Kurt Nichols Andrews v. State of Maryland
No. 101, September Term 2000

HEADNOTE:

EVIDENCE; RELEVANCE; DEMONSTRATIONS; DEMONSTRATIVE EVIDENCE; TESTIMONY; INFANTICIDE; SHAKEN BABY SYNDROME

Before admission of demonstrative evidence, the party seeking its introduction for the purpose of explaining testimony and assisting the trier of fact has the burden of establishing the substantial similarity between the in-court demonstration and the events it purports to depict.

IN THE COURT OF APPEALS OF MARYLAND

No. 101

September Term, 2000

KURT NICHOLS ANDREWS

v.

STATE OF MARYLAND

Bell, C.J.
Eldridge
Raker
Wilner
Cathell
Harrell
Battaglia
JJ.

Opinion by Bell, C.J.

Filed: November 14, 2002

The petitioner, Kurt Nichols Andrews, was arrested and tried, in the Circuit Court for Montgomery County, for the death of his infant daughter, Kristin Andrews,[1] which, it was alleged, was caused by "Shaken Baby Syndrome." Shaken Baby Syndrome is characterized by violent acceleration and deceleration forces being applied to an infant, whose head is disproportionately heavy, whose neck muscles are weak, and whose brain is unmyelinated and soft, making it more susceptible to trauma. The petitioner was found not guilty of second degree depraved heart murder, involuntary manslaughter, and child abuse. He was convicted, however, of reckless endangerment, for which he was sentenced to a term of five years imprisonment. After unsuccessfully appealing his conviction to the Court of Special Appeals, the petitioner filed a petition for Writ of Certiorari with this Court, which we granted. Andrew v. State, 362 Md. 34, 762 A.2d 968 (2000). In this Court, the petitioner argues that the trial court erred by allowing a demonstration, using a doll that did not have the same characteristics as the infant child alleged to have been shaken, to be conducted before the jury for the purpose of showing the amount of force necessary to cause an injury associated with Shaken Baby Syndrome, and by permitting the expert witness, called by the respondent, the State of Maryland, to testify on the basis of that demonstration. We agree. Accordingly, we shall reverse.

I.

As acknowledged by the State, the facts of the case sub judice are largely undisputed.

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[1]There seems to be a discrepancy in the spelling of the victim's name. For the sake of consistency, we will refer to the victim as "Kristin."

Kristin Andrews was born prematurely, at a gestational age of 23 ½ weeks,[2] weighing only one pound and eight ounces, in Mercy Hospital on May 6, 1997. As a result, she was plagued with severe health complications, including intraventricular brain hemorrhage, sustained at birth, patent ductus arteriosus (a hole in the heart), and Respiratory Distress Syndrome. Kristin required eight blood transfusions as a result of anemia of prematurity. In addition, Kristin suffered from periodic bouts of apnea, a cessation of breathing for 20 seconds or more, and bradycardia, a slowing of the heart rate to less than 100 beats per minute. Kristin was also treated for an e-coli infection and monitored for retinopathy of prematurity, a condition in which blood vessels to the eye develop abnormally, resulting in the eye becoming engorged, possibly leading to detachment of the retina. She was unable to self-feed and required an arterial line to the umbilicus for formula, antibiotics and fluids.

Kristin remained hospitalized for a period of 89 days after birth, requiring during that period, numerous medications and medical equipment. Due to the Respiratory Distress Syndrome caused by the premature development of her lungs, she required an artificial surfactant[3] to prevent lung collapse; medication to stimulate the brain center to breathe; a diuretic to prevent pulmonary edema; a powerful steroid to decrease inflammation of the

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[2]Evidence at trial suggested that the earliest survivable gestational age of a premature infant is twenty-three weeks and that the mortality rate for infants born as young as Kristin is about 50%.

[3]Surfactant is a natural material produced in the body that lines the air sacs of the lungs and helps keep the lungs open when exhaling. Without surfactant, the lungs tend to collapse with each breath.

lungs; and supplemental oxygen to assist her breathing. Her first 28 days of life were spent in the Neonatal Intensive Care Unit. The remainder of Kristin's hospital stay was spent in the Stepdown Unit, which was one level higher than a traditional newborn nursery. Throughout her hospitalization, Kristin was under constant monitoring as a result of apnea and bradycardia attacks. Some of those attacks required medical intervention.

The petitioner and Debbie Young, Kristin's mother and the petitioner's fiance, visited their daughter daily while she was hospitalized. Testimony adduced at trial indicated that both parents bonded strongly with Kristin and that, the petitioner, Ms. Young, Ms. Young's seven-year old son and Kristin appeared to be a caring and loving family.

Kristin was discharged from the hospital on August 2, 1997, about the same time she would have been born at full-term. Although she was allowed to leave the hospital, she continued to have health problems associated with her premature birth: Kristin was diagnosed as having bronchial pulmonary dysplasia, damage to the lungs associated with Respiratory Distress Syndrome in premature infants. Thus, Kristin was sent home with a 24-hour a day monitor and instructions for the continued administration of medication designed to stimulate breathing. Both of her parents were instructed in the use of the monitor and cardiopulmonary resuscitation (CPR) of infants. The record indicates that the leads to the monitor sometimes became detached, which would trigger an alarm. In addition, the monitor would sound an alarm when the memory was full indicating that the monitor required servicing. The alarms resulting from a loose lead or a full memory are different

from the alarm sounded when triggered by an apnea event. Nevertheless, whenever an alarm sounded, the petitioner or whoever was caring for her would have to check on Kristin to determine whether the alert from the monitor was a false alarm or a true alarm.

Kristin also required on-going medical evaluation. In one such followup examination, Kristin's doctor noted that she exhibited abnormally rigid muscle tone which suggested a brain injury that may become more apparent as Kristin developed.

As a consequence of Kristin's need for heightened medical care and attention that her parents had been trained to provide, the petitioner and Ms. Young agreed that, because Ms. Young, a nursing assistant, earned a higher salary than petitioner, she would keep her job and the petitioner would quit his employment and care for their daughter full time. As a result, the petitioner acted as Kristin's primary caretaker from the moment she was discharged from the hospital until her death. The record indicates that the petitioner took Kristin to all of her followup examinations with her doctors. During this time, Kristin's weight increased to eleven and-a-half pounds, which was characterized as excellent weight gain. Kristin's last recorded apnea event took place on September 5, 1997.

In October of 1997, Ms. Young was offered a position as a medical assistant with Kaiser Permanente. Although the position was located in Towson, Maryland and the family resided in Baltimore County, acceptance of the job was dependent on Ms. Young traveling to Rockville, Maryland for a three-day training seminar. Ms. Young being unfamiliar with the Rockville area, the petitioner and Ms. Young agreed that the petitioner would drive Ms.

Young to the training seminar. Due to financial difficulties, however, to avoid wasting gas making the return trip to Baltimore and back to Rockville to pick Ms. Young up at the conclusion of the training and concerned that no one would be available to pick up Ms. Young's seven-year old son after school, the couple also decided that the entire family would accompany Ms. Young to Rockville and would remain there the entire day while Ms. Young attended the training seminar.

The family left for Rockville at about 6:00 a.m. on October 27, 1997 and arrived at the Kaiser Permanente garage at approximately 8:00 a.m. The leads from Kristin's monitor detached several times that morning, causing the monitor to sound an alarm. The petitioner remained in the car with the two children. During a break in the training session, between 9:00 a.m. and 10:00 a.m., Ms. Young returned to the car to check in on the family. She testified that all was well during this visit which lasted approximately fifteen minutes. Ms. Young returned to the car shortly after noon, when she received her lunch break. She testified that, once again, the entire family appeared fine and that no one seemed frustrated by the wait.

The petitioner fed Kristin a bottle and burped her at approximately 2:45 p.m. At the conclusion of the feeding, according to accounts given by the petitioner to medical personnel, Kristin began choking and stopped breathing. Testimony at trial also indicated that the petitioner informed the medical personnel that he had unsuccessfully attempted to resuscitate Kristin by performing CPR and shaking her gently. A passerby in the garage, flagged by

petitioner, was able to place a call from the garage office to 911 at 2:54 p.m.

The log on Kristin's monitor indicated that between 11:05 a.m. and 2:59 p.m. the monitor had registered 20 "loose lead" alarms and 16 "full memory" alarms.[4] The last loose lead alarm occurred at approximately 2:47 p.m. and lasted until the monitor was turned off at 2:59 p.m. Emergency medical technician, Captain Michael Prete, arrived at the scene at approximately 2:59 p.m. Captain Prete noticed that Kristin was lying on the back seat of the vehicle, unconscious, not breathing with some blueness around her lips, indicating a lack of oxygen in the body. Captain Prete unsuccessfully attempted to arouse Kristin by tapping her on the feet. He then covered her nose and mouth with his mouth and blew two breaths of air into Kristin's lungs. At this point, Captain Prete noticed a rise and fall in Kristin's chest and that she began to vomit a milky substance. Unable to detect a pulse, Captain Prete then began CPR and proceeded to transfer her by ambulance to Shady Grove Adventist Hospital. During the ambulance ride, Prete noted that he was able to stimulate a spontaneous pulse in Kristin, however, she never breathed on her own and required the assistance of an "ambu-bag" which contained 100 percent oxygen. Although, Kristin vomited a couple more times in the ambulance, the emergency technicians were able to keep her airways clear. The technician administered epinephrine, a medication designed to increase Kristin's slow ventricular heart rate.

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[4]This level of activity was not unusual because it was difficult to keep the leads attached to Kristin's thin skin.

Arriving at the hospital at 3:18 p.m., the hospital personnel immediately suctioned milk and vomitus from Kristin's airways. Kristin's eyes and body were unresponsive to light or touch. She was wheezing and her hands and feet were blue. Dr. Rebecca Salness, a pediatric emergency physician, and Dr. Allison Goodman, a pediatric intensive care physician, unsuccessfully continued CPR and the administration of various medicines for more than two hours. Nevertheless, Kristin never regained consciousness and was pronounced dead at 5:25 p.m. Dr. Salness recorded her diagnostic impression as electro-mechanical disassociation (pulseless electrical activity, and consequently, no circulation), aspiration vomitus (inhaled vomit or milk in the breathing system blocked, totally or partially, the airway); complications of respiratory problems associated with premature birth, disseminated intravascular coagulopathy (clotting problem caused by oxygen deprivation to the brain) and cardiorespiratory arrest (heart and breathing stopped). Dr. Salness testified at trial that the chances of survival for a child after a choking event similar to Kristin's was "very good" if CPR is administered soon after. She further indicated that patients usually respond to the CPR quickly or would "die within 30 minutes or maybe an hour," and that it was unusual to perform CPR on a person for as long as they had on Kristin.

An autopsy was performed on Kristin's body the day after her death. Dr. James Laren Locke was the assistant medical examiner on duty that day. The autopsy of Kristin Andrews was initiated by Dr. Ling Lee, a post graduate research pathologist with a special interest in research into Sudden Infant Death Syndrome (SIDS); however, it was completed by Dr.

Locke.[5] Dr. Locke testified that a technician cut and removed Kristin's skullcap, and that "40 to 50 milliliters of blood," in fluid form, escaped as the skull cap was removed, a "very little" amount being captured in a specimen cup. Dr. Locke believed the presence of the blood to be evidence of an acute and recent subdural hemorrhage. He also noted a subarachnoid hemorrhage of the brain which he also thought was recent, and bruising along the optic nerve sheath. Dr. Locke did not obtain complete medical records for Kristin and was unaware that she had been diagnosed with intraventricular hemorrhaging in her brain while in Mercy Hospital. He was further unaware that Kristin was evaluated for retinopathy of prematurity and that there had been blood in a spinal tap (which can indicate blood in the subarachnoid space in the brain) done at Mercy Hospital.

Having marked on the death certificate that the cause of death was "pending," Dr. Locke consulted with two pathology specialists, Dr. Juan Troncosa, a neuropathologist and Dr. W. Richard Green, an ophthalmologic pathologist, advising them of what he knew and of his conclusions. On November 12, 1997, without obtaining Kristin's medical records or waiting for the reports from the pathology specialists, he changed the cause of death on Kristin's death certificate from "pending investigation" to "homicide," "head trauma as a result of shaking."[6] The petitioner was subsequently arrested and charged with the murder

[5]Dr. Lee had worked with Dr. Smylic, the Chief Medical Examiner, on a study of SIDS deaths in Baltimore. Dr. Lee was neither licensed to practice pathology in the State of Maryland, nor specially authorized as an un-licensed practitioner.

[6]The neuropathology report was not completed until November 17, 1997 and the ophthalmology report was not completed until December 1, 1997.

of his infant daughter.

At the petitioner's trial, Dr. Locke was accepted as an expert witness for the prosecution, over defense objections. He testified that he had determined the cause of Kristin's death to be consistent with "Shaken Baby Syndrome." He further testified that, in his determination, the cause of Kristin's death was inconsistent with any other findings. Although Dr. Troncosa, the neuropathologist, was not called as a witness, Dr. Locke did testify as to the contents of the report that he wrote. That report disagreed with Dr. Locke and, instead, concluded that there was no evidence of a recent subdural hemmorrhage, as Dr. Locke had concluded as a result of the autopsy he conducted. The neuropathology report further concluded that there was no evidence of a swelling, tearing or bruising of the brain or shifting of the brain tissue. Dr. Locke also acknowledged that the neuropathologist had examined the spinal cord and the cervical medullary junction (where the spinal cord meets the brain), two areas susceptible to injury from shaking, but found no signs of injury.

Dr. W. Richard Green, the consulting ophthalmologic pathologist, testified at trial as an expert in ophthalmology and pathology. He stated that, based on the post-mortem examination of Kristin's eyes, he noticed evidence of internal and external hemorrhaging of the optic nerve, hemorrhaging of the retina, and bleeding in the circumferential macula folds of the eyes.[7] Dr. Green testified that the specimen showed massive, diffuse

[7]Dr. Green testified that Dr. Alex Sua, a post graduate fellow, examined the eyes, which had been sent by the medical examiner's office and prepared a report that was reviewed and revised by Dr. Green.

hemorrhages in both eyes, which he believed occurred at least 6 days prior to Kristin's death, perhaps more. Concluding that Kristin's injuries could have resulted in two ways: (i) increased intervascular pressure as a result of chest compressions; or (ii) Shaken Baby Syndrome, Dr. Green's determined that the results of the examination were consistent with a diagnosis of Shaken Baby Syndrome.

Dr. Green did not believe that the chest compressions used in CPR could result in the type of injuries sustained by Kristin, but acknowledged that some studies had shown that CPR compressions can cause retinal hemorrhages in children. Dr. Green discounted the possibility that hemorrhaging found in Kristin's sample were produced by CPR because he had never seen the degree or pattern of hemorrhaging found in Kristin's specimen with any of the cases he examined after "vigorous CPR." Dr. Green acknowledged that in the cases he referred to, the CPR lasted about 30 minutes, whereas the CPR on Kristin lasted almost two and a half hours. He also acknowledged that none of the 76 child eye pathology exams he had done for the medical examiner involved premature infants, and none involved infants with a history of retinopothy of prematurity. Dr. Green further testified that the force of the chest compressions required to cause retinal bleeding would be less on the supple chest of a neonate.

The prosecution called Dr. Barbara Craig as its final expert witness. Accepted as an expert in pediatrics, child abuse and the anatomy and physiology of head injuries in children, Dr. Craig opined that Kristin's death resulted from Shaken Baby Syndrome. She testified

that the minimal criteria to justify the forensic medical diagnosis of shaken baby syndrome would be: (i) a baby who was well who suddenly became unconscious; (ii) the subdural hemorrhage described by Dr. Locke and the subarachnoid hemorrhage shown by the autopsy of the brain; and (iii) the absence of any major head injury, such as that caused by, for example, a car accident. She further stated that retinal hemorrhages are not a necessary factor in the diagnosis, but can result from Shaken Baby Syndrome.

The defense called both fact and character witnesses and three expert witnesses. Dr. Michael Baden was accepted as an expert witness in the area of pathology, forensic pathology and child abuse for the defense. He testified that, in his opinion, to a reasonable degree of medical certainty, Kristin's death was not the result of Shaken Baby Syndrome. Dr. Baden opined that Kristin's death was a result of choking on her formula resulting in an apnea and bradycardia event from which she did not recover.

Dr. Baden's opinion was based on his review of Kristin's complete medical history, including some 700 pages of records from her initial hospitalization at Mercy Hospital following birth, her pediatric records and ophthalmology records, the printouts from Kristin's monitor, the reports from the consulting specialists, the autopsy report, tissue slides, photographs and police reports. From these records, he concluded that Kristin suffered a brain hemorrhage at birth, severe anemia (Kristin had less than a third of the red blood cells that she should have had), abnormal blood vessels in the retina because of the prematurity, and severe episodes of apnea and bradycardia. Dr. Baden submitted that the physicians at

Mercy Hospital were able to stabilize Kristin for 89 days and that she lived for an additional 85 days thereafter; however, he concluded that she was nevertheless still a very sick child. Dr. Baden agreed with the conclusion of the emergency room physician, that Kristin's death was a result of cardiac arrest and pulmonary arrest triggered by choking on vomitus. Dr. Baden's conclusions were also consistent with (i) the account given by the petitioner to the emergency room personnel and (ii) the treating physician's attempts to remove vomitus from Kristin's airways.

Dr. Baden expressly disagreed with the conclusion reached by Dr. Locke that Kristin's death was caused by the subdural hemorrhage. He opined that the blood that escaped during the autopsy of Kristin's brain was the result of post-mortem bleeding and not a subdural hemorrhage. Dr. Baden testified that he disagreed with

> "the transient observation of the pathologist who saw the subdural, and in no way documented it, and [in]. . . my own experience [of] over 39 years, that it is a common mistake beginners make to misinterpret accumulations of blood in the back of the scalp with a subdural hemorrhage because of the post-mortem seepage of blood after the dura is cut."

Dr. Baden noted that subdural hemorrhages do not appear in liquid form at the autopsy, rather they appear as clotted blood, which can be photographed and examined. In addition, a death resulting from a subdural hemorrhage would show signs of swelling. The post-mortem examination, consistent with the observations of the treating emergency room physicians, indicated no evidence of swelling. Dr. Baden concluded that the CPR efforts used to resuscitate Kristin could account for any abnormality in the brain and eyes.

In addition to Dr. Baden's testimony, the defense presented an expert in ophthalmologic pathology and ophthalmological findings associated with Shaken Baby Syndrome and an expert in neurologic traumatic injury of the head and neck. Both experts agreed with Dr. Baden that Kristin's death was not a result of Shaken Baby Syndrome, but rather, was the result of a lack of oxygen caused by choking.

Against this background of conflicting expert testimony, the prosecution was allowed to conduct an in-court demonstration. The demonstration - intended to show the force necessary to cause Shaken Baby Syndrome - was performed before the jury, using a doll designed for infant CPR training, by Dr. Barbara Craig. Defense counsel objected to the use of the CPR doll, arguing that the prosecution had not laid a proper foundation, either a showing of a sufficient similarity between the doll and Kristin or that Dr. Craig possessed the expertise to demonstrate the amount of shaking force required to cause the injuries. The trial court rejected defense counsel's request for an in camera voir dire of Dr. Craig. Deferring its ruling until the prosecution had established the foundation, it believed that Dr. Craig's basis of knowledge "would go to the weight rather than the admissibility of any demonstration," and, thus, should be challenged by cross-examination.

Although the prosecutor argued that the foundation for the demonstration had been laid, offering two reasons: (i) the nurse from Shady Grove Hospital who testified had demonstrated a gentle shaking motion which Petitioner had shown her to explain how he had attempted to stimulate Kristin to begin breathing; and (ii) Dr. Craig had already laid a

foundation by her testimony about her review of pertinent studies, her attendance at seminars, and her knowledge of biomechanics, the trial court informed him that he had "to ask her how she is able to determine the amount of force, her basis of knowledge." This prompted the prosecutor to inquire:

> "Q [PROSECUTOR]: And now by way of kind of defining what you mean by violent shaking, I want to ask you a couple of foundational questions.
>
> "When you talk about the shaking that is necessary to cause these injuries, I guess I am getting to the basis of your knowledge for how much shaking would be involved.
>
> "So let me start by saying is that issue, the degree of force necessary to cause injuries like the one you have listed, is that something that is within the literature in the field of child abuse and head injuries in children?
>
> "A [DR. CRAIG]: Yes. It is.
>
> "Q: Is that same issue, the degree of force necessary for these injuries, something that is a topic of scholarly publishing and conversation and debate in the context of national seminars as well as more localized seminars?
>
> "A: Yes. It is.
>
> "Q: Is it an issue that you discuss with your peers in the field?
>
> "A: Yes. It is.
>
> "Q: Is it an issue that you have had some knowledge about from your treatment of surviving children from Shaken Baby Syndrome and the manifestation of injury that they have?
>
> "A: Yes. It is.

> "Q: And have you had the occasion to review the findings of the autopsies and studies that stem from autopsies when it comes to the amount of force necessary to cause these types of injuries.
>
> "A: Yes. I have."

The trial judge then ruled, based on this testimony, that Dr. Craig could demonstrate the amount of force necessary to cause Shaken Baby Syndrome by using the CPR doll. Defense counsel renewed his objection, reiterating at a bench conference that he did not believe a proper foundation had been laid. He detailed his reasons:

> "[DEFENSE COUNSEL]: There has been no evidence that this doctor has testified about that she is aware of actual studies that show how much force is necessary.
>
> "And, in fact, the only study has [sic] been done again suggests that the force – simply a shaking is not sufficient to cause the injuries she has described.
>
> "She has not testified that Kristin Andrews' physical condition is sufficiently similar to the doll that is going to be used both in her size, weight, and the relationship between her weight and size and her head, the development of the neck in the doll with the neck in Kristin Andrews – all of those factors she has not testified about.
>
> "She has not talked at all about any principles of physics that would lead her to the basis to think that she could have an actual opinion of shaking.
>
> "She has not said that she had people who have shaken children describing how violently they are or that that has been described in the literature.
>
> "She has not done anything [sic] of those things, and for that reason, I do not believe that it is an expert opinion."

The trial judge reiterated her previous ruling: "That would go to the weight of [the expert's]

opinion rather than the admissibility of the demonstration."

Thereafter, the following colloquy occurred in front of the jury prior to the actual demonstration:

> "Q [PROSECUTOR]: Now we have used this doll, State's exhibit 6, for purposes of talking about CPR. And I want to ask you first of all – – and this is compared to babies in general and then compared to Kristin Andrews – – can you tell us what the similarities and differences are by the way of weight and flexibility of this doll compared to an actual baby in the condition of Kristin Andrews?
>
> "A [DR. CRAIG]: Can I pick it up?
>
> "Q: Yes please. Sorry. I did not mean to leave it there.
>
> "A: The doll is much lighter than 11 ½ pounds.
>
> "Q. Okay.
>
> "A: This feels like [it] probably weighs about 3 or 4 pounds. So this doll is lighter, and it does not feel as heavy as a baby that would weigh 11 ½, which is how Kristin weighed when she died.
>
> "Q: What about the neck?
>
> "A: And this baby's neck does not really move when you – – when you gently move it back and forth. Babies' necks are very weak, and their heads are very heavy.
>
> "So if I did this to a baby that was a few months old, their heads would naturally fall all the way back so that the back of the head would almost touch to scalpula, the shoulder blades on either side.
>
> "And if I tip them forward, the baby's head would fall down, and the chin would touch the chest if this were a real baby.
>
> "Q: Is it fair to say that aside from being roughly a third the weight of Kristin Andrews, that the rigidity of the neck will make a demonstration

incomplete in terms of the exact arc movement and rotational forces at work within the head?

"A: That is true.

"Q: Okay. Obviously it would not be quite as graphic though either – – I mean, by doing it this way?

"[DEFENSE COUNSEL]: Objection

"THE COURT: Overruled

"Q [PROSECUTOR]: By doing it this way, it is not going to be quite as graphic to watch as if the baby's head and neck had the same [sic] portions of Kristin Andrews?

"[DEFENSE COUNSEL]: Objection

"THE COURT: Overruled

"THE WITNESS: That is true.

"Q [PROSECUTOR]: Is that correct? Now when you describe this as violent shaking, and keeping in mind that obviously this doll is lighter, and most significantly that the neck does not have the same consistency, can you demonstrate to the jury the type of movement that an adult would have to have to cause the injuries that caused Kristin's death?

"[DEFENSE COUNSEL]: Objection.

"THE COURT: Overruled for the reasons stated at the bench.

"Q [PROSECUTOR]: Go ahead."

(Witness demonstrates)

Immediately after the demonstration the witness gratuitously added, "[a]lmost more energy than you can do, if you are not – – already have your adrenalin flowing."[8]

Defense counsel requested a cautionary instruction. Granting the request, the trial judge told the jury:

> "THE COURT: Well, I will tell the jury this was not an accurate re-enactment, but I think [the prosecutor] made this clear to you. This is Dr. Craig's opinion about the amount of force."

On cross-examination, defense counsel was able to establish that, in addition to the differences in weight and flexibility between the doll and Kristin, there was a difference, as between the doll and Kristin, in the proportional ratio of head to body, both in circumference and weight. Specifically, Dr. Craig acknowledged that based on her "adjusted age" of 3 months, Kristin was in the 90th percentile for head circumference, the 5th percentile for height, and the 60th percentile for weight, signifying an "extremely large disproportion" between the size of her head and the length of her body, and a significant disproportion between the weight of her head and the weight of her body. Dr. Craig also agreed that there

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[8] The trial was not videotaped, so there is nothing in the record to memorialize the demonstration for the appellate court. Immediately after the demonstration, defense counsel objected, "she has done the demonstration. I think that that is sufficient." The trial judge agreed, "Yes. That is sufficient." and the prosecutor thanked Dr. Craig.

was considerable difference between the doll and Kristin in the strength of the neck muscles. Furthermore, Dr. Craig admitted that there had only been one study of Shaken Baby Syndrome using a bio-mechanical model (a doll with sensors in the head to measure the force of various trauma) - the 1992 study by Dr. Christina Duhaime, a neurosurgeon from the Children's Hospital in Philadelphia, Pennsylvania, and Dr. Lawrence Theobald, an expert in physics at the University of Pennsylvania. Dr. Craig admitted that the results of that study were that Shaken Baby Syndrome could not be caused by shaking alone, but rather it must coalesce with some impact trauma to produce such injuries.

Concluding cross-examination was the following exchange:

> "Q [DEFENSE COUNSEL]: ...And so what we are left with now is people basing it on their experience and looking at cases and trying to decide how much force is necessary to create these injuries; isn't that right?
>
> "A [DR. CRAIG]: And we are looking at the old studies on primates, the mechanical model studies, and then also people who have confessed and demonstrated what they have done yes.
>
> "Q: And you yourself have never actually seen a child being shaken, I hope?
>
> "A: No
>
> "Q: Not in a violent way?
>
> "A: No. Not violently, no.

II.

We begin our analysis with the proposition that all relevant evidence is admissible. Pappaconstantnou v. State of Maryland, 352 Md. 167, 181, 721 A.2d 241, 248 (1998); Smallwood v. Bradford, 352 Md. 8, 27, 720 A.2d 586, 595 (1998). See Md. Rule 5-402.[9] Evidence is relevant if it has "any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence." Md. Rule 5-401. See Snyder v. State, 361 Md. 580, 590-91, 762 A.2d 125, 131 (2000). The initial determination of whether evidence is relevant is made by the trial judge. Merzbacher v. State, 346 Md. 391, 404, 697 A.2d 432, 439 (1997); Ebb v. State, 341 Md. 578, 587, 671 A.2d 974, 978 (1996); North River Ins. Co. v. Mayor and City Council of Baltimore, 343 Md. 34, 89-90, 680 A.2d 480, 508 (1996); Armstead v. State, 342 Md. 38, 66, 673 A.2d 221, 235 (1996). Relevant evidence, however, should be excluded by the trial court, if the probative value of such evidence is determined to be substantially

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[9]Rule 5-402. Relevant Evidence Generally Admissible; Irrelevant Evidence Inadmissible.

Except as otherwise provided by constitutions, statutes, or these rules, or by decisional law not inconsistent with these rules, all relevant evidence is admissible. Evidence that is not relevant is not admissible.

outweighed by the danger of unfair prejudice. See Md. Rule 5-403.[10] See also, e.g., Snyder, 361 Md. at 592-93, 762 A.2d at 132 ("[t]herefore, evidence which meets the definition of "relevant evidence" under Rule 5-401, and which, therefore, would be admissible under Rule 5-402 as having logical relevance, may nonetheless be excluded under Rule 5-403.") citing Merzbacher, 346 Md. at 404, 697 A.2d at 439; William v. State, 342 Md. 724, 737, 679 A.2d 1106, 1113 (1996).

Likewise, "the decision to admit demonstrative evidence rests within the sound discretion of the trial court." Ware v. State, 348 Md. 19, 65, 702 A.2d 699, 721-722 (1997). Our decision in Ware illustrates the basis and proper procedure for admission of demonstrative evidence. We explained:

> "Demonstrative evidence has been described as physical evidence that 'helps the jurors understand the testimony, but it is otherwise unrelated to the case.' JOSEPH F. MURPHY, JR., MARYLAND EVIDENCE HANDBOOK § 1101, at 576 (2d ed.1993); see, e.g., Grandison v. State, 305 Md. 685, 731-33, 506 A.2d 580, 603-04 (1986); Evans v. State, 304 Md. 487, 520-21, 499 A.2d 1261, 1278-79 (1985). Demonstrative evidence is generally offered for clarification or illustration of the witness's testimony and it need not be

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[10]Maryland Rule 5-403 provides:
"Although relevant, evidence may be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence."

original or authentic. 'Instead, the theory justifying admission of these exhibits requires only that the item be sufficiently explanatory or illustrative of relevant testimony to be of potential help to the trier of fact.' 2 MCCORMICK ON EVIDENCE § 212, at 9 (J. Strong 4th ed. 1992).

* * * * * *

"Professor McLain discusses the foundation requirements for demonstrative evidence:

> 'A foundation simply must be laid through the witness's testimony that the evidence fairly and accurately depicts what it purports to depict (a subject as to which the witness has the required knowledge) and that it will be helpful to the witness in explaining his or her testimony. It is then admissible in the trial court's discretion; if the court determines that the evidence will be helpful to the trier of fact. . . .'

* * * * * *

"The court must weigh the demonstrative evidence's probative value against the possibility of unfair prejudice or confusion."

Id. (internal citations omitted).

In-court demonstrations are permitted with the court's permission, if the pertinent conditions are substantially the same as at the time in question, and if the procedure will not be unduly time-consuming, confusing or likely to arouse unfairly emotional reactions in the jury. Lynn McLain, 5 Maryland Evidence, § 403.4 (West Publishing Co. 1987). See also 4 Wigmore § 1160 (rev.1972); 2 McCormick on Evidence, § 215 (5th ed., Strong, ed. 1999); Joseph F. Murphy, Jr., Maryland Evidence Handbook, 2d Ed., § 1105 (The Michie Co.,

1993). This Court has applied these general principles to demonstrations involving objects and required that the party seeking to utilize the demonstration make a preliminary showing that what the demonstration is expected to establish is "substantially similar" to the facts and circumstances at issue. See O'Doherty et. ux., v. Catonsville Plumbing and Heating Co, Inc., 269 Md. 371, 374-75, 306 A.2d 248, 250 (1973).

In O'Doherty, this Court, noting the views from other jurisdiction, stated:

> "The courts now very generally permit a party to make or perform an experiment, demonstration, or test in open court before the jury when it will prove, tend to prove, or throw light upon, the issue in the case on trial, provided such experiment or test are made under similar conditions and like circumstances to those existing in the case at issue. Demonstrations should ordinarily be conducted within the courtroom if it is practical to do so; if it is not practical to do so, they may be conducted outside, subject to the same conditions and limitations applicable to demonstrations or experiments made in the courtroom. . . ."

Id. (emphasis added). O'Doherty further held that the mere fact that a demonstration is performed in open court does not denigrate the evidential validity of a demonstration. Id. at 374-75, 306 A.2d at 250.

We have further stated that "demonstrative evidence need not be original in order to be admissible, [however,] there must be 'ample evidence' that the item offered as demonstrative evidence is substantially similar to the item that actually played a part in the events at issue." Ware, 348 Md at 66, 702 A.2d at 722, (emphasis added), citing Grandison,

305 Md. at 732, 506 A.2d at 603. As we see it, the "substantially similar" requirement gives effect to the initial relevance determination required of all evidence by Md Rule 5-402. Without the substantially similar requirement serving as a gatekeeper to the admission of demonstrative evidence, the net effect would be the admission of all demonstrative evidence, whether relevant or irrelevant.

As the petitioner notes in his brief, the "application of the general principle of 'essential similarity of conditions' is more difficult when what is involved is not objects, but people." (Petitioner's Brief at 30). Illustrating the conflicting decisions, from other jurisdictions, with respect to this area of the law, he draws our attention to United States v. Gaskell, 985 F.2d 1056 (11th Cir. 1993) and State v. Candela, 929 S.W.2d 852 (Mo. App. 1996). The petitioner urges this Court to adopt the rule applied in Gaskell.

In Gaskell, a case with substantially similar facts to the case sub judice, Robert Gaskell, the accused, was alleged to have caused the death of his infant daughter, Kristen, as a result of, inter alia, Shaken Baby Syndrome. Over the objection of defense counsel, the government was allowed to have its expert witness conduct a demonstration, for the jury, of Shaken Baby Syndrome using a rubber mannequin designed for the practice of infant CPR techniques. On appeal, Gaskell argued that the demonstration using the rubber mannequin was "irrelevant and unfairly prejudicial." 985 F.2d 1056, 1060. After stating the general

principle that the "district court has wide discretion to admit evidence of experiments conducted under substantially similar circumstances," the court made clear that the "burden is on the party offering a courtroom demonstration or experiment to lay a proper foundation establishing a similarity of circumstances and conditions." Id., citing Barnes v. General Motors Corp., 547 F.2d 275, 277 (5th Cir. 1997); accord Jackson v. Fletcher, 647 F.2d 1020, 1027 (10th Cir. 1981) ("The party introducing the evidence [of an experiment] has a burden of demonstrating substantial similarity of conditions. They may not be identical but they ought to be sufficiently similar so as to provide a fair comparison.").

The 11th Circuit concluded that the government failed to meet its burden of establishing substantial similarity of conditions[11] and that the prejudice resulting from the

[11] The federal court stated "the conditions of the demonstration. . .were not sufficiently similar to the alleged actions of the defendant to allow a fair comparison. As noted by defense counsel in her objection, due to differences in the weight of the doll's head as well as the flexibility and length of the doll's neck, a considerably greater degree of force was required in order to produce the head movement characteristic of shaken baby syndrome. As the party offering the evidence, the burden was on the government to show that the conditions of [the expert's] demonstration were sufficiently similar to the circumstances of the [victim's] death to afford a comparison. Based on the differences enumerated by defense counsel, the government failed to meet its burden. [The expert] admitted that the doll's neck was stiffer than that of a seven-month old infant and that this would affect the degree of force necessary to move the head in the required fashion. [The expert] explained that his presentation was based on a demonstration of shaken baby syndrome by a police officer whose knowledge was derived from the confession of a father in an unrelated case. Although an expert may rely upon hearsay as the basis for his or her opinion if the out of court statements are "of a type reasonably relied upon by

demonstration outweighed any probative value it might have. Gaskell, 985 F.2d at 1061. The court was not persuaded by the government's argument that cautionary instructions to the jury cured the prejudice and concluded that "the ability to cross examine is not a substitute for the offering party's burden of showing that a proffered demonstration or experiment offers a fair comparison of the contested events." Id. at 1062.

In contrast to the ruling in Gaskell, in Candela an intermediate appellate court in Missouri held that a demonstration of Shaken Baby Syndrome using a rag doll was properly admitted, where the defense counsel had the opportunity to point out to the jury the differences between the victim and the doll. The Missouri court's ruling was based on the determination that the demonstration was for illustrative purposes only and was not admitted for the purpose of showing what was alleged to have actually happened. See Candela, 929

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experts in the particular field," the government did not establish that [the expert's] hearsay knowledge of this unrelated case provided any reliable or accurate basis upon which to draw conclusions regarding [the victim's] death. Further, although [the expert] repeatedly shook the doll before the jury, he was unable to state the number of oscillations required to produce the [victim's] injuries. The conditions of the demonstration were thus substantially dissimilar; the government failed to establish that either the degree of force or the number of oscillations bore any relationship to the defendant's actions. Although the presentation did illustrate the path of movement of an infant's head during shaken baby syndrome, this phenomenon could have been demonstrated with equal effectiveness by a direct manipulation of the doll's head, as suggested by defense counsel at sidebar." Gaskell, 985 F.2d 1056, 1060-61 (internal citations omitted).

S.W.2d at 867. In a similar case, a Georgia court also adopted the rationale of Candela, stating:

> "Obviously, a demonstration of how shaken infant syndrome occurs would have to be done with a mannequin or a doll rather than a real infant. Such objects will differ in many respects from a real child. However, any dissimilarity between the conditions of the demonstration and the actual occurrence affects the weight rather than the admissibility of the evidence."

Powell v. State, 226 Ga. App. 861, 863-864, 487 S.E.2d 424, 426 (1997). See also Minor v. State, 780 So. 2d 707 (Ala. 1999), in which, finding Candela more persuasive, the Supreme Court of Alabama distinguished Gaskell as follows:

> "In Gaskell, unlike this case, defense counsel specifically objected to the degree of force used in the demonstration; the witness said he based his presentation on a demonstration by a police officer whose knowledge was derived from a father in another case; the witness admitted he displayed a greater degree of force than that required to produce shaken baby syndrome; Gaskell had admitted shaking the child, though for resuscitation purposes, making the issue of the amount of force actually used critical; and, the conviction was not reversed solely on the demonstration, but also on two other errors in the trial of the case."

Id. at 763-764.

Apparently, agreeing with the reasoning of Candela and Powell, the trial court, as we have seen, admitted the demonstration. We decline to follow suit, believing the Gaskell holding and rationale to be consistent with Maryland law.

III.

We have stated, supra, that before demonstrative evidence is admitted, "there must be 'ample evidence' that the item offered is substantially similar to the item that actually played a part in the events at issue." Ware, 348 Md at 66, 702 A.2d at 722, (emphasis added), citing Grandison, 305 Md. at 732, 506 A.2d at 603. The test is the same when, rather than an item, the subject of dispute is an event. Consequently, as a threshold matter, the trial court was required to determine whether the State had met its burden in establishing that the demonstration would be substantially similar to the event in question, namely approximating the amount of force "an adult would be required to use to inflict the injuries sustained by Kristin Andrews." (Respondent's Brief at 8). The trial court abdicated its duty in determining the threshold issue and, instead, after consideration of the holdings in Gaskell, Candela and Powell, determined that the differences "would go to the weight of [Dr. Craig's] opinion rather than the admissibility of the demonstration."

In the case sub judice, the trial court allowed the State to proceed with the demonstration with a presumption and acknowledgment of dissimilarity, thus relieving the burden on the State to establish the demonstration's substantial similarity to the facts at issue. We conclude that the differences between the doll and the victim were not insignificant, but, rather, were substantially material to the determination of the amount of force necessary to

constitute Shaken Baby Syndrome. The net effect of allowing the State to proceed with a presumption of dissimilarity was to weaken the petitioner's ability to challenge the demonstration on cross-examination. The exchange between the prosecutor and Dr. Craig, on direct examination, specifically highlighted and noted the differences of the demonstration.[12] During cross-examination, defense counsel did manage to highlight more specific differences between the doll and Kristin's proportional ratio of head to body, both in weight and circumference; however, the jury had already been fully apprised of the fundamental differences on direct examination. We agree with the Gaskell court where it stated "[t]he ability to cross-examine is not a substitute for the offering party's burden of showing that a proffered demonstration or experiment offers a fair comparison to the contested events." Gaskell, 985 F.2d at 1062.

The Court of Special Appeals attempted to distinguish the case sub judice from Gaskell on the basis that the demonstration in petitioner's trial was "not [to] show Kristin's head or neck movements during the shaking, [r]ather, the doctor sought to illustrate the amount of adult force and degree of shaking that she contended was necessary to cause

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[12]Q [Prosecutor]: Is it fair to say that aside from being about roughly a third the weight of Kristin Andrews, that the rigidity of the neck will make the demonstration incomplete in terms of the exact arc of movement and rotational forces at work within the head?

A [Dr. Craig]: That is true.

Kristin's injuries." We are not persuaded. That the "federal court based its ruling on the fact that the doctor had to display a greater degree of force than the level required to produce shaken baby syndrome due to the characteristics of the doll that was used" rather than supporting the distinction the intermediate appellate court seeks to draw, actually supports the petitioner's argument. Dr. Craig testified on direct examination that the doll's neck "does not really move," consequently, any amount of force used by Dr. Craig to conduct the demonstration was an unfair comparison when viewed in light of the alleged events.

Finally, the petitioner argues that the demonstration using the doll may have misled the jury. We agree. Without laying a proper foundation that the in-court demonstration would be substantially similar to the events related to Kristin's death, the demonstration was irrelevant as a matter of law. As the Gaskell decision noted, "several circuits have recognized that demonstrative exhibits tend to leave a particularly potent image in the jurors' minds." Gaskell, 985 F.2d at 1061 n.2, citing United States v. Wanoskia, 800 F.2d 235, 237-238 (10th Cir. 1986); Carson v. Polley, 689 F.2d 562, 579 (5th Cir. 1982). That the jurors may have relied upon this demonstration in their deliberation may have prejudiced the petitioner.

After taking notice of defense counsel's repeated objection to the demonstration, the trial court issued a cautionary instruction to the jury acknowledging that the demonstration was not an "accurate re-enactment" and only an opinion. We are not persuaded that the

cautionary instruction cured any possible prejudice suffered by petitioner.

We conclude that the trial court erred by allowing the demonstration conducted by Dr. Craig without requiring the State to establish the substantial similarity between the in-court demonstration and the event at issue. Accordingly, we reverse.

JUDGMENT OF THE COURT OF SPECIAL APPEALS REVERSED. CASE REMANDED TO THAT COURT, WITH INSTRUCTIONS TO REVERSE THE JUDGMENT OF THE CIRCUIT COURT FOR MONTGOMERY COUNTY AND REMAND TO THAT COURT FOR NEW TRIAL. COSTS IN THIS COURT AND IN THE COURT OF SPECIAL APPEALS TO BE PAID BY MONTGOMERY COUNTY.