

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)	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 measurement) 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-

			neck 5.6% thighs front 12.1% upper arm 15% lower arm 2.8% hands 0.9% back of leg 2.8% feet 3.7% head 15% face 14% eyes 3.7% (Kemp)	neck 6.7% thighs front 3.3% upper arm 6.7% lower arm 0% hands 0% back of leg 0% feet 10% head 13.3% face 13.3% eyes 0% (Kemp) Bruises on the face and head: 78% forehead: 50% shins: 22% In all cases on bony prominences and front of the body (Carpenter)	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)	blinded measurement) and indirectness (children with suspicion of abuse)
4. Patterns of bruises	1 (Carpenter)	Non-comparative (Carpenter) n=177	neck 5.6% thighs front 12.1% upper arm 15% lower arm 2.8% hands 0.9% back of leg 2.8% feet 3.7% head 15% face 14% eyes 3.7% (Kemp)	neck 6.7% thighs front 3.3% upper arm 6.7% lower arm 0% hands 0% back of leg 0% feet 10% head 13.3% face 13.3% eyes 0% (Kemp) Bruises on the face and head: 78% forehead: 50% shins: 22% In all cases on bony prominences and front of the body (Carpenter)	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)	Very low – because of study limitations and non-comparative 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 Abused versus non-abused	QoE
1. Prevalence	6 (Chang ¹) (Kemp ²) (Labbé ³) (Pierce ⁴) (Sugar ⁵) (Worlock ⁶)	Comparative (Kemp) n=350+156 (Pierce) n=42+53 (Worlock) n=35+116 Non-comparative (Chang) n= 750 (Labbé) n=1012 examinations (Sugar) n=500 (9-35 months) n=973 (total)	89.4% (Kemp) 78.6% (Pierce) 71.4% in children with non-accidental fractures (Worlock)	69.9% (Kemp) 71.7% (Pierce) 0.9% in children with accidental fractures (Worlock) 42% contusions cases (=children with craniofacial injuries) (Chang) 60.3% (Labbé) 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 9-35 months: 10.9% Cruisers 9-35 months: 17.2% Walkers 9-35 months: 51.9% (Sugar)	Difference 19.6% (95% CI 12.0 – 27.7%) (Kemp) Difference 6.9% (95% CI -10.9 – 23.3%)(Pierce) Difference 70.6% (95% CI 53.6 – 82.8%)(Worlock)	Low – because of study limitations (unblended measurement of bruises, definition abuse and non-abused) and indirectness (children with suspicion of abuse)
2. Number of bruises per child	3 (Kemp) (Pierce) (Sugar)	Comparative (Kemp) Walking n=199+91 (Pierce)	Mean (SD): Walking: 6.2 (6.7) Mean number of bruises and number of sites affected lower in	Mean (SD): Walking: 2.1 (2.2) Mean number of bruises and number of sites affected	MD 4.10 (95% CI 3.07-5.13)	Low – because of study limitations (unblended

		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) walkers 2.4 (1-11) (Sugar)	P-value <0.0005 (Pierce)	measurement of bruises, definition abuse and non-abused) and indirectness (children with suspicion of abuse)
3. Distribution 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 measurement of bruises, definition abuse and non-abused) and indirectness (children with suspicion of abuse)

			<p>back 39%</p> <p>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% (Pierce)</p> <p>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)</p> <p>72% of significant bruising on head and neck in children with bruise and non- accidental fracture (Worlock)</p>	<p>back 5%</p> <p>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% (Pierce)</p> <p>1 significant bruise in children with accidental fractures (Worlock)</p> <p>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)</p> <p>Pre cruiser: anterior tibia or knee 0.6%</p>	<p>Body region not significantly predictive of abuse (Pierce)</p> <p>Model sensitivity 97%, specificity 84% (Pierce)</p>	
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4. Patterns of bruises	1 (Kemp)	Comparative (Kemp) n=350+156	<p>Petechiae 15.4%</p> <p>Linear bruises / bruises with distinct pattern 47/51</p> <p>Clustering (>2 bruises in same location) 67.4%</p> <p>Mean length bruise 1.53cm (Kemp)</p>	<p>forearm 1.6%</p> <p>face 1.6%</p> <p>buttocks 0%</p> <p>hands 0%</p> <p>abdomen and hip 0.9%</p> <p>upper arm 0.6%</p> <p>posterior leg or foot 0.3%</p> <p>93.1% of bruises over bony prominences (Sugar)</p> <p>Petechiae 1.9%</p> <p>Linear bruises / bruises with distinct pattern 4/51</p> <p>Clustering (>2 bruises in same location) 33.9%</p> <p>Mean length bruise 1.57cm (Kemp)</p>	<p>OR 9.3 (95% CI 2.9-30.2)</p> <p>OR 5.9 (95% CI 2.1-16.7)</p> <p>OR 4.0 (95% CI 2.5-6.4) (Kemp)</p>	Moderate – because of indirectness (children with suspicion of abuse)
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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.

		<p>thighs front 26.1% upper arm 25.1% lower arm 16.6% hands 3% back of leg 10.1% feet 5.0% head 9.5% face 25.6% eyes 9.5% (Kemp)</p>	<p>thighs front 14.3% upper arm 17.6% lower arm 12.1% hands 2.2% back of leg 7.7% feet 1.1% head 6.6% face 15.4% eyes 13.2% (Kemp)</p>	<p>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)</p>	
4. Patterns of bruises	1 (Dunstan)	Comparative (Dunstan) n=133+189	<p>Mean length bruise 2.1-5.1cm (different regions) Identifiable shape: 57% at least one bruise (Dunstan)</p>	<p>Mean length bruise 0.1-0.9cm (different regions) Identifiable shape: <2% at least one bruise (Dunstan)</p>	<p>Not tested</p> <p>Low – because of study limitations (difference in measurement) and imprecision</p>

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 (Labbé ¹)	Non-comparative (Labbé) n=203 examinations		52.7% (Labbé)		Very low – because one non-comparative study design
2. Number of bruises per child						
3. Distribution by site						
4. Patterns of bruises						

¹ Labbé: Children aged 10-17 years.

Subgroup: All ages (0-17 year)

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

¹ Nayak: Children aged < 17 years.

Subgroup: Disabled children (all ages)

	No studies	Study type	Abused	Non-abused	Statistical association	QoE
1. Prevalence	1 (Goldberg ¹)	Non-comparative (Goldberg) n=50		4-9 yrs: 100% 10-20 yrs: 86% (Goldberg)		Very low – because of non-comparative
2. Number of bruises per child	2 (Goldberg) (Newman ²)	Non-comparative (Goldberg) n=50 (Newman) n=168		Mean (SD): Female: 1.9 (3.0) Male: 2.0 (1.9) White: 2.0 (2.8) Non-white: 1.9 (1.5) 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 mobility categories) (Newman)		Very low – because of non-comparative study design
3. Distribution by site	1 (Goldberg)	Non-comparative (Goldberg) n=50		Rarely bruises on buttocks, cheeks, chin, ears and neck among disabled and non-disabled Lower legs more bruised in non-disabled Feet, thighs, hands, arms, back, abdomen and pelvis more bruised in disabled (Goldberg)		Very low – because of non-comparative study design
4. Patterns of bruises						

¹ Goldberg: Children aged 4-20 years.

² Newman: Children aged 2-17 years.