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Dear distinguished members of the committee,

My name is Colleen A. Malloy. I serve as an associate professor in the Division of Neonatology in the Department of Pediatrics at Northwestern University Feinberg School of Medicine. I am speaking on my own behalf. I am pleased to have this opportunity to testify on current issues that may arise during your consideration of the Born Alive Abortion Survivors Protection Act, S. 2066, and the Pain-Capable Unborn Child Protection Act, S. 1553.

This legislation seeks to protect the health and well-being of fetuses and infants with gestational ages beginning at 20 weeks post fertilization. This is equivalent to 22 weeks in the dating system commonly employed in obstetrics and neonatology, which counts pregnancy as beginning at the time of the last menstrual period (the "LMP" system). In the LMP system, pregnancy dating counts the first day of the last menstrual period as day zero. Development in the womb is commonly referred to by post-fertilization age, or post-conceptual age (PCA). Like most legislation, the Pain-Capable bill is written using PCA data. This is an important point, as PCA = LMP MINUS 2 weeks. This legislation concerns pain beginning at 20 weeks PCA. In neonatologist and NICU terms, that equals 22 – 40 weeks LMP.

With the advancement of in-utero imaging, blood sampling, and fetal surgery, we now have a much better understanding of life in the womb. Our generation is the beneficiary of new information that allows us to understand more thoroughly the existence and importance of fetal and neonatal pain. As noted in my biography, I am trained and board-certified in the field of neonatology and pediatrics. It is standard of care in my field to recognize, evaluate, and provide treatment as needed for neonatal pain.

With advancements in neonatology and perinatal medicine, we have been able to push back the gestational age at which a neonate can be resuscitated and resuscitated successfully. It is easy for us to imagine the lives of infants past 22 weeks LMP, as they are kicking, moving, reacting, and developing right before our eyes in the Neonatal Intensive Care Unit (NICU).

In today's medical arena, we resuscitate patients at 22 weeks LMP and beyond, and we are able to witness their ex-utero growth and development. In June 2009, the *Journal of American Medical Association* reported a series of over 300,000 infants. Survival at 22, 23, 24, 25, and 26 weeks LMP was 10%, 53%, 67%, 82%, and 85%, respectively. In May of 2015, the *New England Journal of Medicine* published a series of 4,987 infants born at 24 U.S. hospitals before 27 weeks LMP. The survival rate for infants born at 22 weeks LMP who received active treatment in the delivery room was 23.1% (interquartile range, 0 to 50.0). At 26 weeks LMP, the overall rate of survival was 81.4%, and 75.6% of survivors had no severe impairment. Given these survival numbers, the NICU commonly cares for infants born at these gestational ages. We can easily witness their humanity, as well as their experiences with pain. Standard of care for neonatal intensive care units requires attention to and treatment of neonatal pain. There is no reason to believe that a born infant would feel pain any differently than that same infant would, were he or she still in utero. The difference between fetal and

neonatal pain is simply the locale in which the pain occurs. The receiver's experience of the pain is the same. I could never imagine subjecting my tiny patients to horrific procedures such as those that involve limb detachment or cardiac injection.

Similarly, the location of your birth should not matter, whether it be a hospital, home, ambulance, emergency room, or abortion clinic. An infant born alive via an abortion procedure should be afforded the same protection as an infant born alive in the course of a routine birth. If a medical provider attempts to perform an abortion and the child is born alive, it would make sense that the health care practitioner present at the time would exercise the same care to preserve the child's life and health as would be exercised for a child of the same gestational age in the course of an intended birth. This does not mean that all born infants require full resuscitation; some are born too early for full resuscitation with today's technology. However, all born infants deserve medical evaluation and appropriate care in line with neonatal standards.

There is ample biologic evidence—physiologic, hormonal, and behavioral evidence—for fetal and neonatal pain. As early as 8 weeks, face skin receptors appear. At 14 weeks, sensory fibers grow into the spinal cord and connect with the thalamus. At 13-16 weeks, monoamine fibers reach the cerebral cortex, so that by 17-20 weeks the thalamo-cortical relays penetrate the cortex. Many authors have substantiated that pain receptors are present and linked by no later than 22 weeks LMP.[1] In fact, by 22 weeks by LMP, the fetal brain has the full complement of neurons that are present in adulthood.[2] At 21-22 weeks LMP, electroencephalogram (EEG) recordings are possible.[3] EEG studies are performed on premature infants. Even when done on extremely premature infants, continuous EEGs show awake and REM sleep states typical of term neonates.

In the Neonatal Intensive Care Unit, we witness firsthand the change in vital signs associated with pain. When procedures such as intravenous line placement, intramuscular injection, or chest tube insertion are performed on a neonate at 22-26 weeks LMP, the response is similar to that seen in an older infant or child. With the advent of ultrasound, including real-time ultrasound, we know that even at 8 weeks, the fetus makes movements in response to stimuli. At 20 weeks LMP, the fetus begins to respond to sound, and many mothers report increased fetal movement in response to music, sirens, or alarms. At 22-23 weeks in utero, a fetus will respond to pain (intrahepatic needling, for example) with the same pain behaviors as older babies: scrunching up the eyes, opening the mouth, clenching hands, withdrawal of limbs. In addition, stress hormones rise substantially with painful blood puncture beginning at 18 weeks gestation.[4] This hormone response is the same one mounted by born infants. In a 1992 study published in the *New England Journal of Medicine*, infants undergoing cardiac surgery had large increases in adrenaline, noradrenaline, and cortisol levels. Opioid analgesia markedly reduced these responses as well as the rate of peri-operative mortality. Use of analgesia during neonatal surgery is standard of care; a patient undergoing fetal surgery is expected to receive appropriate pain medication.

In fact, the fetus and the premature neonate may be even more susceptible to the pain experience. There is ample evidence to show that while the pain system develops in the first half of pregnancy, the pain modulating pathways do not develop until the second half. It is later in pregnancy that the descending, inhibitory neural pathways mature, which then allow for dampening of the pain

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[1] Myers 2004; Derbyshire 2010; Anand 1987; Vanhalto 2000; Brusseau 2008; VanScheltema 2008.
[2] Lagercrantz H et al. *Functional development of the brain in fetus and infant*. Lakartidningan 1991;88:1880-85.
[3] Flower MJ. *Neuromaturism of the human fetus*. J Med Philos 1985;10:237-251.
[4] Giannakoulopoulos X, Sepulveda W, Kourtis P, Glover V, Fisk NM. "Fetal plasma cortisol and beta-endorphin response to intrauterine needling." *Lancet* 1994;344:77-81.

experience. As reported in the *British Journal of Obstetrics and Gynecology*, the "… fetus may actually be more sensitive than the older child, and [this] may explain why the newborn shows exaggerated behavioral responses to sensory provocation."[5] The idea that premature infants actually have greater pain sensitivity is supported by the fact that while pain transmitters in the spinal cord are abundant early on, pain-inhibiting transmitters are sparse until later in the pregnancy.[6] In addition, the premature infant requires greater concentrations of drugs to maintain effective anesthesia, as compared to the older infant. The fetus and premature infant may even have a heightened sensation of pain compared to an infant more advanced in gestation.

In conclusion, I have no doubt that my premature neonatal patients feel pain and experience pain. Even early on, they demonstrate personalities and interact positively as well as negatively with their environments. With our advanced "views into the womb," we are now better able to appreciate the active life of the developing fetus as one engaged with his or her uterine locale. I firmly believe, as the evidence shows, that the fetal pain experience is no less than the neonatal pain experience or even than that which you or I would experience from dismemberment or other physical injury.

One of the most basic of government principles is that the state should protect its members, including all born infants, from harm. If we are to be a benevolent society, we must protect the fetus from pain and administer appropriate medical care to all born infants. We should not tolerate the gruesome and painful procedures being performed on the smallest of our nation, and we should not treat infant abortion survivors with any less medical care than their neonatal peers.

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[5] *Br J Obs Gyn* 1999;106:881-886.

[6] Anand KS, McGrath PJ, editors. *Pain Research and Clinical management*. Vol. 5. *Pain in neonates*. Amsterdam:Elsevier 1993:19-38.