
2. Number of bruises per child (mean (SD)	2 (Kemp ⁵) (Carpenter)	Comparative (Kemp) Baby: n= 107+30 Early mobile: n=40+35 Non- comparative (Carpenter) n=177	Mean (SD): Baby: 2.8 (3.5) Early mobile: 3.8 (3.3) (Kemp)	Mean (SD): Baby: 1.3 (1.8) Early mobile: 1.2 (1.4) (Kemp) 1.5 (Carpenter)	MD 1.50 (95% CI 0.58- 2.42 MD 2.10 (95% CI 0.83- 3.37)	Low- because of study limitations (non- blinded measureme nt) and indirectness (children with suspicion of abuse)
3. Distribution by site	2 (Kemp) (Carpenter)	Comparative (Kemp) Baby: n= 107+30	Buttocks 0.9% ear 24.7-7.5% cheek 13.1-27.1% trunk 9.3-16.8%	Buttocks 0% ear 0% cheek 3.3-6.7% trunk 3.3-10%	OR: Buttocks 10.9* ear 1.5-7.1* cheek 2.8-5.2* trunk 2.8-4.7*	Low- because of study limitations (non-

		Non-	neck 5 6%	neck 6 7%	neck 3.8*	hlinded
		comparativo	thighs front 12 10/	thighs front 2 20%	thighs front 2 5*	moscuromo
		(Carportor)	$111g_{115} = 11011(12.17)$	$\frac{111}{2}$	101112.5	nt) and
						indiana atao ang
		n=1//	lower arm 2.8%	lower arm 0%	lower arm 1.6	indirectness
			hands 0.9%	hands 0%	hands 2.0	(children
			back of leg 2.8%	back of leg 0%	back of leg 1.9	with
			feet 3.7%	feet 10%	feet 1.7	suspicion of
			head 15%	head 13.3%	head 1.6	abuse)
			face 14%	face 13.3%	face 1.4	
			eyes 3.7%	eyes 0%	eyes 1.0	
			(Kemp)	(Kemp)	(* = OR significant)	
					(Kemp)	
				Bruises on the face and head: 78%		
				forehead: 50%		
				shins: 22%		
				In all cases on bony prominences and		
				front of the body		
				(Carpenter)		
1 Pattorns of	1	Non-		Bruises (n=32) were circular or		Very low -
4. Fatterns of	(Carnenter)	comparative		rectangular and where they were more		because of
bruises	(Cal penter)	(Carpontor)		linear tended to reflect hony		study
		$\left(\text{Calpender} \right)$		initial tended to reflect bolly		limitationa
		n=1//		prominences. All bruises \leq 10mm.		limitations
				(Carpenter)		and non-
						comparativ
						e study
						design

¹ Labbé: Children aged 0-8 months.
 ² Peters: Children aged 2 weeks – 120 months (mean age 13.6 months, median 6.0 months).

³ Sugar: Children aged 0-8 months.
⁴ Carpenter: Children aged 6-9 months.
⁵ Kemp: Baby: pre-mobile, rolling, sitting. Children aged < 6 years.

Subgroup: Toddlers (9 months - 4 year)

	No studies	Study type	Abused	Non-abused	Statistical association	QoE
					Abused versus non-	
1 Duranalamaa	6	Comparativo	80.40/	60.00/	abused	Low
1. Prevalence	0 (Chang1)	(Kemp)	89.4% (Kemn)	69.9% (Kemp)	CI 12.0 = 27.7%	LOW – because of
	(Kemp ²)	n=350+156	(nemp)	(Relip)	(Kemp)	study
	(Labbé ³)	(Pierce)			(limitations
	(Pierce ⁴)	n=42+53	78.6%	71.7%	Difference 6.9%	(unblended
	(Sugar ⁵)	(Worlock)	(Pierce)	(Pierce)	(95% CI -10.9 –	measureme
	(Worlock ⁶)	n=35+116			23.3%)(Pierce)	nt of
		Nasa	71 40/ in shildren with man and douted		D:ff 70 (0/	bruises,
		Non-comparative $(Chang) = 750$	/ 1.4% In children with non-accidental	0.9% in children with accidental	Difference 70.6%	definition
		(Lahhé) n=1012	(Worlock)	(Worlock)	(93% Cl 33.0 - 82.8%)(Worlock)	non-
		examinations				abused) and
		(Sugar) n=500		42% contusions cases (=children with		indirectness
		(9-35 months)		craniofacial injuries)		(children
		n=973 (total)		(Chang)		with
				(0.20)		suspicion of
				60.3% (Labbá)		abusej
				Overall 9-35 months: 40.7%		
				Boys 20.1%, girls 21.9%		
				White 22.7%, African American 8%,		
				Asian/Pacific Islander 16.3%, Other 7%		
				[based on all children]		
				Precruisers 9-35months: 10.9%		
				Cruisers 9-35 months: 17.2%		
				Walkers 9-35 months: 51.9%		
				(Sugar)		
2. Number of	3	Comparative	Mean (SD):	Mean (SD):	MD 4.10 (95% CI 3.07-	Low –
bruises per	(Kemp)	(Kemp) Walking	Walking: 6.2 (6.7)	Walking: 2.1 (2.2)	5.13)	because of
child	(Pierce)	n=199+91	Moon number of bruises and	Moon number of		study
	(Sugar)	(Pierce)	number of sites affected lower in	bruises and number of sites affected		funblended

		n=42+53 Non-comparative (Sugar) n=500	walking than earlier developmental stages (Kemp) Median: 6 bruises (interquartile range: 1-10, max 25) (Pierce)	lower in walking than earlier developmental stages (Kemp) Median: 1.5 bruises (interquartile range: 1-2, max 4) (Pierce) Mean number (SD): boys 2.4 (1.9), girls 2.4 (1.6) Mean number (range): precruisers 1.3 (1-2) cruisers (1-5) walkers 2.4 (1-11) (Sugar)	P-value <0.0005 (Pierce)	measureme nt of bruises, definition abuse and non- abused) and indirectness (children with suspicion of abuse)
3. Distributio n by site	5 (Chang) (Kemp) (Pierce) (Sugar) (Worlock)	Comparative (Kemp) Early mobile n=40+35 (Pierce) n=42+53 (Worlock) n=35+116 Non-comparative (Chang) n=750 (Sugar) n=973	Buttocks 12.5% ear 2.5-7.5% cheek 20% trunk 5-7.5% neck 2.5% thighs front 17.5% upper arm 25% lower arm 0% hands 2.5% back of leg 7.5% feet 2.5% head 12.5% face 22.5% eyes 12.5% (Kemp) Ears 17% neck 21% hands 17% right arm 21% chest 27% buttocks 27%	Buttocks 0% ear 0-5.7% cheek 2.9-8.6% trunk 2.9-8.6% neck 0% thighs front 5.7% upper arm 8.6% lower arm 2.9% hands 0% back of leg 0% feet 0% head 2.9% face 25.7% eyes 5.7% (Kemp) Ears 0% neck 0% hands 0% right arm 0% chest 0% buttocks 0%	OR: Buttocks 10.9* ear 1.5-7.1* cheek 2.8-5.2* trunk 2.8-4.7* neck 3.8* thighs front 2.5* upper arm 1.9* lower arm 1.6 hands 2.0 back of leg 1.9 feet 1.7 head 1.6 face 1.4 eyes 1.0 (* = OR significant) (Kemp) Body region significantly predictive of abuse	Low – because of study limitations (unblended measureme nt of bruises, definition abuse and non- abused) and indirectness (children with suspicion of abuse)

back 39%	back 5%	
back 39% Abdomen 27% genitourinary 12% hip 12% head 24% scalp 12% forehead 15% face 24% eyes 21% cheek 6% nose 3% lip 6% chin 6% shoulders 17% left arm 21% left leg 30% right leg 30%	back 5% Abdomen 10% genitourinary 0% hip 0% head 29% scalp 13% forehead 21% face 15% eyes 23% cheek 10% nose 2% lip 0% chin 0% shoulders 5% left arm 7% left leg 10% right leg 13%	Body region not significantly predictive of abuse (Pierce)
 (Pierce) Model: High suspicion of abuse if: bruising in TEN (torso, ear, neck) region of a child ≤4 years or any bruising of an infant ≤4 months and no confirmed accident in a public setting that accounts for bruising (Pierce) 72% of significant bruising on head and neck in children with bruise and non- accidental fracture (Worlock) 	(Pierce) 1 significant bruise in children with accidental fractures (Worlock)	Model sensitivity 97%, specificity 84% (Pierce)
	44% of the contusions involved the forehead, eye, nose, lip and chin (T shape) and 37% involved the posterior head (=children with craniofacial injuries) (Chang) Precruiser: anterior tibia or knee 0.6%	

		forehead 0.6%	
		scalp 0.6%	
		unner leg 0 2%	
		heads $00/$	
		Dack 0%	
		chest 0%	
		forearm 0%	
		face (cheek or nose) 0.2%	
		buttocks 0%	
		hands 0%	
		abdomen and hin 0%	
		upper arm 0.4%	
		posterior leg or foot 0%	
		Cruiser:	
		anterior tibia or knee 11 9%	
		forehead 3%	
		F_{0}	
		scalp 5%	
		upper leg 1%	
		back 1%	
		chest 0%	
		forearm 0%	
		face 1%	
		huttocks 0%	
		handa 00/	
		abdomen and hip 0%	
		upper arm 0%	
		posterior leg or foot 0%	
		buttocks 0%	
		hands 0%	
		abdomen and hin 0%	
		upper arm 004	
		posterior leg or foot 0%	
		Walker:	
		anterior tibia or knee 44.7%	
		forehead 5.7%	
		scalp 0.6%	
		unner leg 4 4%	
		$\frac{1}{100}$	
		Dack 1.9%	
		chest 1.3%	

					forearm 1.6% face 1.6% buttocks 0% hands 0% abdomen and hip 0.9% upper arm 0.6% posterior leg or foot 0.3% 93.1% of bruises over bony prominences (Sugar)		
4.	Patterns of bruises	1 (Kemp)	Comparative (Kemp) n=350+156	Petechiae 15.4%	Petechiae 1.9%	OR 9.3 (95% CI 2.9- 30.2)	Moderate – because of indirectness
				Linear bruises / bruises with distinct pattern 47/51	Linear bruises / bruises with distinct pattern 4/51	OR 5.9 (95% CI 2.1- 16.7)	(children with suspision of of abuse)
				Clustering (>2 bruises in same location) 67.4%	Clustering (>2 bruises in same location) 33.9%	OR 4.0 (95% CI 2.5-6.4) (Kemp)	
				Mean length bruise 1.53cm (Kemp)	Mean length bruise 1.57cm (Kemp)		

¹ Chang: Age <12years; mean age 3.4years. ² Kemp: Early mobility: crawling, cruising. Age < 6 years.

³ Labbé: Children aged 9 months–4 years.

⁴ Pierce: Children aged 0-48 months.

⁵ Sugar: Children aged 0-35months.
 ⁶ Worlock: Children aged 12 and younger. Non-accidental fractures: 80% <18 months old. Accidental fractures: 86% > 5 years old.

Subgroup: Primary school children (4-14 year)

	No studies	Study type	Abused	Non-abused	Statistical association	QoE
					Abused versus non-	
					abused	
1. Prevalence	e 1	Non-comparative		80.3%		Very low –
	(Labbé ¹)	(Labbé) n=579		(Labbé)		because one
		examinations				non-
						comparativ
						e study
						design
2. Number o	f 1	Comparative	Mean: 5.74	Mean: 1.49		Low –
bruises pe	r (Dunstan ²)	(Dunstan)	(Dunstan)	(Dunstan)		because of
child		n=133+189				study
						limitations
						in
						measureme
						nt) and
						imprecision
3. Distributi) 2	Comparative	13% bruises left ear and 3% right ear	0% bruises ear	P-values <0.001	Low –
n by site	(Dunstan)	(Dunstan)	29-36% face	1-2% face		because of
ii by site	(Kemp ³)	n=133+189	26% neck and head	3% neck and head		study
			25% anterior chest and abdomen	4% anterior chest and abdomen		limitations
			38% back	12% back		and
			20% buttocks	3% buttocks		indirectness
			30% left arm,	18% left arm	P-values <0.05	
			29%right arm	15% right arm		
			26% left leg	27% left leg	No	
			28% right leg	19% right leg	significance (Dunstan)	
			(Dunstan)	(Dustan)	Significance (Dunstan)	
		(Kemp) Walking	Buttocks 16.1%	Buttocks 2.2%	OR	
		n=199+91	ear 6.5-14.6%	ear 3.3-4.4%	Buttocks 10.9*	
			cheek 21.1-23.6%	cheek 6.6-8.8%	ear 1.5-7.1*	
			trunk 24.1-36.2%	trunk 6.6-13.2%	cheek 2.8-5.2*	
			neck 11.6%	neck 2.2%	trunk 2.8-4.7*	

				thighs front 26.1% upper arm 25.1% lower arm 16.6% hands 3%	thighs front 14.3% upper arm 17.6% lower arm 12.1% hands 2.2%	neck 3.8* thighs front 2.5* upper arm 1.9* lower arm 1.6	
				feet 5.0%	feet 1.1%	back of leg 1.9	
				head 9.5%	head 6.6%	feet 1.7	
				face 25.6%	face 15.4%	head 1.6	
				eyes 9.5%	eyes 13.2%	race 1.4	
				(Kemp)	(Kemp)	(* - OP significant)	
						(Kemp)	
4.	Patterns of bruises	1 (Dunstan)	Comparative (Dunstan) n=133+189	Mean length bruise 2.1-5.1cm (different regions) Identifiable shape: 57% at least one bruise (Dunstan)	Mean length bruise 0.1-0.9cm (different regions) Identifiable shape: <2% at least one bruise (Dunstan)	Not tested	Low – because of study limitations (difference in measureme nt) and imprecision

¹ Labbé: Children aged 5-9 years. ² Dunstan: Children aged 1-14 years, mean age cases 7.7 and controls 6.4. ³ Kemp: Walking independently. Age < 6 years.

Subgroup: High school children (> 12 year)

		No studies	Study type	Abused	Non-abused	Statistical association	QoE
1.	Prevalence	1	Non-comparative		52.7% (Labbé)		Very low –
		(Labbé ¹)	(Labbé) n=203				because one
			examinations				non-
							comparativ
							e study
							design
2.	Number of						
	bruises per						
	child						
3.	Distributio						
	n by site						
4.	Patterns of						
	bruises						

¹ Labbé: Children aged 10-17 years.

<u>Subgroup: All ages (0-17 year)</u>

		No studies	Study type	Abused	Non-abused	Statistical association	QoE
1.	Prevalence						
2.	Number of						
	bruises per						
	child						
3.	Distributio						
	n by site						
4.	Patterns of	1	Comparative	Petechiae 21.9% (95% CI .2-7.2);	Petechiae 2.3% (95% CI 1.1-5.0);	Presence of petechiae	Low –
	bruises	(Nayak ¹)	(Nayak) n=	of these cases 24/28 had associated	of these cases 4/7 had associated	for abuse: 21.9 (95% CI	because of
			190+263	bruising;	bruising	15.6-29.8), specificity	study
				of these 24 cases 10 had patterned	(Nayak)	97.8 (95.6-99.0), PPV	limitations
				bruising		80.0 (64.1-90.0) LR	and
				(Nayak)		6.0(2.5-14.1)	imprecision
						(Nayak)	

¹Nayak: Children aged < 17 years.

Subgroup: Disabled children (all ages)

	No studies	Study type	Abused	Non-abused	Statistical association	QoE
1. Prevalence	1	Non-comparative		4-9 yrs: 100%		Very low –
	(Goldberg ¹)	(Goldberg) n=50		10-20 yrs: 86%		because of
				(Goldberg)		non-
						comparative
2. Number of	2	Non-comparative		Mean (SD):		Very low –
bruises per	(Goldberg)	(Goldberg) n=50		Female: 1.9 (3.0)		because of
child	(Newman ²)	(Newman)		Male: 2.0 (1.9)		non-
		n=168		White: 2.0 (2.8)		comparative
				Non-white: 1.9 (1.5)		study design
				No statistically significant		
				relationship between number of		
				bruises and age, gender, race, BMI,		
				mobility, muscle tone or piece of		
				equipment. (Goldberg)		
				Mean (SD), range:		
				All 2.6 (3.3), 0-16		
				Unrestricted walkers 3.6 (4.3), 0-16		
				Restricted walkers 2.4 (2.3), 0-10		
				Wheelchair dependent 1.3 (2.1), $0-9$		
				(p=0.001 for differences between		
				(Nerversen)		
	1	Non compositivo		(Newman)		Vomilari
3. Distributio	1 (Coldborg)	(Coldborg) n=50		Rarely bruises on buttocks, cheeks,		very low –
n by site	(Goldberg)	(Goldberg) n=50		chin, ears and neck among disabled		because of
				and non-disabled		non-
				Lower logg more bruised in non		comparative study dosign
				disabled		study design
				Feet thighs hands arms back		
				abdomen and pelvis more bruised in		
				disabled		
				(Goldberg)		
4. Patterns of						
	1	1				1

¹ Goldberg: Children aged 4-20 years. ² Newman: Children aged 2-17 years.