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**REDACTED REPORT**

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**File No: 122590**

**Subject: Bone Fracture Investigations**

**Children 0-3 years from seven counties**

**FY 2009-2011**

## INTRODUCTION

The OIG received a complaint involving a five-month-old infant with six fractures who was returned to the care of his parents by County A court in the Southern Region. The Assistant State's Attorney cited that there was not enough information to go forward with temporary custody even though the Department took protective custody and the physician reported that the infant's injuries appeared abusive.<sup>1</sup> The OIG reviewed all bone fracture investigations from County A during FY2009, 2010, and 2011 and found a second infant with similar injuries (a four-month old with seven fractures)<sup>2</sup> who was also returned to the care of his parents despite the Department's recommendation that the infant remain in foster care.

The OIG initiated a review of bone fracture investigations of children three years and younger living in Southern Region from County A, County B, County C and County D. Bone fracture investigations from the counties of County E and County F were added to expand representation from the Northern and Central regions of Illinois for an assessment of the Department and child protection court responses to bone fractures in young children. The OIG also utilized information from a prior OIG report discussing bone fracture allegations in County G of children birth to three years old in FY2009.<sup>3</sup>

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<sup>1</sup> See OIG Report #2011-2079.

<sup>2</sup> See OIG Report #2012-0198.

<sup>3</sup> See OIG Report #2010-1795.

## Bone Fractures in Infants

Bone fractures are the second most common presentation of child abuse following soft-tissue injuries.<sup>4</sup> Fractures caused by abuse predominantly occur in infants and toddlers and are less common in older children.<sup>5</sup> Kemp et al. (2008) performed a systematic review of the literature on patterns of abusive fractures, and found that 25% - 56% of fractures in children under one year of age were due to child abuse. Leventhal, Martin and Asnes (2008) reviewed fracture data from the Kids' Inpatient Database that included discharge data on 80% of acute pediatric hospitalizations in the United States. The proportion of fractures attributed to abuse was highest in infants less than one year at 24.9%. The proportion decreased to 7.2% in children 12 to 23 months of age and 2.9% in children 24 to 35 months of age.

The OIG initiated a review of bone fracture investigations of children three years and younger living in County A and its collar counties: County B, County C, and County D in Southern Illinois. County E and County F were added to the review to expand case representation from the Northern and Central regions of Illinois. A total of 81 investigations in these counties in fiscal years 2009, 2010 and 2011 were reviewed. In a previous report, the OIG reviewed all reported bone fracture allegations (130 investigations) in County G of children ages birth to three years from fiscal year 2009.<sup>6</sup> A sum total of 211 investigations of bone fracture allegations were reviewed.

Of the 211 bone fracture investigations reviewed, 70% of the children birth to three years had a single fracture, with infants representing 27% of these children. Among the children with multiple bone fractures, 19 (8%) had four or more fractures, with infants (0-6 months) accounting for 16 or 83% of these children.<sup>7</sup> Infants (0-6 months) had the highest number of investigations (66) involving all number of fractures (31%). Conversely, three-year-old children had the lowest number of investigations representing 10% of the total population (See Table One).

**Table 1: Number of Bone Fractures by Age**

Age	Number of Children					TOTAL	
	1 Fracture	2 Fractures	3 Fractures	4 Fractures	5+ Fractures		
<b>0-6 months</b>	40	9	1	2	14	<b>66</b>	<b>31%</b>
<b>7-12 months</b>	26	8	3	--	1	<b>38</b>	<b>18%</b>
<b>1 year</b>	44	7	4	1	--	<b>56</b>	<b>27%</b>
<b>2 years</b>	22	5	1	--	1	<b>29</b>	<b>14%</b>
<b>3 years</b>	15	6	1	--	--	<b>22</b>	<b>10%</b>
<b>TOTAL</b>	<b>147</b> <b>(70%)</b>	<b>35</b> <b>(17%)</b>	<b>10</b> <b>(5%)</b>	<b>3</b> <b>(1%)</b>	<b>16</b> <b>(8%)</b>	<b>211</b>	

<sup>4</sup> McMahon, Grossman, Gaffney, & Stanitski (1995)

<sup>5</sup> Kemp et al., 2008

<sup>6</sup> OIG Report File No. 2010-1795.

<sup>7</sup> For further discussion see section entitled Infants with Four or More Fractures found later in this report.

*Child Protection Investigative Findings*

Sixty-two percent (130) of the child protection investigations of bone fractures in children birth to three years were unfounded for abuse and neglect. Infants (0-6 months) represented the highest percentage of indicated findings totaling 51% of the 81 total indicated findings. Three-year-olds also had the lowest number of indicated findings with seven out of 22 investigations indicated for abuse or neglect. (See Table Two)

**Table 2: Age Distribution by Investigation Findings**

Age	Investigative Finding				Total
	Indicated		Unfounded		
	#	% <sup>8</sup>	#	% <sup>9</sup>	
0-6 months	41	62%	25	38%	<b>66</b>
7-12 months	13	32%	28	68%	<b>41</b>
1 Years	12	23%	41	77%	<b>53</b>
2 Years	8	28%	21	72%	<b>29</b>
3 Years	7	32%	15	68%	<b>22</b>
<b>Total</b>	<b>81</b>	<b>38%</b>	<b>130</b>	<b>62%</b>	<b>211</b>

***Infants with Four or More Fractures***

In this OIG sample of 66 infants (0-6 months), sixteen (24%) of the investigations involved infants with three or more fractures. Two infants died from their injuries while the DCP investigation was pending. Injuries to 15 (94%) of the 16 infants were determined to be abusive by the evaluating physician. The single multiple fracture investigation involving accidental injuries was a two-month-old infant in foster care whose physician attributed the infant’s six rib fractures to co-sleeping on a sofa with an adult caregiver.<sup>10</sup> The infant remained in the foster home and the caregivers were provided with education surrounding the dangers of co-sleeping with infants. (See *OIG Review of Infants 0-6 Months after Closing the DCP Investigation* for further discussion.)

Kaczor and Pierce (2011) wrote “as the number of fractures increases, the likelihood of child abuse also increases.” While a fall or other accidental injury could cause multiple fractures, Pierce and Bertocci (2006) emphasized that “A common misconception is that if trauma was bad enough to cause 1 fracture, it could cause a second fracture or additional injuries.<sup>11</sup> Short of a motor vehicle crash or a pedestrian being hit by a vehicle, more than 1 fracture and/or additional injuries are uncommon, except in the case of inflicted trauma.”<sup>12</sup> A study of 13,870 children under 36 months reported that the likelihood of abuse increased 4 to 6 times in children who had

<sup>8</sup> Percentage of Indicated Findings by age group.

<sup>9</sup> Percentage of Unfounded Findings by age group.

<sup>10</sup> The DCP investigator interviewed the evaluating physician, who was also the infant’s primary care physician. The doctor reported that the infant had six rib fractures. However, according to the medical records obtained by the OIG, the radiologist noted “rib fractures at the left 6th, 7th and 8<sup>th</sup> anterolateral ribs and possibly at the fourth and fifth.”

<sup>11</sup> Pierce & Bertocci, 2006

<sup>12</sup> Pierce & Bertocci, 2006

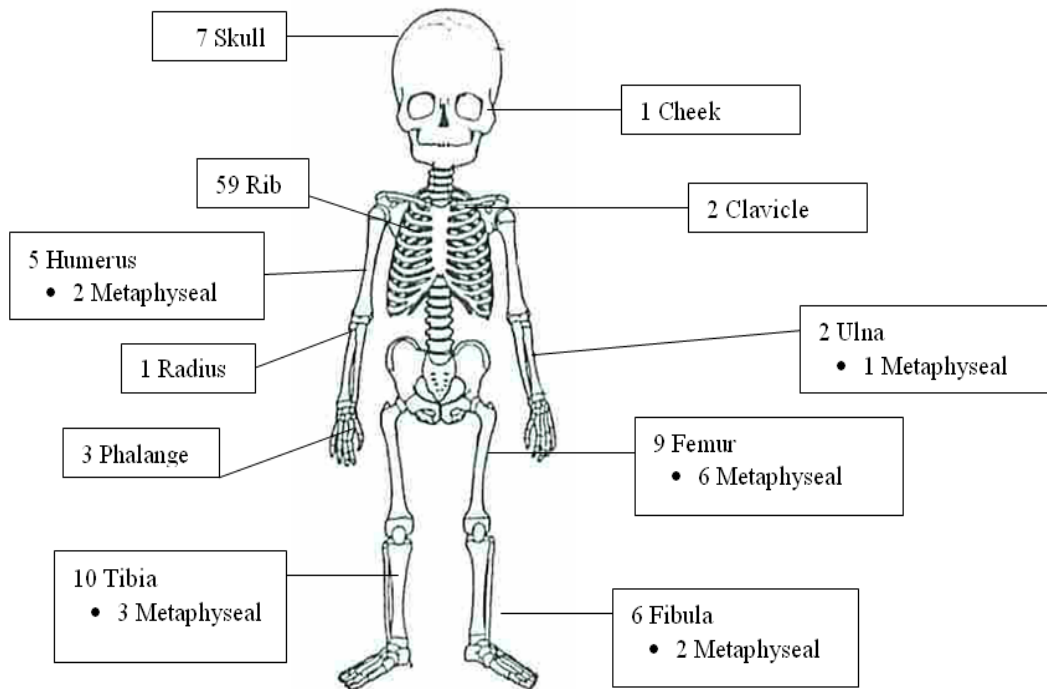
three or more fractures as compared to one fracture.<sup>13</sup> The table below represents the findings from review of the Kids Inpatient Database (KID).

*Proportion of Abusive Fractures in Infants from the KID<sup>14</sup>*

Age in Months	One fracture		Two Fractures		Three or More Fractures	
	Number of Infants	% from Abuse	Number of Infants	% from Abuse	Number of Infants	% from Abuse
0-11	5076	18.5	477	55.1	298	85.4

**Fracture Type in Infants with Four or More Fractures**

The 16 infants with four or more fractures reviewed by the OIG had a combined total of 105 fractures. Rib fractures were the most common with a total of 59 fractures in 13 infants. Only three infants in the investigations reviewed did not have a rib fracture. The second most common fracture was the tibia fracture with ten fractures in six infants followed by nine femur fractures in seven infants. The diagram below illustrates the distribution of fractures in infants reviewed by the OIG. (See Diagram Below)



Certain fracture types may indicate abuse, although no single fracture type alone can distinguish those children who have been victims of child abuse from those who have suffered accidental trauma.<sup>15</sup> Fractures specific for abuse include rib, scapular, sternal, and metaphyseal ‘corner or

<sup>13</sup> Leventhal, Martin, & Asnes, 2008

<sup>14</sup> Leventhal et al., 2008

<sup>15</sup> Nirav, P.K. et al., 2009; Pressel & D.M., 2000.

bucket handle' fractures.<sup>16</sup> Fractures in the radius, ulna, tibia, and fibula are also more likely to have been caused by abuse than accidental injury among children 0-11 months.<sup>17</sup> Skull and femur fractures, while common fractures found in abuse, are also common in accidental injury.<sup>18</sup>

### *Rib fractures*

Rib fractures are commonly seen in cases of abusive trauma and have a high specificity for abuse when found in young children.<sup>19</sup> Leventhal et al. (2008) found that rib fractures were the third most common fracture in children under 1 year, and that 69% of rib fractures in this age range were attributed to abuse.<sup>20</sup> A meta-analysis of seven studies of abusive fractures in children 0-18 years found that after controlling for motor vehicle crashes, accidental violent trauma, and post-surgical cases, there was a 71% probability that a rib fracture was caused by abuse.<sup>21</sup> A second study found that a rib fracture in a child less than three years of age had a positive predictive value of 95% for the diagnosis of non-accidental trauma.<sup>22</sup> Cadzow and Armstrong (2000) reviewed 1201 children age two years and younger with fractures that were referred to a hospital's child protection team over a five year period.<sup>23</sup> The authors found that 18 infants were diagnosed with rib fractures with 15 infants' fractures attributed to abuse. In three infants the rib fractures were attributed to an accident. Two infants were struck and reversed over by a motor vehicle. The third infant had a metabolic bone disease.

Infants' chests are more malleable than those of older children and as a result, their ribs will deform rather than break unless major force is exerted.<sup>24</sup> Most rib fractures in infants are thought to occur by anterior-posterior (front to back) compression, the type of force exerted by abusive shaking, and are often associated with intracranial injuries.<sup>25</sup> This mechanism of non-accidental injury most commonly results in rib fractures in the posterior and lateral regions.<sup>26</sup>

Often children with rib fractures do not present with a history of trauma, but instead have respiratory complaints, gastrointestinal problems, irritability, or mental status changes related to intracranial injury. Therefore the fractures are usually clinically unsuspected until detected on x-ray.<sup>27</sup> When there is no displacement of bone fragments, acute rib fractures are often hard to diagnose and may go undetected even on x-ray until callus formation 7-10 days after the injury. For this reason it is recommended to have follow-up x-rays taken within two weeks of the suspected abuse. In order to increase sensitivity, specificity, and accuracy in detecting rib fractures, standard chest x-rays along with right and left oblique views are recommended.<sup>28</sup>

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<sup>16</sup> Kazcor & Pierce, 2011

<sup>17</sup> Leventhal et al., 2008

<sup>18</sup> Loder & Bookout, 1991; Leventhal et al., 2008; Pandya et al., 2009

<sup>19</sup> Pierce and Bertocci, 2006

<sup>20</sup> Leventhal et al, 2008

<sup>21</sup> Kemp et al., 2008

<sup>22</sup> Barsness et al., 2003

<sup>23</sup> Cadzow & Armstrong, 2000

<sup>24</sup> Bilo et al., 2011

<sup>25</sup> Bulloch et al., 2000

<sup>26</sup> Ibid

<sup>27</sup> Kazcor & Pierce, 2011

<sup>28</sup> Barsness et al., 2003

Caregiver explanations may include that the fractures were caused by birth trauma or falls, but a literature review indicates that these incidents rarely result in rib fractures. One study screened for birth injuries in 35,000 infants and found no rib fractures.<sup>29</sup> Falls from heights and complex falls can cause rib fractures, but posterior and lateral rib fractures are more likely to be attributed to child abuse.<sup>30</sup>

### *Femur fractures*

Abuse is a common cause of femur fractures in children under one year, but becomes an uncommon cause once the child starts walking.<sup>31</sup> Leventhal et al. (2008) who reviewed 13,870 children under 36 months and found that femur fractures are the second most common fracture type in children under one year, and that 30% of femoral fractures in this age range are caused by abuse.<sup>32</sup> Smaller studies have found that between 17% and 60% of femur fractures in children younger than one are caused by abuse.<sup>33</sup>

The femur is the largest bone in the body, and it can be fractured by both high and low energy mechanisms. Common causes include motor vehicle collisions, falls, and child abuse. In children younger than three years, the most common cause of femur fracture is a fall, followed by abuse.<sup>34</sup> Abusive femur fractures are most likely to occur in the shaft followed by distal region of the bone, and 55% of children with abusive femur fractures also have additional injuries.<sup>35</sup> No specific fracture site or pattern has been found that allows differentiation between accidental and abusive femoral fractures.<sup>36</sup>

### *Tibia/Fibula*

Leventhal et al. (2008) found that 58% of tibia/fibula fractures in children 0-11 months are caused by abuse.<sup>37</sup> In the non-ambulating child this fracture location is concerning, but as the child begins to walk, accidental tibia and fibula fractures, commonly referred to as toddler fractures, become relatively common skeletal injuries.<sup>38</sup> Abusive fractures can occur when the child is grabbed by the leg or when the leg is twisted.<sup>39</sup>

### *Skull fractures*

A parietal linear fracture is the most common skull fracture type in both abusive and accidental injuries.<sup>40</sup> Although it may be difficult to determine the cause of the skull fracture, certain factors raise suspicion for abuse. Multiple skull fractures and bilateral skull fractures are associated with abuse.<sup>41</sup> Growing fractures, depressed fractures,<sup>42</sup> and intracranial injury are

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<sup>29</sup> Bhat et al., 1994

<sup>30</sup> Chadwick, Bertocci, & Guenther, 2011

<sup>31</sup> Shwend, Werth, & Johnson, 2000

<sup>32</sup> Leventhal et al, 2008

<sup>33</sup> Thomas, Rosenfield, Leventhal & Markowitz, 1991; Shwend et al., 2000; Hui et. al, 2008

<sup>34</sup> Rewers et al., 2005

<sup>35</sup> Rewers et al., 2005

<sup>36</sup> Rex & Kay, 2000; Kaczor & Pierce, 2011

<sup>37</sup> Leventhal et al reviewed 13,870 children under 36 months.

<sup>38</sup> Kaczor & Pierce, 2011

<sup>39</sup> Kaczor & Pierce, 2011

<sup>40</sup> Kemp et al., 2008

<sup>41</sup> Ibid

suggestive of abuse when present with other fractures.<sup>43</sup> In cases where the fracture results from abuse, infants usually present with a symptom such as swelling on the head or vomiting. A history of trauma is often absent, and the caregiver may construct a history of trauma after identification of the fracture.<sup>44</sup>

Because skull fractures are not specific for abuse, the history given by the caregiver becomes particularly important when identifying the cause. If a fall is offered as an explanation, the type of fall should be discussed with the caregiver to determine injury compatibility with the history provided. Accidental skull fractures do occur, but are typically caused by falling from a distance of 3 to 6 feet, such as falls from baby chairs placed on tables and from standing adults' arms.<sup>45</sup> Most falls from short distances do not result in skull fractures in infants. A study of 3357 falls in infants under 6 months found that serious injury, defined as a concussion or fracture, occurred in less than 1% of the falls.<sup>46</sup> The most common falls reported in the study were from beds, couches, arms, arms of child, and arms on stairs. There are several reports of fractures resulting from bed falls or other short distances less than 3 feet, but in each case the infant hit a hard surface, such as a radiator, table corner, or toy while falling.<sup>47</sup>

Birth trauma is another explanation that may be offered for skull fractures in young infants. In uncomplicated deliveries, skull fractures at birth are very rare. Rubin studied 15,435 births and found a single skull fracture.<sup>48</sup> Bhat et al. (1994) studied 35,000 births and found 4 skull fractures. Vacuum extraction or forceps use at birth increases the chance of head injuries including cephalhematoma<sup>49</sup> and skull fracture. Skull fractures are also found in approximately 5% of infants who undergo vacuum extraction.<sup>50</sup>

However, most skull fractures that result from birth trauma are uncomplicated linear fractures of the parietal bone and are often not detected at birth.<sup>51</sup> Therefore x-rays may not be completed and fractures may go undiagnosed. When a child presents with skull fractures in the first months of life, it can be difficult to determine if the fracture was caused by birth trauma or abuse. Kleinman (1998) wrote that an uncomplicated linear skull fracture caused by birth trauma will no longer be visible on x-rays at six months.

### *Metaphyseal Fractures*

The term "classic metaphyseal lesion," also called a "corner fracture" or "bucket-handle fracture," refers to a fracture that occurs when the extremity is pulled or twisted, or the child is

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<sup>42</sup> Growing fractures are described as enlarged linear fractures and depressed fractures are described as a fracture where the skull has an inward displacement of the bone. (Hobbs, 1984 as cited in Kaczor & Pierce, 2011)

<sup>43</sup> Hobbs, 1984

<sup>44</sup> Kaczor & Pierce, 2011

<sup>45</sup> Hobbs, 1984

<sup>46</sup> Warrington & Wright, 2001

<sup>47</sup> Kaczor & Pierce, 2011

<sup>48</sup> as cited in Bilo et al., 2010, p.26

<sup>49</sup> A cephalhematoma is a collection of blood under the scalp of the newborn. The occurrence of cephalhematoma is 4% in forceps deliveries, as compared to 1-2% in spontaneous vaginal deliveries (Doumouchtsis and Arulkumaran, 2008), and in up to 5% of cephalhematomas, an underlying skull fracture will be present (Towner and Ciotti, 2007).

<sup>50</sup> Simonson, et al., 2007

<sup>51</sup> Bilo et al., 2010

abusively shaken.<sup>52</sup> The classic metaphyseal lesion occurs most often in children under one year<sup>53</sup> and is highly specific for abuse when it occurs in children of this age group.<sup>54</sup> Worlock et al. (1986) compared fracture patterns in 35 children ages 0-5 years that had abusive fractures with fracture patterns in 116 children who had accidental fractures. 11% of the abusive fractures were metaphyseal, whereas none of the fractures found in the accidental injuries group were metaphyseal. Metaphyseal fractures are also the most frequently found long bone fracture in infants who die with evidence of abuse.<sup>55</sup> A study of 31 infants under 11 months who died of inflicted injuries found 72 fractures of the long bones, of which 64 (89%) were classic metaphyseal lesions.<sup>56</sup>

Classic metaphyseal lesions occur in the metaphysis of a long bone, which is the wider part of the bone toward the end of the bone. The most common long bone sites for the classic metaphyseal lesion are the distal femur (end of the thigh bone further from the center of the body), proximal tibia (end of a lower leg bone closer to the center of the body), distal tibia (end of a lower leg bone further from the center of the body), and proximal humerus (end of the upper arm bone closer to the center of the body).<sup>57</sup>

The classic metaphyseal lesion is highly specific for child abuse in infants because the tensile and shearing forces necessary to cause this injury are unlikely to occur from accidental causes. Dwek (2011) wrote that “children who are not toddling or walking generally cannot exert this type of force by themselves to cause this type of fracture” and “this fracture does not result from falls and has never been reported as a result of falls in infants in multiple studies.”

Although metaphyseal fractures in infants are highly specific for child abuse, other causes should be taken into account before confirming the diagnosis. A study that reviewed 22 years of records for an obstetrics practice that delivered 8,500 babies per year found three reports of babies with distal femoral metaphyseal fractures identified on radiographs after uncomplicated caesarean section.<sup>58</sup> Classic metaphyseal lesions have also been reported to occur during casting for repair of clubfoot.<sup>59</sup> After the age of one year, accidental trauma becomes a more frequent diagnosis.<sup>60</sup>

Imaging studies are essential in diagnosing metaphyseal fractures because there is usually no outward physical evidence of these fractures. There is ample data from autopsies and clinical studies that metaphyseal fractures usually do not cause bruising and only cause pain when severe.<sup>61</sup> For these reasons, metaphyseal fractures are usually not detected until found on x-rays.

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<sup>52</sup> Scherl & Endom, 2010

<sup>53</sup> Kleinman, Marks, Richmond, & Blackbourne, 1995

<sup>54</sup> Kaczor & Pierce, 2011

<sup>55</sup> Kleinman et al., 1995

<sup>56</sup> Kleinman et al., 1995

<sup>57</sup> Kleinman, 2008

<sup>58</sup> O'Connell and Donoghue, 2006

<sup>59</sup> Grayev, Boal, Wallach, & Segal, 2001

<sup>60</sup> Kleinman, 2008; Dwek, 2011

<sup>61</sup> Kleinman, 2008; Carty, 1993



Follow up x-rays two weeks after the initial study are also recommended, as additional metaphyseal fractures may be found at this time.<sup>62</sup>

### ***OIG Review of Infants 0-6 Months after Closing the DCP Investigation***

The OIG reviewed the outcomes for the 66 infants with bone fractures at the close of the DCP investigation. Two infants died during the DCP investigation. One was a five-month-old who was placed face down on a mattress and suffocated. An autopsy revealed a clavicle fracture and 11 rib fractures and the mother later admitted to punching the infant in the midsection. The surviving sibling was placed with the grandfather. A three-month-old with ten fractures (8 rib, healing humerus, and cheek) also suffered bilateral brain hemorrhaging and bilateral retinal bleeds and died from the injuries. The father was arrested and charged with the infant's murder. The mother, who was at work at the time of the infant's injuries, moved to Mexico with the surviving four-year-old sibling.

A six-week-old infant, who was placed in a relative foster home, suffered six compression rib fractures. The examining physician, a HealthWorks doctor, determined that the family's explanation that the infant co-slept on the sofa with an adult aunt, who was visiting the home, was plausible. The infant remained in the foster home, and the family was given information on safe sleep practices. While the doctor determined the injuries as accidental, review of the literature on rib fractures does not support the caregiver's explanation.<sup>63</sup> The infant has since been adopted by the caregivers with no further reported injuries.

Three families had an open intact case at the time of the bone fracture investigation. A five-month-old suffered a tibia fracture after the mother fell down stairs while holding the infant. The investigation was unfounded and the infant remained in the home while the Department continued to provide services. A two-month-old suffered a tibia fracture attributed to the parents handing the infant back and forth during a domestic dispute. The parents were indicated for bone fractures by abuse and the Department continued to provide intact services. A three-month-old suffered five fractures (2 skull and 3 rib) and the father was indicated for bone fracture by abuse and head injuries by abuse. The father was the sole caretaker for the infant and none of his explanations could account for the infant's injuries. The mother obtained an order of protection against the father and the Department continued to provide intact family services.

### ***No Services Needed N=22***

Twenty-two of the 66 investigations were closed without any further services warranted. Of these six were indicated for abuse or neglect. One infant resided in another state and the investigation was indicated and referred to out of state authorities. In the remaining five investigations a caretaker was indicated for an allegation of abuse or neglect. In two of the five investigations an unknown perpetrator was indicated for bone fracture by abuse. In a third investigation a babysitter was indicated for bone fracture by abuse. In the fourth and fifth investigations the parent was indicated for bone fractures by neglect. A mother failed to ensure the infant was belted into the bouncy seat and the infant fell off the table top and sustained a broken femur. A second mother left her three week old infant on a changing table unattended and the infant fell off and sustained a skull fracture. Of the remaining 16 investigations where

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<sup>62</sup> Kleinman et al., 1996

<sup>63</sup> Cadzow & Armstrong, 2000

the allegations of abuse and neglect were unfounded, in 9 investigations the infants' fractures were attributed to an accidental fall.

#### *Community Referrals N=3*

In three of the 66 investigations, the family was referred for community services. The mother of a two-month-old fell while holding the infant who suffered a transverse tibia fracture. The fall was accidental; however, the mother delayed medical treatment and was subsequently indicated for medical neglect. A five-month-old suffered a metaphyseal humerus fracture after a sibling pulled the infant's arm. The doctor determined the incident was accidental; however, the mother was indicated for bone fractures by neglect because she did not stop the three year old sibling. The third infant was six months old with a spiral humerus fracture and skull fracture with no explanation. The infant was being cared for by her father and also attended day care. The father was indicated for bone fracture by neglect and an unknown perpetrator was indicated for bone fracture by abuse.

#### *Intact Family Services N=15*

In 15 of the 66 investigations (23%), the Department opened an intact family services case. In one investigation the Department took protective custody of a three-month-old infant with an unexplained rib fracture. However, the County G's State's Attorney's office declined to file a petition for temporary custody and the infant was returned to the parents. The Department provided intact family services for three months when a second report was made to the hotline and the infant was placed in foster care.<sup>64</sup>

In five of the 15 investigations the allegation for bone fracture by abuse or neglect was unfounded. In one investigation, there were no additional allegations indicated, but an intact case was opened with the Department to address issues of domestic violence in the home. In the remaining four investigations two investigations had an indicated finding for substantial risk of injury to their infants, one parent was indicated for medical neglect for delaying treatment of the bone fracture and one parent was indicated for inadequate supervision.

In four investigations the infant had four or more fractures. A one-month-old with four fractures from County G remained in the home with both parents. That infant died two months later from abusive injuries.<sup>65</sup> In three of the remaining investigations the perpetrator of the injury was identified and no longer a household member. In County F a mother obtained an order of protection against the father, who had been determined the perpetrator of the abuse. In County E the mother was ruled out as a perpetrator and was not in the home at the time of the abuse. The mother obtained a court order prohibiting the father from contact with the infant. In County G, the father was ruled out as a perpetrator and the mother was arrested for the infant's injuries.

#### *Foster Care N=20*

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<sup>64</sup> For further discussion see *Families Reported to the Department after the Initial Bone Fracture Investigation* in this report.

<sup>65</sup> See OIG report #091138.

The Department took protective custody and placed 20 of the 66 (30%) infants in foster care. In 18 of the 20 investigations, or in 90% of the investigations a perpetrator was indicated for bone fracture by abuse. In the remaining two investigations, a perpetrator was indicated for bone fractures by neglect. Eight of the 20 (40%) infants who were taken into protective custody had four or more fractures. Three of those infants were returned home by the courts within 60 days. The Department was granted temporary custody of an infant from the southern region with five fractures, but the court returned the infant home one month later, after the mother, who was out of state at the time of the infant's injuries, was ruled out as a perpetrator. In the two remaining investigations, both from County A in the Southern Region, the first infant with six fractures, in which the parents provided multiple explanations, was returned home at the shelter care hearing. The second infant with seven unexplained fractures was returned home two months after the Department was granted temporary custody.

### ***Perpetrator Findings***

In 47 of the 66 (71%) investigations involving infants (0-6 months) with bone fractures a perpetrator was indicated for abuse or neglect.

- Thirty-five (74%) were indicated of bone fractures by abuse.
- Six were indicated for bone fractures by neglect.
- Two were indicated for inadequate supervision.
- Two were indicated for medical neglect
- Two were indicated for substantial risk of physical injury.

In eleven (17%) investigations involving infants (0-6 months), a parent or caregiver was arrested by local law enforcement. Of the eleven perpetrators arrested, four have been convicted by the courts.

- County F (Central Region): The father of a one-month-old with seven fractures was convicted of aggravated battery of a child and sentenced to 12 years in prison.
- County B (Southern Region): The father of a two-month-old with five fractures was convicted of aggravated battery to a child and sentenced to 10 years in prison.
- County G: The father of a three-month-old with two healing rib fractures pled guilty to endangering the life and health of a child. The father was sentenced to one year supervision.
- County G: The father of a six-month-old with a humerus fracture pled guilty to aggravated domestic battery and was sentenced to three years in the Department of Corrections.

In five of the investigations the arrested perpetrator is awaiting trial on the criminal charges.

- County F (Central Region): The father of a three-month-old with two skull fractures and three rib fractures was charged with aggravated battery of a child.
- County E (Northern Region): The father of a four-month-old with eight fractures was charged with aggravated domestic battery and aggravated battery to a child.
- County E (Northern Region): The father of a two-month-old with three rib fractures and an ulna fracture was charged with aggravated battery of a child and aggravated domestic battery.

- County G: The father of a three-month-old with ten fractures who died from the injuries was charged with murder.
- County G: The mother of a one-month-old with five fractures was charged with aggravated battery of a child.

In two investigations charges were never filed or later dismissed.

- County F (Central Region): The father of a three-month-old with a healing rib fracture was arrested for domestic battery but the State's Attorney's Office never filed charges.
- County D (Southern Region): The mother of a five-month-old with one fracture and burns was arrested for endangering the life and health of a child. The charges were later dismissed.

***Families Reported to the Department Prior to the Initial Bone Fracture Investigation***

Nine of the 66 families (14%) had prior investigative involvement with the Department. In five of the nine investigations, the infant with the bone fracture was also the alleged victim in the prior investigation. Below are the descriptions of the five prior investigations involving infants birth to six months. Four of the five prior investigations involved reports of domestic violence between the parents. One of the five investigations involved a parent with substance abuse issues.

A three-month-old with nine unexplained fractures to the femurs, ribs and tibias was taken into protective custody. Two months earlier the mother was indicated for risk of harm to the then one-month-old infant. The mother had a history of substance abuse and the infant required hospitalization at birth for substance abuse withdrawal and prematurity. The Department took protective custody at the time of the infant's discharge from the hospital. The County G State's Attorney's office did not file a petition and protective custody was allowed to lapse. The Department provided intact family services.

A two-month-old had a healing tibia fracture. The family had an open intact case with the Department stemming from a prior incident. One month earlier, the police arrested both parents during a domestic dispute. A medical evaluation determined the infant had no injuries and both parents were indicated for risk of substantial injury.

A three-month-old with unexplained healing fractures to the humerus and tibia was taken into protective custody. Two months earlier the parents were involved in an incident of domestic violence and the police were called. The mother and infant moved out of the home and the father was indicated for risk of injury to the then one-month-old infant.

A five-month-old with an accidental femur fracture had an open intact family case at the time of the injury. One month earlier, the police responded to the family's home after a report of domestic violence. The allegations were unfounded citing that the parents engaged in a verbal dispute.

A five-month-old sustained an accidental tibia fracture when the mother fell while holding the infant. The family had an open intact case stemming from an earlier incident. Four months

earlier the mother was indicated for substantial risk of injury after a domestic dispute between the parents. The mother kicked the father and threatened to kill him while he held their newborn.

***Families Reported to the Department after the Initial Bone Fracture Investigation***

In a study completed by Sledjeski, Dierker, Brigham and Breslin, 244 families were followed for 18 months. A prior indicated or substantiated child protection allegation was the most important factor in re-abuse risk.<sup>66</sup> In another study, Thompson and Wiley (2009) followed 149 families with prior reports to child protective services for maltreatment, but the child remained in the home.<sup>67</sup> The children who were physically or sexually abused at the initial report were 4.55 times more likely to be re-referred than children who did not experience physical or sexual abuse at the time of the initial report. Also, if the maltreatment allegation had been substantiated versus unsubstantiated, the child was twice as likely to be re-referred to child protection services.<sup>68</sup>

In the OIG sample of 66 investigations of infants (0-6 months) with bone fractures, 48 infants remained or returned to the home where they received the initial bone fracture.<sup>69</sup> Eight (17%) of the 48 families where the infant remained or returned to the home had subsequent hotline reports within 24 months of the bone fracture investigation report. Three of the subsequent reports involved a sibling of the infant as the alleged victim. In the remaining five investigations the infant with the initial bone fracture was the alleged victim of the subsequent report.

**Table 3: *Infants Reported to the Department Following Initial Bone Fracture Investigation***

<b>Infant</b>	<b>Bone Fracture Finding</b>	<b>First Outcome</b>	<b>Age at Subsequent Report</b>	<b>Subsequent Report</b>	<b>Allegation Finding</b>	<b>Subsequent Outcome</b>
1-Month Old with 4 fractures	Indicated for abuse	Intact Family	3 Months	Head Injuries, Death	Indicated for abuse	Infant Died
3-month-old with tibia fracture	Indicated for abuse	Foster Care & Returned Home 19 months	2 years	Substantial Risk of Harm	Unfounded for neglect	Community Services
3-month-old with rib fracture	Indicated for abuse	Intact Family	6 Months	Substantial Risk of Harm	Indicated for neglect	Foster Care for 11 months
3-month old with five fractures	Indicated for abuse	Intact Family	3 ½ Months	Head Injuries	Unfounded for neglect	Intact Remained Open
			17 Months	Cuts, Welts, Bruises and Head Injuries	Unfounded for A&N	Intact Remained Open
			18 Months	Substantial Risk of Injury	Indicated for neglect	Foster Care
3-month-old	Indicated	Intact	19 Months	Inadequate	Unfounded	Community

<sup>66</sup> Sledjeski, Dierker, Brigham, and Beslin, 2008

<sup>67</sup> Thomson and Wiley, 2009

<sup>68</sup> Thompson and Wiley, 2009

<sup>69</sup> Six infants were returned home; three in 60 days; two in four months and one in 13 months. Fourteen infants remain in foster care or have been adopted.

with skull fractures	for neglect	Family		Supervision	for Neglect	Services
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## **ANALYSIS**

In the review of young children’s bone fracture investigations conducted by the Office of the Inspector General, infants 0-6 months accounted for 31% of the investigations, the largest age category. In comparison, children three years old represented 11% of the investigations. When investigating bone fracture allegations in infants, it is critical to understand the seriousness of the injuries in light of their limited mobility, and vulnerability. Distinguishing abusive fractures from accidental injuries is a complex process that involves physical examination, radiographic findings, and history of the injury.<sup>70</sup> While some fracture types are specific for abuse, no fracture type is completely diagnostic of accidental or abusive trauma.<sup>71</sup> Therefore, diagnosis should address whether the explanation adequately correlates with the severity, age, pattern, and distribution of injuries and the likelihood of non-accidental causes for the injury.<sup>72</sup> The assessor must determine injury plausibility, which includes assessing if the history and injury are compatible, how the injury is described by the caregiver, if signs and symptoms are consistent with the details provided, and whether other injuries are present.<sup>73</sup>

Infants who have been diagnosed with rib fractures require additional scrutiny given rib fracture’s association with abuse. Massive force is required to account for accidental injury in infants with rib fractures.<sup>74</sup> In the review conducted by the OIG, 19 infants birth to 11 months of age were diagnosed with rib fractures. The fractures were considered abusive and a perpetrator was indicated for abuse in 18 of the 19 investigations. In the 19<sup>th</sup> investigation, the HealthWorks doctor determined that the infant’s six rib fractures occurred accidentally from co-sleeping with an adult on a sofa in a relative foster home. The examining physician noted in the medical record that there was no external bruising or any other lesions that suggested abuse. Cadzow and Armstrong (2000) write that “in the absence of witnessed massive trauma or underlying metabolic bone disease, even a single rib fracture must be considered to be indicative of abuse.” Additionally, Carty (1993) noted that rib fractures are seldom accompanied by external evidence of trauma. Review of the literature on rib fractures in infants does not support the plausibility of the caregiver’s explanation that the infant received the rib fractures from co-sleeping. Researchers have concluded that education makes a difference in reporting suspected child abuse, and efforts must be made to ensure medical professionals receive continuing and updated education about child abuse.

### *Infants with Multiple Fractures*

As the number of fractures in an infant increases, so does the likelihood that the injuries are abusive. Several studies have addressed the association between multiple fractures and abuse.<sup>75</sup> Leventhal found that infants with multiple fractures are 4 to 6 times more likely to have been

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<sup>70</sup> Hilton, 2006

<sup>71</sup> Kaczor & Pierce, 2011

<sup>72</sup> Kellogg, 2007

<sup>73</sup> Kaczor & Pierce, 2011

<sup>74</sup> Cadzow & Armstrong, 2000.

<sup>75</sup> Leventhal et al., 2008 & Worlock, Stower, Barbor, 1986.

abused then those infants with a single fracture.<sup>76</sup> In the OIG review of investigations of bone fractures in infants 0-6 months, 15 (23%) of the 66 investigations involved infants with four or more fractures. Two of the 15 infants with multiple injuries died during the DCP investigation. The remaining 13 infants and their families received services from the Department: one infant, a ward, remained in the relative foster home where the injury occurred; four families received intact family services; and eight infants were removed from the home and placed in foster care. In three of the four families who received intact services the perpetrator of the injury was identified and no longer a household member. In the fourth investigation the infant remained in the home and died two months later from abusive injuries.

Among the eight infants who were removed from the home and placed in foster care, three were returned home by the courts within 90 days. In County B in the Southern Region a two-month-old with five fractures was returned to the mother after one month in foster care. The father confessed to causing the injuries and was criminally charged. The mother was ruled out as a perpetrator and the Department provided services to the infant and the mother. In County A in the Southern Region the court returned two infants to their parents. The Judge ordered a three-month-old with seven unexplained metaphyseal fractures returned home after three months, citing a lack of services provided by the Department.<sup>77</sup> The second infant from County A in the Southern Region, a four month old with six fractures, including bi-lateral skull and bi-lateral metaphyseal femur fractures was returned home after the State's Attorney's Office decided to withdraw the child abuse and neglect petition citing a lack of evidence.<sup>78</sup> In both investigations the caregivers could not provide adequate explanations for their infants' extensive injuries. Returning vulnerable infants with unexplained injuries placed the children at further risk.

Young children are at greater risk of recurrent maltreatment.<sup>79</sup> In the OIG sample, 17% of the families had subsequent reports, though a low percentage, one infant died and another suffered multiple head injuries. Both families had intact family cases with the Department at the time of the subsequent report. The infant who suffered additional head injuries was later removed from the home and placed in foster care. Intervening effectively in the lives of children and their families is not the sole responsibility of any single group or person. No one system serving the needs of abused and neglected children can work effectively by itself. When infants with fractures come to the attention of child protection, it is imperative that all involved professionals, including law enforcement, officers of the court, medical professionals and child protection staff, understand the seriousness related to abusive injuries.

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<sup>76</sup> Leventhal et al, 2008

<sup>77</sup> See OIG Report # 2012-0198.

<sup>78</sup> See OIG Report #2011-2079.

<sup>79</sup> Connell, Vanderploeg, Hatz, Caron, Saudners and Trebes, 2009,

## APPENDIX A

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