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Evaluation of noise levels experienced by medically fragile neonates during emergency helicopter transport

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Evaluation of Noise Levels Experienced by Medically Fragile Neonates during Emergency Helicopter Transport

by

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Abstract:
There was a concern medically fragile infants may be exposed to high noise levels during emergency helicopter transport. This study had been initiated in 2007. Data was collected using a Larson Davis noise dosimeter. The purpose of this study was to collect additional data to evaluate the noise exposure experienced by medically fragile neonates during emergency transport via helicopter inbound/outbound of St. Louis Children's Hospital, St. Louis, MO. The results suggested neonates may be exposed to noise levels ranging 85 to 95 dBA during transport. These high noise exposures may pose a risk to hearing.

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Table of Contents

List of Figures

Abbreviations

SLCH	St. Louis Children's Hospital
NICU	Neonatal Intensive Care Unit
OSHA	Occupational Safety and Health Administration

Introduction

Imagine an infant born at St. Anthony's Hospital in rural Effingham, Illinois. The infant is 15 weeks premature and weighs one pound five ounces. He has several life threatening complications and is in dire need of immediate emergency specialized care that is not available locally. Moments later a doctor at St. Anthony's Hospital communicates with St. Louis Children's Hospital (SLCH) requesting immediate flight for life transport. The SLCH transport team is notified and fifteen minutes later three transport team members are en route in a specially equipped BK-117 helicopter. It is a scene repeated daily by the SLCH transport team; jumping at a moment's notice to transport precious cargo; some of the tiniest, most delicate and sickest infants imaginable to SLCH for specialized neonatal intensive care.

A new mother and father seeing their newborn infant so fragile and weak are immediately put into some of the most stressful situations at a moment's notice (Dudek-Shriber, 2004). Their lives are completely turned upside down when they find out their infant needs immediate emergency care or he may not survive. The stress and anxiety of the parents are extremely high and it is not surprising they feel everything is out of their control. They sit down with doctors in utter disbelief and sign dozens of legal papers filled with foreign terms which grants' permission to transport their infant via helicopter and acknowledges' their infant may not survive the transport. Throughout this time, the infant's stress is mounting as well because he has been abruptly taken away from his mother and hooked up to dozens of wires monitoring all bodily functions. Then an hour later this fragile infant is thrown out into the real world in a high noise environment and his stress level rises even more and causing his heart rate to increase and his peripheral blood vessels to constrict (Shenai, 1977; Sittig, Nesbitt, Krageschmidt, Sobczak, & Johnson, 2011).

It is well known that excessive exposure to sound can be damaging to hearing (Aucott, Donohue, Atkins, Allen, 2002; Bess, Peed, Chapman, 1979; Committee on Environmental Health, 1997). However, few research studies have reported data on sound level exposures experienced by medically fragile neonates during emergency transport. It is also known that very young ears are more susceptible to noise compared to adolescent and adult ears. International guidelines have been developed for monitoring sound levels within neonatal intensive care units (NICU) in order to make this environment tranquil and the least stressful for neonates and parents. These guidelines advise sound levels to be 45-50 dB within the NICU and transport international guidelines recommend that sound levels during emergency transport suggest 60 dB or lower because higher noise levels can negatively affect the neonates by increasing stress levels and causing bodily complications (Macnab, Chen, Gagnon, Bora, Laszlo, 1995).

Infants may be more susceptible than adults to acquire noise-induced hearing loss. Falk, Cook, Hoseman, and Sanders (1974) found young infants, particularly immature neonates, are the most susceptible to sound hazards by the fact that younger animals show a greater susceptibility to noise-induced physiologic and pathologic alterations. Kujawa and Liberman (2006) found young mice that experienced high doses of noise exposure were more susceptible to acquiring noise-induced hearing loss as well as significantly more vulnerable to acquiring age-related hearing loss later in life. Given these studies, even exposures at levels of 70 dB SPL may be an excessive and hazardous for the neonates. Observations reported visible changes in neonates' heart rate and peripheral vasoconstriction began to occur when noise levels reach 70 dB as well as disturbances in sleep when sound was presented at 70 to 75 dB (Committee on Environmental Health, 1997). The 1974 report from the Committee on Environmental Hazards stated that noise exposure is commonly linked with stress causing an increase secretion of hormones, changes in heart rate, and variations in peripheral vasoconstriction can be seen at levels as low as 70 dB. Furthermore, research has found prolonged noise exposure over 85 dB can change the structure of hair cells, resulting in often irreversible hearing loss (Campbell, Lightstone, Smith, Kirpalani, Perlman, 1984; Daniel, 2007).

Infants admitted to the NICU are very susceptible to so many illnesses that commonly have short-term or long-term complications including disabilities and impediment in growth and mental development (Buckland, Austin, Jackson, Inder, 2003.) When comparing the normal population for prevalence of hearing loss; infants admitted into a NICU are 30 times more likely to acquire hearing loss than those infants that are never admitted into a NICU (Aucott *et al.*, 2002). These medically fragile neonates are an at-risk population and there is a great need for additional data evaluating noise levels experienced by critically ill neonates in order to appropriately recommend sound level guidelines for emergency transport vehicles to reduce the risk to hearing in neonates.

There is very limited data analyzing noise exposure experienced by medically fragile infants during emergency helicopter transport. Several studies listed below collected noise levels from a variety of emergency transport vehicles such as helicopters (rotary winged aircrafts), ambulances, and fixed wing aircrafts. However, for the purposes of this study we will only be evaluating and discussing emergency helicopter transports. Only a few studies evaluated noise levels using Occupational Safety and Health Administration (OSHA) methods with well calibrated noise dosimeters. Furthermore, of those studies, sound levels were not collected by knowledgeable hearing acquisitions or people familiar with high quality noise dosimeters.

Shenai (1977) studied sound levels neonates experienced during transport via various emergency vehicles. The results showed neonates in transit are exposed to extremely high sound levels. The helicopter transports indicated noise exposures ranging 90 to 110 dB which are in the hazardous range.

Campbell *et al.* (1984) found neonatal infants are exposed to high sound levels and mechanical vibrations during emergency transport. Recorded sound levels showed transported infants experienced noise levels that were in the hazardous range. Mechanical vibrations from portions of the incubator vibrating were reported to add some additional noise exposure. For the purposes of our study, mechanical vibration was not analyzed. Sound levels measured in the infant incubator during transport reported levels between 107 to 110 dB. Again, these results were similar to those obtained by Shenai (1977).

Buckland *et al.* (2003) studied sound levels that neonatal infants were exposed to during routine transports. Compared to other emergency transport vehicles, the highest sound levels were recorded in Eurocopter BK-117 averaging 82.2 dBA inside the incubator during transport. These measures were above the recommended international guidelines of 60 dB and again potentially hazardous to hearing.

Sittig *et al.* (2011) evaluated noise levels neonates experienced inside the incubators during air transport. Data was recorded from helicopters BK-117 and Bell 222. The overall noise exposure inside the incubator was consistently reduced by 6 dBA due to the cover on the incubator when compared to the noise exposure levels experienced by the transport crew. The average sound level for the BK-117 flight study was 83.2 dBA and the Bell 222 averaged 82.0 dBA in the incubator. However, noise levels recorded during the actual flight time, eliminating warm-up and cool down, which is the loudest part during transport and sound levels averaged 85.6 dBA.

The purpose of our study was to evaluate noise measured exposures experienced by medically fragile neonates during emergency helicopter transport to SLCH. Additionally, we also evaluated noise measured exposures that had been previously collected but never reported from 2007. These infants may be very susceptible to acquiring noise-induced hearing loss if exposed to high noise levels in their early days of life. Preliminary data suggested noise peaks as high as 125 dB SPL can be experienced during helicopter transport. The data was analyzed to determine the overall noise levels that neonates are exposed to during emergency transport via helicopter. Additionally, emergency helicopter transport procedures were reviewed and recommendations were suggested to reduce overall noise exposure. Research is needed to collect additional data in order to reduce the risk to hearing from these high noise exposures.

Methods

In this study, all the emergency helicopter transport flights used was the BK-117 model. For more than 20 years, hospitals and medical centers across the country have relied on the BK-117 model for their Flight for Life programs. The helicopter utilized for the St. Anthony's transport was an N911KD. The helicopter utilized for the Moberly Regional Medical Center transport was an N122SL.

Figure 1. BK-117 Helicopter—N911KD

Figure 2. BK-117 Helicopter—N122SL

Sound level data was collected from emergency helicopter transport flights en route to hospital destinations for NICU infant transport as well as inbound flights to SLCH in St. Louis, Missouri. We also had noise exposure data previously collected in 2007 by Mary Jude Weathers, SLCH lead transport nurse; however, this study was abruptly interrupted and was not completed nor was the preliminary data reported. Weathers first began collecting data with a hobbyist model Radio Shack sound level meter, model number 33-2055. Weathers used the sound level meter to manually record data every five minutes with the help of SLCH transport team. Once the data suggested noise exposures were in the potentially hazardous range, she began collecting additional data using a professional Larson Davis 706 Noise Dosimeter which meets federal requirements for noise surveys. The noise dosimeter was set to record noise levels every 30 seconds during each transport flight. For our study, we continued to use the Larson Davis 706 Noise Dosimeter to electronically record sound levels every 30 seconds during transport.

All dosimeters were calibrated according to the manufacturer's guidelines every time data was extracted. All dosimeters were set to record "A" weighted slow responses. "A" weighted slow response is the international standard for assessing sound pressure levels, which emulates the response of the human ear (Buckland *et al*., 2003).

The noise dosimeter was set to record 24 hours per day for a three day period. Noise levels were obtained with help of the SLCH's transport team and at no time was the transport team distracted from caring for the infant. The SLCH's transport team was asked to take the green "noise study bag" before leaving on an emergency helicopter transport flight. For each transport, the noise dosimeter was placed inside the incubator with the microphone clipped to the top left corner on the mattress approximately at the level of the NICU infant's ears. After a three day collection period, we picked up the noise dosimeter and extracted data using the computer program, Blaze. We then exported the data into Excel to complete the data analyses. From the data, we calculated the Leq, maximum, minimum, and peak noise levels for each transport.

Figure 3. *Noise dosimeter placed inside the infant incubator. The microphone was clipped to the upper left corn of the mattress.*

Results

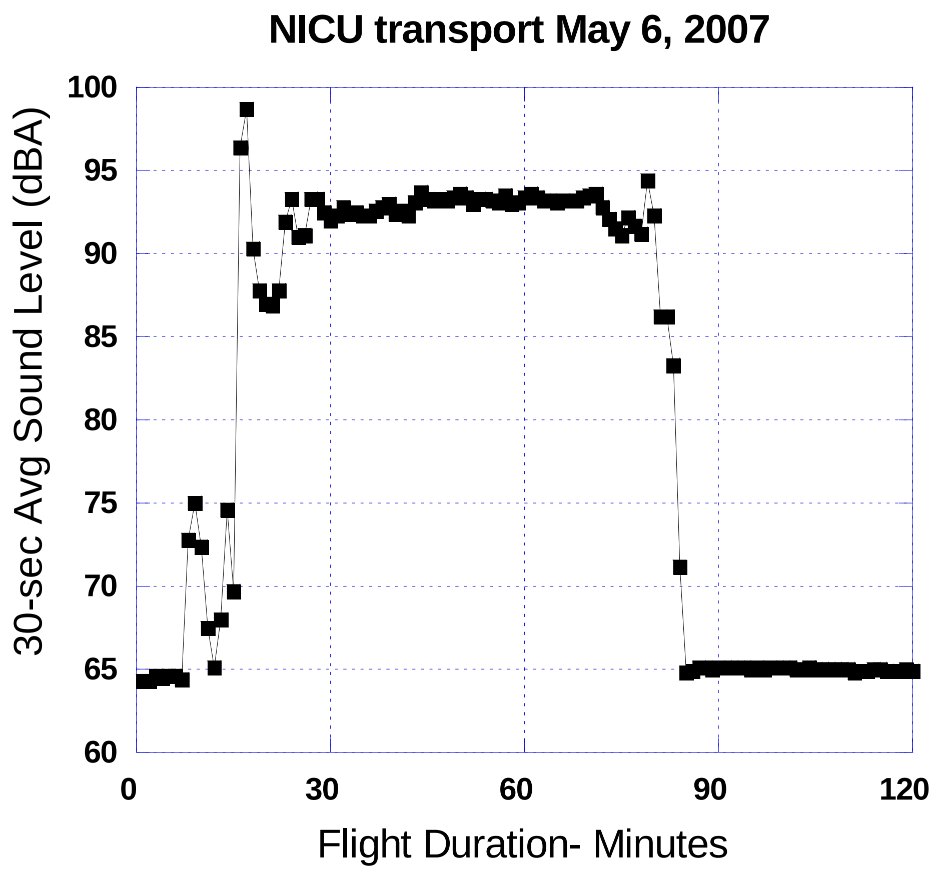

***Figure 4**—An outbound helicopter transport on May 6th, 2007.*

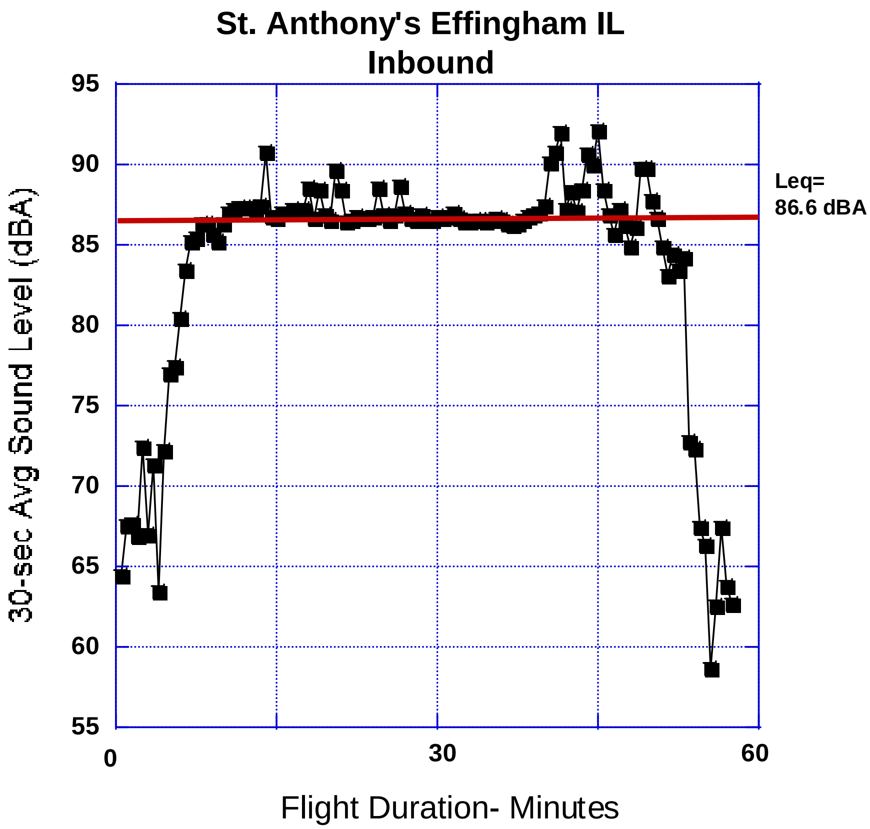

***Figure 5**—N911KD helicopter transport inbound to SLCH from St. Anthony's Hospital in Effingham, IL on April 12, 2011.*

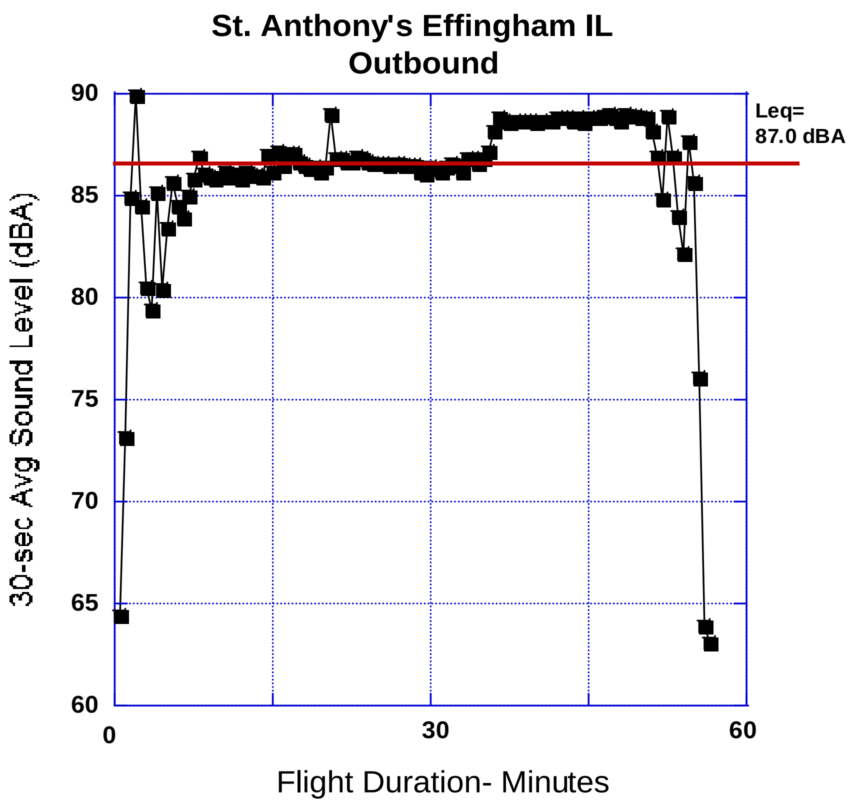

Figure 6**—*N911KD helicopter transport outbound from SLCH to St. Anthony's Hospital in Effingham, IL on April 12, 2011.***

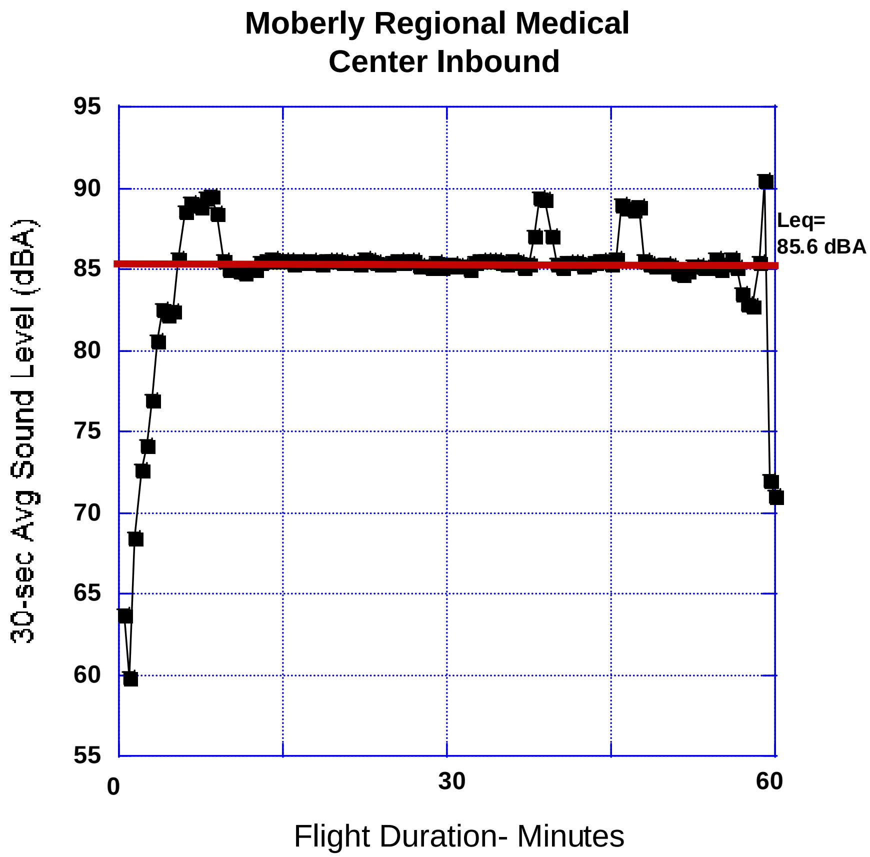

Figure 7*—SN122SL helicopter transport inbound to SLCH from Moberly Regional Medical Center in Moberly, MO on April 17, 2011.*

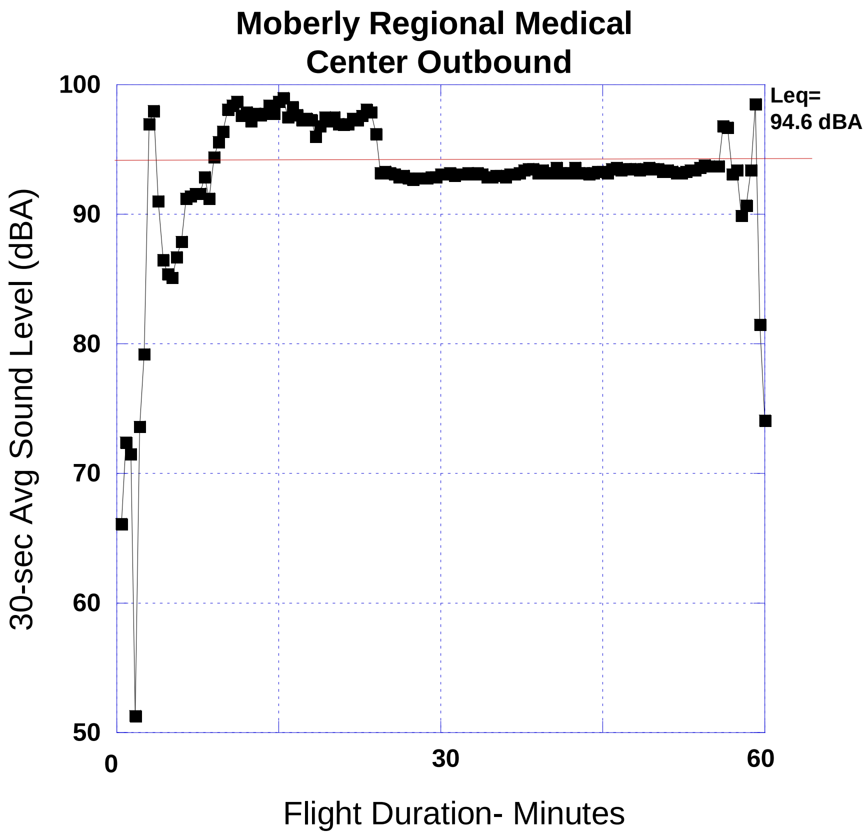

Figure 8—*SN122SL helicopter transport outbound from SLCH to Moberly Regional Medical Center in Moberly, MO on April 17, 2011.*

Given both studies, noise levels can be variable. According to Weather's data, neonates were exposed to sound levels above 90 dBA noise exposure range throughout most of the transport. These levels are extremely high for fragile neonates. During one outbound flight recorded on May 6th, 2007 noise levels were ranging from 65.0 dBA to peaks as high as 98.0 dBA (see Figure 4).

There were a total of two complete SLCH helicopter transport flights recorded with data which includes two outbound and two inbound flights. The results from our two outbound and inbound flights showed noise exposure levels were consistent with data previously reported by Stigg et al (2011).

Figure 8 displays sound levels of an outbound flight to Moberly Regional Medical Center in Moberly, Missouri. The noise levels recorded within the helicopter were obtained every 30 seconds and then averaged, Leq, during flight was 94.6 dBA. However, when compared to Figure 6 an outbound flight to Effingham, IL the 30 second averaged noise levels, Leq, were 87.0 dBA.

Figure 7 represents an inbound flight from Moberly Regional Medical Center with neonate onboard. The 30 second averaged noise levels were collected during flight. The Leq for Figure 7 was 85.6 dBA. Similarly, Figure 5 displays an inbound flight from St. Anthony's Hospital transporting a fragile neonate. Noise levels were recorded consisting of 30 second averaged noise levels during flight. The Leq for Figure 5 was 86.6 dBA.

During both inbound flights, the transported neonates needed additional care. When this occurred the port holes on the incubator were opened. Figure 6 and Figure 8 show noise levels briefly increasing to noise levels around 93.0 dBA. Both inbound flights reported the port holes were opened three times during transport. These port holes were kept open for one to five minutes at a time.

Discussion

The noise levels obtained from the two outbound helicopter flights varied. This was due because the noise dosimeter was not yet placed inside the enclosed incubator since these flights had no neonate onboard. Noise levels of 94.6 dBA within the helicopter are extremely high. In 1998, the National Institute for Occupational Safety and Health recommended exposure limit for occupational noise exposure is 85 decibels, A-weighted, as an 8-hr time-weighted average.

These levels are set for adult workers and might not be appropriate for premature neonates whose auditory systems may not be fully developed to handle such high noise exposures. Therefore, exposures at or above this level are considered hazardous for adults, children, and infants. Medically fragile neonates with under developed auditory systems and adults on the emergency helicopter transport crew must utilize hearing protection in order to preserve hearing. Persons experiencing excessive exposure to high noise levels could result in acquiring noise induced hearing losses.

Furthermore, when these noise levels within the helicopter were compared to noise levels within the enclosed incubator they were significantly lower. Figure 2 noise level results demonstrate the importance of a fragile neonate to be kept within the enclosed incubator to help preserve the neonates hearing. This is very important because we need to keep in mind that these very fragile neonates are the only ones in the helicopter that have no hearing protection available. Commercially available hearing protection is available for children three years and older. Manufacture's state this is because ear plugs are considered a choking hazard for infants. However, these premature fragile neonates' ear canals are too tiny to even fit an ear plug into. Hearing protection for infants is limited to MiniMuffs. This product is available for young infants to help protect their hearing. However, MiniMuffs are placed over the infants' ear and held in place with two-sided sticky tape. This is not appropriate for premature neonates because their skin is so thin and fragile when these ear muffs are removed they tear the neonates' skin. There is an extreme need for new hearing protection to be available in order to fully protect the fragile neonates' auditory system.

There were a few limitations of our study. One limitation would be we were only able to collect noise exposure data from two helicopter transport flights. We understand that the SLCH transport crew is working in an emergency life threatening situations, and the neonate onboard needs to be cared for with the uttermost care. There is only a 15 minute time slot between when the flight crew is notified and en route to hospital destination. This is not a lot of time in general and this time is used to gather necessary equipment and patient information to make this emergency transport successful. So, with these factors in mind, we appreciate SLCH for working with us and thankful for their support to have been able to collect noise exposure data from two different helicopter transport flights.

A second limitation of our study was the short amount of time available for data collection. This project was approved in September 2010 however the time and planning to coordinate with SLCH and helicopter transport team members, supply transport team with necessary instructions to carry out this study properly, limited neonatal flights, as well as time and stress factors involved in emergency situations have resulted in a reduced data set.

We recommend further data analysis of sound levels is needed for a more extensive review of noise exposure experienced by medically fragile neonates during transport. With additional data, manufactures could better provide hearing protection for young children and infants. There is a lack of commercially available hearing protection for fragile infants. The only commercially available hearing protection for infants, MiniMuffs, are not recommended for this population due to the double-sided sticky tape that results in tearing of the skin when removed. Consequently, a reduction in 7 dB is not sufficient enough to protect the infants hearing when noise exposures during transport are 85 dBA or greater.

We also recommend the port holes on the infant's incubator remain closed throughout the transport to reduce sound levels 7-8 dB. We are aware if the infant is in need of emergency medical assistance then the transport crew must open the port holes to provide immediate care to the infant; however, when the infant is stable the port holes should remain closed during transport.

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APPENDIX 1

Time History						
Number	Date	Time	Leq	Max	Min	Peak
1643	17-Apr-11	13:42:00	66.1	80.9	46.9	119
1644	17-Apr-11	13:42:30	72.4	81.6	46.6	120.3
1645	17-Apr-11	13:43:00	71.5	84.1	41.4	120.3
1646	17-Apr-11	13:43:30	51.3	62.2	42.1	96.9
1647	17-Apr-11	13:44:00	73.6	80	54.6	106.3
1648	17-Apr-11	13:44:30	79.2	84.7	66.8	119.8
1649	17-Apr-11	13:45:00	97	99.7	83	120.3
1650	17-Apr-11	13:45:30	98	102.1	91.5	120.3
1651	17-Apr-11	13:46:00	91	92.1	88.6	120.3
1652	17-Apr-11	13:46:30	86.5	88.6	84.6	120.3
1653	17-Apr-11	13:47:00	85.4	85.9	84.8	119.9
1654	17-Apr-11	13:47:30	85.1	85.9	84.2	120.3
1655	17-Apr-11	13:48:00	86.7	88.1	84.8	118.8
1656	17-Apr-11	13:48:30	87.9	89.7	86.3	120.3
1657	17-Apr-11	13:49:00	91.2	92	89.5	120.3
1658	17-Apr-11	13:49:30	91.4	92.2	90.9	118.4
1659	17-Apr-11	13:50:00	91.6	92.3	91.2	118.7
1660	17-Apr-11	13:50:30	91.6	92.5	90.8	120.3
1661	17-Apr-11	13:51:00	92.9	95.3	88.6	120.3
1662	17-Apr-11	13:51:30	91.2	91.9	90.6	120.3
1663	17-Apr-11	13:52:00	94.4	100.4	90.5	120.3
1664	17-Apr-11	13:52:30	95.6	96.4	94.7	120.3
1665	17-Apr-11	13:53:00	96.4	97.5	95.4	120.3
1666	17-Apr-11	13:53:30	98.1	99	96.8	120.3
1667	17-Apr-11	13:54:00	98.4	99.1	97.7	120.3
1668	17-Apr-11	13:54:30	98.7	99.6	97.7	120.3
1669	17-Apr-11	13:55:00	97.6	98.8	96.7	120.3
1670	17-Apr-11	13:55:30	97.9	98.5	96.9	120.3
1671	17-Apr-11	13:56:00	97.2	97.6	96.5	120.3
1672	17-Apr-11	13:56:30	97.8	99.2	96.3	120.3
1673	17-Apr-11	13:57:00	97.7	98.6	96.9	120.3
1674	17-Apr-11	13:57:30	97.8	98.4	97	120.3
1675	17-Apr-11	13:58:00	98.4	99.6	96.9	120.3
1676	17-Apr-11	13:58:30	97.8	98.5	97	120.3
1677	17-Apr-11	13:59:00	98.7	99.7	97.2	120.3
1678	17-Apr-11	13:59:30	99	100.2	97.1	120.3
1679	17-Apr-11	14:00:00	97.5	98.3	96.8	120.3
1680	17-Apr-11	14:00:30	98.3	98.9	97.7	120.3
1681	17-Apr-11	14:01:00	97.7	98.7	96.8	120.3

1682	17-Apr-11	14:01:30	97.3	97.9	96.5	120.3
1683	17-Apr-11	14:02:00	97.4	98.3	96.5	120.3
1684	17-Apr-11	14:02:30	97.3	98.4	96.2	120.3
1685	17-Apr-11	14:03:00	96	96.9	95	120.3
1686	17-Apr-11	14:03:30	96.8	97.9	95.3	120.3
1687	17-Apr-11	14:04:00	97.5	98.1	97	120.3
1688	17-Apr-11	14:04:30	97.2	97.7	96.7	120.3
1689	17-Apr-11	14:05:00	97.5	98.4	96.3	120.3
1690	17-Apr-11	14:05:30	97	97.4	96.4	120.3
1691	17-Apr-11	14:06:00	96.9	97.9	96.2	120.3
1692	17-Apr-11	14:06:30	97	97.6	96.1	120.3
1693	17-Apr-11	14:07:00	97.4	98	96.6	120.3
1694	17-Apr-11	14:07:30	97.3	98.1	96.5	120.3
1695	17-Apr-11	14:08:00	97.6	98.3	97	120.3
1696	17-Apr-11	14:08:30	98.1	99.4	97.1	120.3
1697	17-Apr-11	14:09:00	97.9	98.8	97.2	120.3
1698	17-Apr-11	14:09:30	96.2	98.4	93.2	120.3
1699	17-Apr-11	14:10:00	93.2	93.5	92.8	120.3
1700	17-Apr-11	14:10:30	93.3	93.6	93	120.3
1701	17-Apr-11	14:11:00	93.2	93.5	92.7	120.3
1702	17-Apr-11	14:11:30	93.1	93.3	92.6	120.3
1703	17-Apr-11	14:12:00	92.9	93.5	92.3	120.3
1704	17-Apr-11	14:12:30	93	93.6	92.3	120.3
1705	17-Apr-11	14:13:00	92.8	93	92.5	120.3
1706	17-Apr-11	14:13:30	92.7	92.9	92.4	120.3
1707	17-Apr-11	14:14:00	92.8	93.2	92.4	120.3
1708	17-Apr-11	14:14:30	92.8	93.1	92.5	120.3
1709	17-Apr-11	14:15:00	92.8	93	92.6	120.3
1710	17-Apr-11	14:15:30	92.9	93.2	92.5	120.3
1711	17-Apr-11	14:16:00	92.9	93.3	92.2	120.3
1712	17-Apr-11	14:16:30	93.1	93.6	92.7	120.3
1713	17-Apr-11	14:17:00	93.1	93.4	92.6	120.3
1714	17-Apr-11	14:17:30	93.2	93.6	92.8	120.3
1715	17-Apr-11	14:18:00	93	93.4	92.6	120.3
1716	17-Apr-11	14:18:30	93.1	93.4	92.8	120.3
1717	17-Apr-11	14:19:00	93.1	93.4	92.8	120.3
1718	17-Apr-11	14:19:30	93.2	93.7	92.8	120.3
1719	17-Apr-11	14:20:00	93.1	93.7	92.7	120.3
1720	17-Apr-11	14:20:30	93.2	93.4	92.9	120.3
1721	17-Apr-11	14:21:00	93.1	93.6	92.6	120.3
1722	17-Apr-11	14:21:30	92.9	93.2	92.6	120.3
1723	17-Apr-11	14:22:00	92.9	93.2	92.5	120.3
1724	17-Apr-11	14:22:30	93	93.4	92.6	120.3

1725	17-Apr-11	14:23:00	93	93.3	92.8	120.3
1726	17-Apr-11	14:23:30	92.9	93.2	92.7	120.3
1727	17-Apr-11	14:24:00	93.1	93.4	92.8	120.3
1728	17-Apr-11	14:24:30	93.1	93.4	92.8	120.3
1729	17-Apr-11	14:25:00	93.2	93.5	92.9	120.3
1730	17-Apr-11	14:25:30	93.4	93.6	93.1	120.3
1731	17-Apr-11	14:26:00	93.5	93.8	93.2	120.3
1732	17-Apr-11	14:26:30	93.5	94.1	92.9	120.3
1733	17-Apr-11	14:27:00	93.2	93.4	92.8	120.3
1734	17-Apr-11	14:27:30	93.4	93.7	93.1	120.3
1735	17-Apr-11	14:28:00	93.2	93.6	92.8	120.3
1736	17-Apr-11	14:28:30	93.2	93.5	92.9	120.3
1737	17-Apr-11	14:29:00	93.6	94.4	93.1	120.3
1738	17-Apr-11	14:29:30	93.2	93.6	92.9	120.3
1739	17-Apr-11	14:30:00	93.2	93.7	92.9	120.3
1740	17-Apr-11	14:30:30	93.2	93.5	92.9	120.3
1741	17-Apr-11	14:31:00	93.6	94.3	93	120.3
1742	17-Apr-11	14:31:30	93.2	93.6	92.5	120.3
1743	17-Apr-11	14:32:00	93.2	93.5	92.8	120.3
1744	17-Apr-11	14:32:30	93.1	93.5	92.5	120.3
1745	17-Apr-11	14:33:00	93.2	93.5	92.9	120.3
1746	17-Apr-11	14:33:30	93.3	93.6	93	120.3
1747	17-Apr-11	14:34:00	93.3	93.8	92.9	120.3
1748	17-Apr-11	14:34:30	93.2	93.5	92.8	120.3
1749	17-Apr-11	14:35:00	93.5	93.7	93.1	120.3
1750	17-Apr-11	14:35:30	93.6	93.9	93.2	120.3
1751	17-Apr-11	14:36:00	93.4	93.8	93.1	120.3
1752	17-Apr-11	14:36:30	93.5	93.8	93.3	120.3
1753	17-Apr-11	14:37:00	93.5	93.8	93.1	120.3
1754	17-Apr-11	14:37:30	93.5	93.8	93.3	120.3
1755	17-Apr-11	14:38:00	93.4	93.6	93.1	120.3
1756	17-Apr-11	14:38:30	93.5	93.8	93.1	120.3
1757	17-Apr-11	14:39:00	93.6	93.9	93.4	120.3
1758	17-Apr-11	14:39:30	93.5	93.8	93.1	120.3
1759	17-Apr-11	14:40:00	93.5	93.9	93	120.3
1760	17-Apr-11	14:40:30	93.3	93.6	93.1	120.3
1761	17-Apr-11	14:41:00	93.4	93.7	93.2	120.3
1762	17-Apr-11	14:41:30	93.3	93.6	93	120.3
1763	17-Apr-11	14:42:00	93.2	93.7	92.9	120.3
1764	17-Apr-11	14:42:30	93.2	93.5	92.9	120.3
1765	17-Apr-11	14:43:00	93.3	93.6	93.1	120.3
1766	17-Apr-11	14:43:30	93.4	93.7	93.1	120.3
1767	17-Apr-11	14:44:00	93.4	93.7	93.1	120.3

1768	17-Apr-11	14:44:30	93.6	93.8	93.3	120.3
1769	17-Apr-11	14:45:00	93.8	94.2	93.3	120.3
1770	17-Apr-11	14:45:30	93.7	94.1	93.4	120.3
1771	17-Apr-11	14:46:00	93.7	94	93.4	120.3
1772	17-Apr-11	14:46:30	93.7	94.1	93.4	120.3
1773	17-Apr-11	14:47:00	96.8	100.1	93.4	120.3
1774	17-Apr-11	14:47:30	96.7	100.6	91.3	120.3
1775	17-Apr-11	14:48:00	93.1	95.6	90.7	120.3
1776	17-Apr-11	14:48:30	93.4	96.1	89.3	120.3
1777	17-Apr-11	14:49:00	89.9	91.4	85.5	120.3
1778	17-Apr-11	14:49:30	90.7	93.7	86	120.3
1779	17-Apr-11	14:50:00	93.4	94.6	92.1	119.8
1780	17-Apr-11	14:50:30	98.5	102	89.1	120.3
1781	17-Apr-11	14:51:00	81.5	89	74.3	116.6
1782	17-Apr-11	14:51:30	74.1	76.4	72	113.9
1783	17-Apr-11	14:52:00	74.9	78.2	71.9	116.5
1784	17-Apr-11	14:52:30	65.9	74.3	55.4	113.3
1785	17-Apr-11	14:53:00	62.6	70.6	52.7	106.9