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Parental factors associated with the request for resuscitation for infants born at
periviability

A Thesis Submitted to the
Yale University School of Medicine
in Partial Fulfillment of the Requirements for the
Degree of Doctor of Medicine

by

Abiola Deborah Femi-Abodunde

2017

ABSTRACT

PARENTAL FACTORS ASSOCIATED WITH THE REQUEST FOR RESUSCITATION FOR INFANTS BORN AT PERIVIABILITY

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The purpose of this study is to determine factors associated with parental request for aggressive resuscitation for infants born at borderline viability, the period between 22^{0/7} and 24^{6/7} weeks of gestation. Between 2013 and 2016, 81 women were admitted to Yale New Haven Hospital (YNHH) for a potential delivery in this critical period. Eighty-four percent of patients elected aggressive resuscitation for their newborn and 16% chose comfort care only. Using bivariate analysis to evaluate statistical significance, 5 of 19 possible variables were included in our logistic regression model. This model demonstrated lower likelihood of a request for resuscitation in patients who did not receive steroids or had multiple gestation. The odds of the request for resuscitation is threefold greater with each increase in gestational age by one day.

In a secondary study, a 15-item survey was administered to the current YNHH Neonatal-Perinatal fellows to evaluate the nature of the prenatal consult and the fellow's recommendations for management of infants born in the gray zone. All five respondents recommend against resuscitation at 22 weeks, 80% recommend full resuscitation at 24 weeks and most prefer a case-by-case consideration at 23 weeks.

These findings stress the importance of frequent re-evaluation of patient choice for newborn management in borderline viable births as this may change with each additional day of pregnancy. Our study has important implications for the decision-making process between expectant parents, neonatologists, and obstetricians.

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Introduction

Understanding Perivable Birth

Extremely preterm births refer to births occurring under 28 gestation weeks (1). The primary focus of this study is on a unique proportion of extremely preterm births, births which occur between 22 and 25 completed weeks. Infants born during this period are considered to be within a 'gray zone' of viability, opening up several ethical concerns for deliberation (2). In this study, borderline viability and periviability are interchangeable terms used to describe births within this period.

There have been several terms which have been used to describe newborns delivered near the limit of viability where outcomes can range from near-certain death to likely survival with a high likelihood of serious morbidities (3). Neonates born prior to 25 weeks of gestation or those weighing less than 750g, are at the highest risk for mortality and morbidity, and thus present complex medical, social and ethical issues for families and physicians alike (4). During a joint workshop sponsored by the Society for Maternal–Fetal Medicine, (SMFM) the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD), the Section on Perinatal Pediatrics of the American Academy of Pediatrics (AAP), and the American College of Obstetricians and Gynecologists (ACOG), an executive summary was prepared which defined *perivable birth* as delivery occurring from 20^{0/7} weeks to 25^{6/7} weeks of gestation (5). Of note, the survival rate for newborns delivered prior to 23 weeks of gestation is 5-6% and among rare survivors, significant morbidity is universal at 98-100% (6,7). In our study, we classified perivable birth as births between 22^{0/7} weeks to 24^{6/7} weeks of gestation which is consistent with the literature (3).

Severe or moderate impairment defined as cerebral palsy, blindness, profound hearing loss, or developmental quotient 2 standard deviations or more below the mean are some of the concerning long-term morbidities seen after births that occur prior to 25 weeks of gestation (8). According to a 2006 study by Moore et al, prevalence of severe or moderate impairment in extremely premature infants declines with increasing gestational age at birth: 45% at 22–23 weeks, 30% at 24 weeks, and 17% at 25 weeks of gestation (8).

The decision whether to offer resuscitation and active treatment for infants born at the edge of viability varies widely between healthcare institutions and remains highly controversial in the fields of neonatology and obstetrics (7). In a study by Rysavy et al, birth and treatment data was collected for 4987 infants born between April 2006 and March 2011 at 24 hospitals participating in the NICHD Neonatal Research Network (7). Hospital rates of active treatment accounted for 78% and 75% of the between-hospital variation in survival and survival without severe impairment, respectively, among children who were born at 22 or 23 weeks of gestation. For children born at 24 weeks of gestation, hospital rates of active treatment accounted for 22% and 16% of the between-hospital variation in survival and survival without severe impairment respectively. The hospital treatment rate did not account for between-hospital variation in survival and survival without severe impairment for infants born at 25 and 26 weeks of gestation (7).

Considering these variations in outcome data, ACOG and SMFM recommend neonatal resuscitation, antenatal steroids and maternal support for imminent delivery between 24^{0/7} weeks to 24^{6/7} weeks of gestation and consideration for neonatal

resuscitation for births between 22^{0/7} weeks to 23^{6/7} weeks of gestation (3). Neonatal resuscitation is not recommended prior to 22^{0/7} weeks of gestation (3).

Epidemiology of Preterm Birth

While the Center for Disease Control (CDC) National Vital Statistics System does not publish the national incidence of births under 25 weeks, it does record that births occurring prior to 27 weeks completed gestation, constituted 0.69% of births in the United States in 2014 (9). Several factors have been associated with increased risk for preterm birth. These factors are maternal age <16 years, maternal age >35 years, and African-American race (10).

Studies have shown a greater than two-fold increased risk of preterm delivery among mothers aged 16 or younger compared to those aged 21 to 24 years (11). The increased risk of preterm birth among adolescents may be due to biological immaturity or the higher prevalence of low socioeconomic status in those who become pregnant at a younger age (11). In a sample of Italian women, mothers aged 35 and over have been shown to have increased risk for preterm delivery compared to mothers less than 35 years even after controlling for education, birth order, and gender (12). The reason for the elevated risk of preterm delivery in older mothers is unknown. Using pooled 1998 to 2000 US birth data from the National Center for Health Statistics (NCHS), there was an inconsistent relationship between advanced maternal age and preterm birth rate across

ethnic groups (10). As is demonstrated in figure 1, earlier in their reproductive years the preterm birth rate rises earlier (27-29 years) for African Americans than for Whites (33-35 years (10). Among all races, the rate of preterm birth is higher at the extremes of the reproductive years.

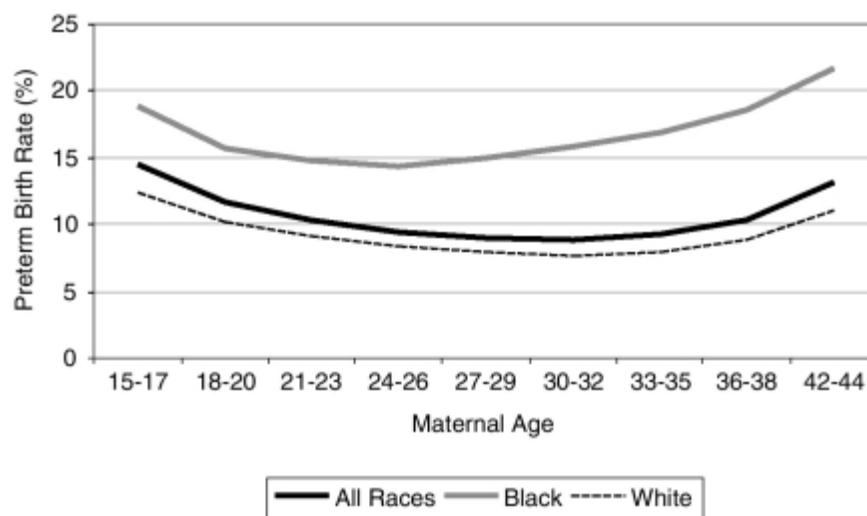


Figure 1: Relationship between maternal age and preterm birth, by race, 1998 to 2000, U.S. birth cohorts (10)

SOURCE: National Academy of Sciences (Obtained from Unpublished NCHS data)

Women's marital status has also been found to be associated with changes in the risk of preterm delivery (10). As shown in table 1, across all racial and ethnic groups preterm birth rates between 1998 and 2000 were found to be higher for unmarried women. Cohabitation has also been studied as an independent risk factor for preterm birth when compared to traditional married relationships (13,14) In a case-control study among 16 European countries, significantly increased risk of preterm birth was associated with cohabitation versus marriage (15). This effect was seen only in countries where less than

20% of births occur outside of marriage and in countries where out-of-marriage births were more common there was no additional risk of preterm delivery (15).

Table 1: Preterm Birth According to Marital Status, Race and Ethnicity

Age	Non-Hispanic African American		Non-Hispanic Whites		Asians-Pacific Islanders		Americans Indians		Hispanics	
	M*	UM*	M	UM	M	UM	M	UM	M	UM
<20	13.7	17.6	10.4	11.5	12.4	14.3	10.3	12.8	10.6	12.7
20–34	13.7	16.7	7.9	10.8	8.3	11.9	10.2	12.0	9.1	11.0
≥35	16.2	22.9	8.6	14.0	9.9	14.0	13.4	16.0	11.5	14.2

* M = Married and * UM = Unmarried

SOURCE (10): National Academy of Sciences from NCHS data for U.S. birth cohorts from 1998 to 2000.

When evaluating the incidence of preterm delivery by race and ethnicity in the National Center for Health Statistics (NCHS) network for 2014, non-Hispanic blacks had close to twice the risk for both preterm birth and very preterm birth compared to their non-Hispanic White counterparts (9). Hispanic women were also at increased risk of preterm deliveries compared to non-Hispanic White women, although the relative risk is low at 1.2 (9). These differences in risk for preterm delivery are potentially accounted for by socio-economic factors, stress, and/or differing maternal behaviors, among others

(16). Negative socioeconomic factors including lower educational attainment, lower household income, and unemployment have been seen at higher rates among African American women compared to non-Hispanic white women, which has subsequently been associated with increased risk of preterm birth (10,17). However, some studies have shown that the difference in preterm birth rates by race and ethnicity were still present even after adjusting for socioeconomic status (18). According to the “weathering” hypothesis, as proposed by Geronimus, the effect of social inequality on health compounds with age, leading to growing gaps in the health status between African American and Whites in young/middle adulthood which ultimately can affect their reproductive outcomes (19).

When educational attainment is considered in parallel to maternal race and ethnicity, the preterm rates are still higher in non-Hispanic blacks than any other racial group/ethnicity (10,18). As seen in table 2 below, this disparity in preterm rates persists even after controlling for the level of educational attainment. Of note, within each maternal race-ethnicity group, there is a trend towards higher preterm birth rates with lower levels of educational attainment (10,18).

Table 2: Preterm Birth Rates (%) by Maternal Race/Ethnicity And Educational Attainment

Educational Attainment^g	Non-Hispanic African Americans	Non-Hispanic Whites	Asians-Pacific Islanders	American Indians	Hispanics
<8	19.6	11.0	11.5	14.8	10.7
8–12	16.8	9.9	10.5	11.8	10.4

Educational Attainment^a	Non-Hispanic African Americans	Non-Hispanic Whites	Asians-Pacific Islanders	American Indians	Hispanics
13–15	14.5	8.3	9.1	9.9	9.3
≥16	12.8	7.0	7.5	9.4	8.4

^aEducational attainment indicates the number of years of school completed.

Source: National Academy of Sciences (10)

Counseling During Periviable Pregnancies

The decision whether to resuscitate the extremely preterm newborn born at the edge of viability is a difficult one that parents must confront under very trying circumstances. For obstetricians and neonatologists providing care to the expectant mother and fetus, that discussion can also be very challenging. There are long-term implications for the mother and her fetus psychologically, physically, emotionally and spiritually before, during and after delivery of a premature baby (20,21). Even after choosing to provide initial resuscitation, parents may again be faced with the decision about whether to continue intensive care during the infant's NICU stay if there are severe complications of prematurity (22). When deciding which course to take for the newborn in this gray zone, parent's values should form an integral part of the decision-making (23).

The decision that parents must make before an impending delivery at the periviable stage is sometimes described as a choice 'between life and death'. Maternal patients presenting with concerns for possible delivery at periviability are first seen at or transferred (if possible) to a specialized care facility with available maternal-fetal medicine and a level III or IV NICU (24). They are then evaluated by an obstetrician and seen by a neonatologist who together prepare parents for the impending birth and obtain informed consent for management of the pregnancy (24). Classification of neonatal care is based on level of complexity (25). A level I facility refers to a well newborn nursery, which provides basic level of care to low risk neonates (25). Such a facility is capable of caring for preterm infants at 35 to 37 gestation weeks' who are physiologically stable. Newborns fewer than 35 weeks of gestation can be stabilized here until transfer to a

facility with specialty neonatal care (25). Stable or moderately ill newborns born at 32 weeks' gestation, or who weigh ≥ 1500 g at birth with problems that are expected to resolve rapidly, and also, would not be anticipated to need subspecialty-level services on an urgent basis, can be cared for in a level II facility (25). Such a facility can provide mechanical ventilation for less than 24 hours (25). There is evidence for referring infants born at < 32 weeks' gestation or weighing < 1500 g at birth, or with medical or surgical conditions regardless of gestational age, to a level II facility (25). A level III facility can provide advanced respiratory support such as, conventional ventilation, high-frequency ventilation and inhaled nitric oxide, for greater than 24 hours (25). Level III NICUs have continuously available personnel such as neonatologists, neonatal nurses and respiratory therapists. Pediatric medical subspecialists and pediatric surgical specialists should also be available. Important subspecialist care services are expertise in neonatology and maternal-fetal medicine (25). A level IV unit combines the features of a level III facility with additional capabilities and considerable experience in the care of the most complex and critically ill newborns (25). Pediatric medical and pediatric surgical specialty consultants should be continuously available 24 hours a day. In a level IV facility, there is additional capability for surgical repair of complex conditions, such as congenital cardiac malformations requiring cardiopulmonary bypass with or without extracorporeal membrane oxygenation (ECMO) (25).

The clinical urgency and lack of a longitudinal relationship with the neonatologist limit the ability to have more detailed conversations that could help elicit patient values and with time constraints associated with an impending delivery, providers must often prioritize what information they are able to provide to parents (22). The stress of this

situation is often experienced by both the parents and the neonatologist, all of whom are faced with the question of whether to help an infant attempt to survive or allow them to die (24). The urgency and pressure of this clinical encounter is compounded by the fact that the neonatologist must remain aware of the ongoing obstetric management while still giving adequate attention to the discussion with the patient (24).

Adopting a shared decision-making model rather than a traditional informed consent for this situation has been well described in the literature (22-24). In a qualitative multicenter study involving 26 mothers whose infants died secondary to extreme prematurity or lethal congenital anomalies, parents did not indicate physician's predictions to be central to their decision; instead most were guided by their personal religion and/or spirituality (26). In another qualitative study involving 12 patients and 12 neonatologists who were interviewed immediately after neonatal consultation in a Canadian tertiary care center, parents expressed the need for more than just data on survival and morbidities from the neonatologist (24). Rather, they wanted more emotional support and desired to feel a sense of responsibility from the physician in the decision-making, as opposed to receiving only statistical data as a basis for the choice to resuscitate. The uncertainty surrounding the decision parents make requires support and engagement from providers to help manage the uncertainty (23). Engaging providers in a shared decision-making model can perhaps be facilitated by having them reflect on what choices they would make in similar circumstances and how that may influence their conversation with parents on management of the newborn.

Physicians Attitudes on Resuscitation

There have been great strides forward in perinatal care over the past 50 years which have led to improved survival of all premature infants, even those born at the edge of viability (27). Antenatal steroids, postnatal surfactant, regionalized care, neonatal ventilation and improved nutrition are a few of the major advances in perinatal care that have led to increased survival (28,29). The gestational age at which at least half of the infants will survive has decreased from 30-31 weeks in the 1960s to 23-24 weeks based on current data (30). Of note, this statistic does not take into consideration the presence of any of the negative sequelae of extreme prematurity (such as cerebral palsy, blindness, chronic lung disease, etc), which are frequently present, especially at the lowest gestational ages. Additionally, there are highly inconsistent data in the literature on survival for babies born less than 25 completed weeks, with some studies reporting less than 10% survival for infants born at less than 23 weeks and some studies reporting up to 43% survival (2,31). Within our institution, Yale-New Haven Children's Hospital, survival at 23 weeks for the years 1994 through 2004 was 26% ($n=88$), although in the last two years, survival increased to 38% ($n=21$) (32).

At this challenging stage of pregnancy, studies have shown that parents desire an individualized approach to their family and situation during prenatal counseling (33-35). Neonatologists and obstetricians are trained to use gestational age as a major predictor of outcome (33-35). The NICHD Neonatal Research Network (NRN) extremely preterm birth outcome data tool is frequently helpful in providing more individualized information to counsel families (36). It is not intended to predict actual outcomes for specific infants; rather it provides possible outcome data based on specific characteristics

of an infant, including gestational age, gender, singleton vs multiple gestation, and whether the mother received antenatal steroids (36). The study utilized a collection of data on over 4000 infants born at one of sixteen NRN hospitals between 1998 and 2003 to predict the likelihood of the outcomes of death, moderate to severe, or profound neurodevelopmental impairment (34,36).

In a 2011 study done by Duffy et al, questionnaires were sent to one trainee and one consultant (attending physician) in each of 63 neonatal units in southeast England to examine attitudes towards initial resuscitation for babies born between 22 and 24 weeks of gestation (37) At 22 weeks, 85% of all respondents would strongly discourage resuscitation; at 23 weeks, 21% would strongly discourage resuscitation, and at 24 weeks, 1% only would strongly discourage resuscitation. Of note, the authors found that there was a significant positive association between increased years of neonatal experience and older age with the desire to resuscitate at 22 weeks ($p < 0.05$) (37).

At the edge of viability there is limited data on the best methodology (if any is even possible) for guiding management of an extremely premature newborn based on appearance in the delivery room (2). The Apgar scores at birth have been used as primary and secondary outcomes in trials of delivery room interventions (38). It is a scoring system developed in 1953 by Dr. Virginia Apgar which can be determined quickly- “sixty seconds after the complete birth of the baby” (39). The score involves the sum of values (0, 1 or 2) which are assigned for each of 5 aspects of a newly born infant’s condition- respiratory effort, heart rate, muscle tone, reflex irritability, and color (38,39). The heart rate is the only aspect of the Apgar score that requires evaluation beyond a

visual assessment of the infant's condition (38). However, there is significant inter-observer variability as the score involves a degree of subjectivity (38).

In a study by Singh et al., U.S. neonatologists were surveyed to assess their decision-making when confronted with a hypothetical situation for infants born at 22 to 26 weeks of gestation (2). Over one-third (36%) of the respondents practiced in a university environment, 54% were in a community setting, while 4% worked in a mixed setting. The authors did not indicate the practice setting for the remaining 6% of respondents in their study. The average number of years of experience among the respondents was 18 years with a range of 1 year to 55 years. The neonatologists were given scenarios for infants with birthweight (BW)/Gestational Age (GA) ranging from >750g/26 weeks to <500g/23 weeks and they were asked whether they would provide full resuscitation, comfort care only, or defer to parents' wishes in delivery room management. Fifty-seven percent of neonatologists opted for comfort care only for infants with BW<500g and 23 weeks GA. The proportion of neonatologists advocating for resuscitation increased from 4% at 23 weeks GA and BW <300g to 59% at 24 weeks GA and BW 500-600g. For infants born at 25 weeks GA and BW 600-750g, 91% of respondents would provide full resuscitation whilst for those with BW >750g/26 weeks, 99% of respondents would provide full resuscitation (2). Forty-five percent of respondents included additional comments in the survey instrument describing their delivery room resuscitation choice. The authors noted that for the vast majority of those comments, the neonatologist deemed the appearance of the infant at birth as important in the decision to offer, continue, or withhold resuscitative efforts.

The researchers then separately assessed 102 infants born in their unit at less than 750 grams, to determine how predictive the physical appearance of the infant in the delivery room (in part based on Apgar scores at 1 and 5 minutes) was for their long-term outcomes. Using multivariate logistic regression analysis, the authors demonstrated that the appearance of the infant in the delivery was not predictive of death of infant before discharge, survival with neurologic abnormality, or survival with normal neurologic exam. The authors therefore concluded that for births at 23 to 24 weeks of gestation and BW 500-600g, which they classified as the 'gray zone', neonatologists do not have accurate measures for predicting long-term outcomes based on infants appearance in the delivery room, so should not use it to help determine their decision for resuscitation versus comfort care (2).

Neonatologists must balance the best interests of the infant, concerns of the family, outcome data, and their own clinical judgement when managing patients in the gray zone of periviability (40). The physician is first and foremost responsible for the patient- the neonate in this circumstance- and any treatment that is futile or of no benefit and simply prolongs the dying process is inappropriate (23). However, at borderline viability, there is a 'gray zone' of uncertainty regarding resuscitation (2). Additionally, there is no universal consensus for a prognosis-based guideline to help patients and providers engage in decision-making in this difficult scenario (34).

To address this need, Lemyre and collaborating authors in Canada created a multi-disciplinary working group which included three neonatologists, a neonatology fellow, a maternal-fetal medicine (MFM) specialist, four nurses, a neonatal nurse practitioner, a social worker, an ethicist, a specialist in knowledge transition, and three

parents of extremely premature infants (34). The purpose of this working group is to develop a guideline for prenatal decisions for resuscitation of extremely premature infants within a shared decision making (SDM) framework. The survival and quality of life of the premature child were key factors considered for decision making with additional consideration of parental values and preferences (34). While the study is still undergoing pre-implementation assessment, it is an excellent attempt to develop a robust model for addressing neonatologist and parental concerns about how to work together to make a decision for resuscitation versus comfort care, especially in light of potentially negative long-term outcomes in resuscitated infants (34).

Rationale of Current Study

The outcomes for extremely preterm infants have improved greatly over the last 50 years due to technological progress, antenatal steroids, surfactant therapy and improved nutrition (27-29). The relevance of data available for evaluating short and long term outcomes via the NICHD outcome estimator may be somewhat questionable since it is based on data obtained almost 20 years ago, although outcomes in this population have not been shown to improved significantly in that time period (32,40). There is also a lack of an available universal framework by which neonatologists and parents can easily engage in a discussion on whether to attempt resuscitation versus provide comfort care only at periviability (34).

Factors shaping parental decisions prior to perivable birth are understudied in the literature. A retrospective study by Tucker-Edmonds et al. explored racial and ethnic differences in the use of neonatal resuscitation for perivable neonates (41). In their study,

they analyzed state-level maternal and infant hospital discharge data linked to birth and death certificate data for California, Missouri and Pennsylvania from 1995 to 2005. To our knowledge, this is the only study to evaluate differences in maternal characteristics, with emphasis on race/ethnicity, among neonates delivered between 23^{0/7} weeks and 24^{6/7} weeks, who received aggressive resuscitation with intubation. The results of this study showed that Black race and Hispanic ethnicity were significantly associated with the increased use of neonatal resuscitation.

We performed an exploratory study focused on the consultation between the neonatologist and the parents, and the resulting decision for management of the newborn. A secondary aim of our study was to determine the preferences that neonatology fellows have for resuscitation at periviable births. While Tucker-Edmonds et al. evaluated births between 23^{0/7} weeks and 24^{6/7} weeks, we are interested in patients who were between 22^{0/7} weeks and 24^{6/7} weeks at the time of consultation with the neonatologist, since an attempt at resuscitation is offered between 22^{0/7} and 24^{6/7} weeks of gestation at our institution. In our institution, at 25^{0/7} weeks of gestation resuscitation will be attempted on all neonates regardless of parental desires, unless a lethal anomaly or severely life-limiting condition exists. Our primary outcome was a documented decision by the mother for attempted resuscitation or comfort care only for the newborn. The Tucker-Edmonds study does not take into consideration whether a consultation with a neonatologist had occurred and who the involved shareholders were in the decision to resuscitate the newborn (41).

The AAP recommends that while the best interest of the infant is paramount, when there is a gray area with uncertainty regarding the infant's best interest,

pediatricians should also consider the concerns and desires of parents (23). The parental desire for newborn management is likely shaped by cultural, religious, social, educational and ethnic influences (23). The goal of this study is to attempt to decipher retrospectively among parents with a potential delivery at periviability, which parental factors were most predictive of the decision for critical care/management of the fetus versus comfort care only.

Specific Aims

The specific aims of this study are:

1. To assess the maternal characteristics of women at risk of preterm delivery who received a neonatology consult between 22^{0/7} and 24^{6/7} weeks of gestation.
2. To determine which maternal factors are predictive of the choice to resuscitate versus provide comfort care only at periviability.
3. To assess personal preferences of neonatology fellows at Yale New Haven Hospital for resuscitation versus comfort care only at 22^{0/7} through 24^{6/7} weeks of gestation.

Methods

Patient Selection

This study is a retrospective review of medical records of patients who were admitted to Yale New Haven Hospital (YNHH), due to risk of preterm delivery between 22^{0/7} and 24^{6/7} weeks of gestation, and received a neonatology consult. This study was designed and led by Abiola Femi-Abodunde (A.FA.) under the supervision of Dr. Alaina Pyle (A.P.), neonatology fellow and Dr. Mark Mercurio (M.M.), Chief of the Neonatal-Perinatal Medicine Division. The study was conducted under the Yale Human Investigations Committee (HIC) approved protocol entitled “Parental factors associated with the request for aggressive resuscitation versus comfort care only for peri-viable births (22-25 completed weeks)” (HIC # 1611018679). The protocol was written by A.FA with input from A.P. and M.M.

The electronic medical record at Yale, EPIC, was queried by Stephen Uss of the Joint Data Analytics Team (JDAT) for the medical record numbers of all patients with threatened preterm delivery from January 1, 2013 to December 31, 2016, who had obtained a neonatology consult. The patient list was then cross-referenced with the gestational age at time of neonatology consult to create a list of all patients who received a consult between 22^{0/7} weeks and 24^{6/7} weeks’ gestation.

Data Collection

The electronic medical records of patients who received a consult within the specified gestational ages were reviewed manually by A.FA. who completed a data acquisition form designed by A.FA. with input from A.P. and M.M. Data were extracted from a combination of the obstetric history and physical (H & P), obstetric progress notes, neonatology consult notes, social work notes and discharge summaries. The following data items were extracted from the medical records and stored in a HIPAA-compatible cloud storage unit.

- i) Patient Demographics: age at time of consult, self-identified race, ethnicity, language preference, marital status, religion, educational attainment, employment status and insurance information. In our retrospective review, this information was abstracted from the social work consult note. We also abstracted marital status, racial and religious identity from the demographic sections of the medical record, which is completed during new patient registrations.
- ii) Obstetric history and past medical history: parity, duration of prenatal care, comorbidities, steroid administration status and magnesium administration
- iii) Clinical Encounter: who was with the mother during the consult itself (partner, father of baby, family member, obstetric team member, nurse, resident and medical student), and whether a visit by ancillary services (clergy and social work) was done
- iv) Infant: Gestational age at consult and at delivery, estimated fetal weight (EFW), estimated delivery date (EDD) and method of estimation (last menstrual period or LMP versus first trimester ultrasound or other), prenatal concerns, presence of fetal anomalies, delivery date and time, birth weight, and Apgar scores at 1, 5 and 10 minutes.

The primary outcome measured in this study was the parental decision to attempt resuscitation of the newborn or to provide comfort care only. The decision to attempt resuscitation for their newborn was recorded from either the maternal admission note, the neonatology consult note, subsequent progress notes or the discharge summaries.

Variable Selection and Statistical Data Analysis

Bivariate logistic analysis was first conducted in which each variable was tested independently against the primary outcome- the decision to pursue resuscitation. After bivariate analysis of each of our nineteen variables, we applied a p-value cutoff of 0.10 in order to determine which variables to include in our regression model. Binary logistic regression analysis was then applied to distinguish covariates among the following factors: maternal age, marital status, race, ethnicity, religion, language preference, gravidity, parity (term, preterm, abortion and live births), level of education, employment, insurance type, maternal steroid administration, gestational age at consult, singleton or multiple gestation, gender of fetus, and presence of fetal anomalies.

Physician Survey

A secondary study was carried out which involved an online fifteen-item survey administered to eight current YNHH neonatology fellows. This study was designed and led by A.FA. under the supervision of A.P. and M.M. Questions in the survey were unique to understanding the nature of a periviable consult at YNHH and were not based on previously published work. The survey questions are yet to be validated. The study was conducted under the Yale HIC approved exemption protocol entitled “Parental

factors associated with the request for aggressive resuscitation versus comfort care only for peri-viable births (22-25 completed weeks)” (HIC # 1612018727). The protocol was written by A.FA. with input from A.P. and M.M. The survey contents are listed in full in Appendix B.

Results

Patient Characteristics

Table 3: Clinical Characteristics Of Patients Within Our Study Cohort

		Frequency	Percentage (%)	Descriptives	
Gravidity	1	22	28	Mean	3
	2	22	28	S.E.M	0
	3	13	16	Min	1
	4	8	10	Max.	9
	5	3	4	25th Percentile	1
	6	9	11	50th Percentile	2
	7	1	1	75th Percentile	4
	8	1	1		
	9	1	1		
Prior Term Births	0	56	70		
	1	18	23		
	2	3	4		
	3	3	4		
Prior Preterm Births	0	58	73		
	1 to 2	20	25		
	3 to 4	2	3		
Abortions (Spontaneous/Induced)	0	37	46		
	1 to 2	32	40		
	3 to 5	11	14		
Living Children	0	45	56		
	1 to 2	29	36		
	3 to 5	6	8		
Consult Gestational Age	22 ^{0/7} -22 ^{6/7}	32	40	Mean	23.2
	23 ^{0/7} -23 ^{6/7}	21	26	SD	0.1
	24 ^{0/7} -24 ^{6/7}	27	34	25th Percentile	22.5
				50th Percentile	23.4
				75th Percentile	24.2
Singleton or Multiple Gestation	Single	73	91		
	Multiple	7	9		
Gender of Fetus	Male	40	50		
	Female	35	44		
	Both	2	3		
	No Info	3	4		

Presence of prenatal anomalies	No	10	13
	Yes	70	88
Steroid Administration Status			
	No Steroid	7	9
	Received Steroid	73	91
<i>Decision for Newborn Care</i>			
Resuscitation	No	13	16
Comfort Care	Yes	67	84
S.D = Standard Deviation			
S.E.M = Standard Error of the Mean			
Min = Minimum Value			
Max = Maximum Value			

Retrospective chart review identified a total of 81 patients admitted to Yale New Haven Hospital between January 1, 2013 and December 31, 2016 who were between 22^{0/7} and 24^{6/7} weeks of gestation and had received a consult from the Department of Neonatal-Perinatal Medicine. One patient was excluded from the study due to multiple maternal and fetal comorbidities restricting management options for the fetus. Table 3 lists the clinical characteristics of these patients. Further information on our patient demographics can be found in table 4 within appendix A.

Over one-third of our patient cohort were between 25-29 years old with the mean age of 29 years, with a range of 15-43 years old. For 28% of the women in our cohort, the periviable pregnancy of interest was their first pregnancy. One patient in our cohort had 8 prior pregnancies, making 9 the highest gravidity for our study cohort, and an average of three prior pregnancies. Fifty-eight of the 80 patients in our study cohort had prior pregnancies and of those, 24 women had experienced a prior full term delivery and 19 patients had experienced at least one prior preterm (prior to 37 weeks) delivery. Amongst the 58 patients with prior pregnancies, there were 34 women who had had at least one spontaneous or induced abortion.

Within our study cohort, 48% of the subjects were married and 53% (n=42) were single. Sixty-one percent identified as Christian with about 47% (23/49) of those identifying as Catholics. Seventy-eight percent of the cohort were non-Hispanic with 21% who identified as Hispanic and 1 patient who did not respond. There were 43% women who self-identified as Black or African American and 33% identifying as White or Caucasian. Twenty-three percent of our study cohort indicated an alternative racial identity while 1 patient identified as Korean and 1 patient did not respond.

Patients also had the option of selecting their preferred language. Ninety-one percent cited English as their preferred language, 5% indicated Spanish, 1 indicated French, 1 patient listed Creole, and 1 cited Korean as a language preference. Of note, evaluation of neonatology consultation notes revealed that for two of the four patients who indicated a preference for Spanish, a live interpreter was recorded as present during the consultation. For the patient with French language preference, the consultation was described as facilitated by a French interpreter on the phone. For the remaining patients,

no information was found in the consultation note for the presence or absence of an interpreter.

Among our 80-patient study cohort, 54% were employed either part-time, full-time or self-employed while 23% were unemployed. Twenty-four percent of the study cohort had no response.

Exploration of the level of educational attainment for our study cohort revealed the following: 6% had less than high school training, 26% had completed high school, 16% were either pursuing or had completed vocational training, 14% were college graduates, and 9% had either completed or were in the process of completing post-graduate training. Twenty-nine percent of the patients in this study did not indicate their level of educational attainment.

The insurance type of our study cohort was also evaluated. Four percent of our cohort were uninsured, 47% had commercial insurance, and 42% with Husky A- the State of Connecticut's Medicaid equivalent. Of note, there was no insurance data for 7% of our study cohort.

The mean gestational age at the time of neonatology consult for our study cohort was 23 weeks and 3 days. There were 32 patients between 22^{0/7} and 22^{6/7} weeks of gestation, 21 patients between 23^{0/7} and 23^{6/7} weeks of gestation and 27 patients between 24^{0/7} and 24^{6/7} weeks of gestation.

Within our cohort, 9% of pregnancies were multiple gestation and 91% singleton pregnancies. Fifty percent of the pregnancies involved a male fetus, 44% involved a female fetus while 3% pertained to multiple gestation with a male and a female fetus. There was no gender identity recorded for 4% of the pregnancies in this study. Prenatal

anomalies were observed in only 13% of pregnancies during routine ultrasound and/or laboratory screening such as the quadruple screen, while no anomalies were identified in 88% of pregnancies in our cohort. At least one steroid dose was administered prior to consultation for 91% of the patients in our cohort.

Within our study group, 84% of patients opted for resuscitative efforts to be attempted after delivery of their child, compared to 16% who did not want resuscitative efforts attempted at the time of consult. Of note, among patients who elected for no resuscitative efforts, two stipulated alternative gestational ages at which point, resuscitative efforts could be attempted on their newborn; the gestational age at which they wanted resuscitation was 23^{0/7} weeks for both patients. Among patients who elected for resuscitation of their newborn, two were documented as initially requesting comfort care only. In the first scenario, one patient was admitted at 22 weeks and initially desired no resuscitative efforts if the baby was born prior to 25 weeks but later changed her request to desiring resuscitation if she delivered at 24 weeks. In the second scenario, a patient admitted at 24^{2/7} weeks changed her mind from comfort care only for her newborn to full resuscitative attempts over the course of three hours.

Statistical analysis

There was a total of 19 variables which were tested against the outcome of interest. The variables considered for analysis were: maternal age, marital status, race, ethnicity, religion, language preference, gravidity, parity (term, preterm, abortion and live births), level of education, employment, insurance type, maternal steroid administration, gestational age at time of consult, singleton or multiple gestation, gender of fetus, and presence of fetal anomalies.

The first step of our analysis was selecting variables to include in our binomial logistic regression model. In nineteen separate bivariate analyses, each variable was tested independently against the outcome. The p-value cut off was <0.10 for selecting a variable for our regression model. The resulting p values are illustrated in table 6 of appendix C. Five variables met the cutoff and were selected to be included in the model. These variables were gravidity ($p=0.07$), Black or African American Race ($p=0.07$), the gestational age at consult ($p=0.01$), absence of steroid administration ($p=0.008$), and multiple gestation ($p=0.008$).

On binary logistic regression analysis, a test of the full model against a constant-only model was statistically significant indicating that the predictors as a set reliably distinguished between the choice to attempt resuscitation for a newborn versus provide comfort care only (chi square = 26.587, $df=8$, $p=0.001$). Cox and Snell's R-Square of 0.284 indicates that 28.4% of the variation in the dependent variable is explained by the logistic model. The Nagelkerke R-square of 0.481 indicating a 48.1% moderate relationship between the predictors and the prediction. In this study, 53.8% of observations were correctly classified in the *no resuscitation* group and 97% in the

resuscitation group. Overall, 90% of observations were correctly classified. This is an improvement from the 83.8% correct classification with the constant model, the model without any of our predictors. The gestational age at consult ($p=0.04$), multiple gestation ($p=0.03$), and absence of steroid administration ($p=0.03$) are three variables as a set which reliably distinguished between resuscitation and comfort care only ($p<0.05$). Table 7 in appendix C illustrates the results obtained from our regression model.

Using odds ratio, with an increase of the gestational age at consult by one day, the odds of the choice for an attempt at resuscitation is threefold higher. Similarly, if a patient did not receive steroids, compared to a patient who received steroids, the odds that she would elect for a resuscitation attempt is 90% lower. Finally, per our model, if a patient has a multiple pregnancy, compared to a patient with singleton gestation, her odds of choosing resuscitation for her newborns is 97% lower.

Fellow Survey Results

There were eight fellows invited via e-mail to voluntarily participate in a survey on periviable consults. The response rate was 63% with 5/8 fellows responding. Appendix C outlines the survey questionnaire, in addition to fellow responses per question item, in detail.

At the beginning of the consult, all fellows indicated that they introduce themselves almost always and clearly state their role. Two fellows provided more details into their introduction. One fellow mentioned, "I state that I am a neonatologist but always mention that there are more senior physicians than myself. I don't usually say "fellow" or try to explicitly explain medical hierarchy or training". The second fellow provided an excerpt into an introduction: "Hi I'm Dr. X, the NICU fellow, that means I'll be the babies doctor once they are born. Your OB doctors asked me to come talk with you about what things might look like and what having a baby in the NICU means".

Sixty percent of fellows indicated that they respond to all borderline viability consult requests in under 4 hours. All fellows indicated that no more than 12 hours lapsed between the time of consult request and their discussion with the patient. All five fellows spend at least 30 minutes with the patient during a consult. Three of the five fellows believed that there is *almost always* sufficient time to address patient's questions and the remaining two fellows stated that it was *often* enough time.

Regarding who is present during a consult, two fellows mentioned that *sometimes* a Labor & Delivery nurse is present at the time of the consult and two fellows indicated *rare* presence of a nurse. Three of the five fellows stated that the spouse is *often* present while the remaining two fellows indicated a spouse is *sometimes* present. There were four

fellows who *rarely* give their personal opinion to the patient on the choice to either attempt resuscitation or to provide comfort care. Only one fellow stated *sometimes* sharing his/her opinion.

Fellows were also surveyed for their personal opinion of the gestational age at which to attempt resuscitation. There was consensus among the fellows towards recommending comfort care at 22 gestation weeks and all five fellows would not advocate for resuscitation at 22 weeks. For 23 and 24 gestation weeks, there was wide variation in response. In fact, one fellow preferred comfort care at all gestations including 23 and 24 weeks. An excerpt of this particular fellow's statement is below:

"If it was me I would probably choose comfort care for all those ages, but I also live this every day and see all the complications and know that that is not something I would want. Also I say that now, but it's an impossibly difficult situation and who knows what I would really end up choosing if that happened to me".

Another fellow based his recommendation to the patient on the choice to resuscitate on the parental goals considered in tandem with the infant's quality of life, stating "Depends entirely on family goals. If they want a child no matter what condition then I would always recommend resuscitation. If quality of life considerations are paramount then I would likely recommend against at 22 and 23 and for at 24." The three remaining fellows recommended and/or advocated for resuscitation at 24 gestation weeks but at 23 gestation weeks, one fellow advocated for resuscitation, one fellow would attempt a trial of life while the final fellow was unsure about attempting resuscitation.

Fellows were also asked on their preferences for newborn management between 22 weeks to 24 weeks assuming the patient in question was a family member or themselves. With the exception of one fellow, all responses were unchanged and

consistent with those described above. However, one fellow who would hypothetically only recommend resuscitation to parents with infants born at 24 weeks, now opted for an initial attempt at resuscitation at 22, 23 and 24 weeks of gestation.

Discussion

Approximately thirty-seven percent of very preterm births (those births occurring prior to 32 weeks) occur at less than 28 weeks of gestation and are classified as extremely preterm (9). A subset of those births occurs at the borderline of viability, which is considered to be the time period between 22^{0/7} and 24^{6/7} weeks of gestation. Gestational age alone is an imprecise predictor of neonatal survival although it has shown clear inverse correlation with rates of morbidity and mortality (3,4,23,42). The American College of Obstetricians and Gynecologists, Society for Maternal-Fetal Medicine, American Heart Association, and American Academy of Pediatrics all recommend against any attempts at resuscitation below 22 weeks of gestation, as it is accepted internationally as the current absolute threshold of viability, offers no benefit to the baby, and as such resuscitation should not be offered (3). For births that occur between 22 and 25 completed weeks of gestation, patient preference for the initiation of resuscitation versus comfort care only should be considered and it is ethically appropriate to provide compassionate comfort (42).

Our study sought to understand which parental factors influence the decision for the initiation of resuscitation versus comfort care for births occurring between 22^{0/7} and 24^{6/7} weeks of gestation. All the patients in our study cohort encountered a neonatologist at the time of admission and our primary outcome was the decision made by the patient

after that encounter. To the best of our knowledge, this is the first clinical study which evaluates the parental decision whether to attempt resuscitation of their newborn when faced with impending delivery between 22^{0/7} gestation weeks and 24^{6/7} gestation weeks.

In this retrospective analysis of patients who select a resuscitative attempt versus comfort care only for their extremely premature newborn, there are three factors which reliably predicted the patient's choice, according to our logistic regression model. These factors were the gestational age of the fetus at the time of consult, antenatal steroid administration, and the presence or absence of multiple gestation. According to our model and with consideration to our sample size, we report that, an increase in gestational age by one day was associated with a three-fold increase in the odds that the patient would desire a resuscitation attempt for her newborn. Of note, our current model does not account for the complexity associated with gestational age and the decision to attempt resuscitation. Specifically, our model does not consider that a curvilinear relationship may exist between gestational age, and the decision to resuscitate. It appears counterintuitive that a three-fold increase in odds for a resuscitation request would persist at the higher end of periviability, as well as at the lower end of periviability: for instance, progression from 22^{6/7} to 23^{0/6} weeks of gestation, and progression from 24^{5/7} to 24^{6/7} weeks of gestation.

For women who did not receive steroids or had a multiple gestation, there is a 90% and 93% decreased likelihood respectively that she would request resuscitation of her newborn compared to a woman who received steroids or had a singleton gestation. Corticosteroids are routinely recommended for impending delivery at periviability, with the exception of 22 weeks of gestation where data supporting the survival benefit to the

newborn, is limited (3). One could speculate that a patient's choice for steroids, could be a surrogate marker for her choice of newborn management.

We were not surprised to learn from surveying our fellows that there was a consensus toward not recommending resuscitation at 22 weeks. This consensus reflects a common practice at our institution (43). Additionally, the survival rate for newborns delivered prior to 23 weeks of gestation is 5-6% and among rare survivors, significant morbidity is universal at 98-100% (7). Our fellow response was split on recommendations for parents for newborns born between 23 and 24 weeks. Although our fellow sample size is small, a similar survey by Duffy et al, which was earlier described, resonates with our result (37). The authors found that at 22 weeks, 85% of all respondents (attending's and fellow equivalents) would strongly discourage resuscitation; at 23 weeks, 21% would strongly discourage resuscitation, and at 24 weeks, 1% only would strongly discourage resuscitation. Between 23 and 24 weeks of gestation, while many centers offer resuscitation, the recommendation for resuscitation during this period is not unanimous. Consequently, as recommended by the American Academy of Pediatrics, parental values are a critical component in decision-making for resuscitation, and our fellows, highlighted parental values as important in our survey (23).

Resuscitation versus comfort care at borderline viability

In a study by Boss et al., the authors conducted interviews of twenty-six mothers whose infants died secondary to extreme prematurity or lethal congenital anomalies from 1999 to 2005 in three hospitals (26). When patients who had opted for delivery room resuscitation were asked on how they arrived at their decision, the authors learned that

the physicians' prediction of morbidity and death were not central to their decision-making. Parent's decision-making was drawn from their personal values such as religion, spirituality, and hope (26). In our study, we similarly expected religion to influence the decision to resuscitate borderline viable infants. However, we did not find religion to be predictive of the decision to resuscitate. The threat of a periviable delivery has several implications regardless of the decision an expectant parent makes. At such a time, religion and faith can simultaneously offer both hope and peace. Our results did not indicate an association or trend among religious patients towards the request for resuscitative efforts for their newborn despite the majority (61%) of our patients identifying as Christian.

Another important finding from our analysis was that racial identity was not a significant predictor of the choice for resuscitation over comfort care. Although race has been studied extensively in relationship to the preterm birth rates, there are few studies in the literature evaluating its influence, if any, on the decisions made at the edge of viability (9). In a retrospective study by Tucker-Edmonds et al., maternal discharge data of women who delivered between 23 and 24^{6/7} weeks of gestation was evaluated (41). Infants born to Black women were more likely to be intubated than infants born to White women with an odds ratio for the outcome 1.25 [95% CI: 1.07–1.46] (41). Our study showed in bivariate analysis that Black women tended to select resuscitative attempts over comfort care compared to White women ($p=0.07$). However, the trend observed was not statistically significant in our regression model with the inclusion of the four other variables. Although race was not shown to be a statistically significant variable in our

study, racial differences may exist in the decision for management of neonates at borderline viability, secondary to differences in shared values and cultural practices.

The aforementioned retrospective study by Tucker-Edmonds et al. identified Hispanic ethnicity as significantly associated with neonatal intubation (41). In our study, bivariate analysis did not indicate any influence of ethnicity on the primary outcome and thus, ethnicity was not included in our regression model. It is important to note that the study by Tucker-Edmonds et al. did not base their outcome of neonatal intubation on the decision recorded from a neonatology consult; the outcome of interest was primarily based on linking maternal and infant data. Consequently, their methodology did not consider the potentially evolving decision(s) experienced by mothers in this difficult time. Of note, the dataset for that study was significantly larger than ours, involved >9000 patients which allows for a significant increase in the power of the study to detect small differences (41).

Our model did not demonstrate a significant impact of socio-economic factors, including employment, educational attainment and insurance type, on the choice of care for the extremely premature newborn. The study by Tucker-Edmonds et al. indicated similar findings with the exception that infants born to mothers with insurance coverage from a health maintenance organization (HMO) or Medicaid were more likely to be intubated.

With each additional day that the fetus remains in the uterus, the likelihood for survival improves (28). This effect may be mediated in our population by the increased effect of antenatal steroids over time as well as the increasing weight and advancing maturity of the fetus. It was therefore unsurprising that there was a three-fold increased

likelihood for parents choosing resuscitative efforts compared to comfort care only when gestational age increased by as little as a single day. Consequently, when a patient is faced with potential delivery during the periviable stage, it is important for the medical teams to frequently reevaluate a patient's choice for clinical management. In our study cohort, there were three women admitted for potential impending delivery who stipulated clear conditions for the gestational age at which resuscitation would be desired. Of those three patients, one patient who initially had stated preference for resuscitation after 25 weeks, later decided for resuscitation at 24 weeks of gestation. This particular mother requested for a second consult with the neonatology team after her delivery failed to occur at the time of her initial consult with neonatology at 22 weeks of gestation. After a repeat consult with the neonatologist during which she received updated outcome data, she elected for resuscitation for her newborn at an earlier gestational age. Although it is very likely that the obstetric provider frequently reassesses the patient's decision, it should perhaps also be an institutional practice for the neonatologist to follow-up regularly with women who haven't yet delivered their periviable fetus, in case they have additional questions or desire to alter their management plan.

Multiple gestation pregnancies were associated with decreased odds for the selection of resuscitative efforts compared to singleton pregnancies. This may be explained by the increased magnitude of emotional stress and uncertainties associated with the hospitalization of two extremely premature infants. There are several complications that can result from an extremely premature birth which affect multiple organ systems, as well as neurocognitive development, which can result in a range of disabilities (28). Facing this potential outcome for one child is challenging and with more

than one child involved, a dire outcome at survival could potentially outweigh the desire for resuscitative efforts. In fact, per NICHD data, the outcome is worse for multiple gestation than singleton gestation at each gestational age (28). It is therefore unsurprising to find the decreased likelihood for the decision to attempt resuscitation of newborns for mothers with multiple gestation.

Our results reflect the impact of steroid administration on the potential survival of an extremely premature newborn (3,28). According to our regression model, mothers who did not receive steroids had 90% lower odds of deciding for resuscitation to be attempted for their newborn. Corticosteroid administration has been associated with a reduction in death and neurodevelopmental impairment at 18–22 months for infants who had been exposed to antenatal corticosteroids and born at 23 weeks of gestation (83.4% versus 90.5%), 24 weeks of gestation (68.4% versus 80.3%), and 25 weeks of gestation (52.7% versus 67.9%) (44). At 22 weeks of gestation, no significant difference in these outcomes was noted (90.2% versus 93.1%) (44). Additionally, antenatal corticosteroids decrease the incidence of intraventricular hemorrhage, periventricular leukomalacia, and necrotizing enterocolitis in infants born between 23 weeks and 25 weeks of gestation (44).

In our study, we recorded the steroid administration status of each patient, which does not accurately reflect whether a patient opted out of steroid administration or was simply not offered the choice of steroids (as is done at 22 weeks of gestation in some institutions). It is logical that the decision to receive steroids may be a good proxy for the decision to attempt resuscitation for the newborn. In such a clinical scenario, it becomes more important to clearly stipulate the impact of the decision to receive or decline

steroids, as it could affect prognosis for the infant if the mother changes her mind and elects for resuscitation without having received adequate steroid dosing. This is because antenatal steroid administration occurs optimally ~48-72 hours prior to delivery for improved outcomes in the neonate (3). Additionally, for patients who are initially admitted to an outside hospital prior to transfer to a hospital with a Level III or IV neonatal intensive care unit (NICU), the initiation of steroids prior to transfer could potentially impact the decision for attempted resuscitation of the newborn.

The goal of antenatal counseling during borderline viability is to allow parents to make a well-informed decision regarding what is in the best interest of the fetus and the mother (32,40). Providing knowledge and support to families in this stressful time is very important to help them with the outcome of whichever choice they make (40). According to the AAP Committee on Fetus and Newborn, the initiation and resuscitation of life support to infants born at the edge of viability may be futile and not in the infant's best interest (40). However, in clinical practice, the "best interest" of the fetus may be difficult to decipher clearly (40). The Committee recommends a shared decision making process and family centered care as the ideal model for engaging in these challenging decisions. Providing survival and long-term outcome data are central to most prenatal counseling, although quantitative predictions of death or morbidity does not appear to be central to parental decision to resuscitate (24,32,33).

Our results reflect most of the fundamental factors associated with the long-term outcome of an extremely premature infant: steroid administration, gestational age at consult (or birth) and the type of gestation (40). In a large cohort of infants born between 22 and 25 weeks of gestation from 19 perinatal centers across the United States, there

were several factors which significantly affected neonatal survival and long-term neurodevelopmental outcome at 18 to 22 months (36). These following factors were each significantly associated with improved outcomes: increasing gestational age, female gender, antenatal corticosteroids, singleton birth, and increased birth weight (per 100-g increments) (36).

In our institution, as in most NICUs around the U.S., the NICHD calculator is a routine tool used for estimating potential outcomes for extremely premature infants (28,36). Although this prognostic estimation tool is valuable, the data which forms the basis of survival estimation is more than two decades old, which potentially limits its contemporary relevance (40). However, we still believe that the NICHD prognostic estimation tool should be used during consultation, as providing available data to decision-makers is an important component of the process of informed consent (40). That being said, emphasis needs to be placed on the limitations of the NICHD estimates in light of its aged data as well as inability to predict absolute outcomes for each individual patient. It is our opinion that providers should routinely initiate a conversation with parents by first engaging in a discussion about what their values are, prior to referencing the NICHD outcome data.

The shared decision making (SDM) model has been described as the most effective for preference-sensitive decisions when options have different benefits/risks or patient values are important in optimizing decision making (34). The American Academy of Pediatrics (AAP), in their published report on antenatal counselling for resuscitation at lower than 25 gestation weeks, emphasize SDM with specific guidance for communication with expectant parents (40). This model strongly incorporates parental

values as well as the objective medical facts and acknowledges that the moral values of the physician should be respected (34). The goal of SDM is to make a decision which is in the best interest of the patient. One ethical question that arises from this model is over what the definition of the patients “best interest” should be and who is able to make the best determination of that interest (34). The stakeholders in this SDM process are parents, neonatologists, and other healthcare providers who have their personal and/or professional experiences, values and interpretation of medical data which shapes their moral judgments on “best interests” (34).

Leutner explores four published statements on the care of the critically ill newborn since 1994 (45). Two of the statements, “The Initiation or Withdrawal of Treatment for High Risk Newborns” and “Perinatal Care at the Threshold of Viability”, were authored by the AAP Committee on Fetus and Newborn (COFN) (4,23,46). The other two statements, “Ethics and the Care of Critically Ill Infants and Children” and “Guidelines on Forgoing Life Sustaining Medical Treatment”, were authored by the AAP Committee on Bioethics (COB) (47,48). These four statements address the goals of neonatal medicine for the critically ill and advocate for the extremely premature infants best interest standard to define the decision-making process, to minimize under- and overtreatment (45). Leuthner argues that the two AAP committees- the COFN and COB- differ in their approach to the infant’s best interest. According to Leuthner, the COFN statements encourage a form of practice consistent with the “expertise” model of determining best interest, while the COB statements encourage a practice consistent with the “negotiated” model. The “expertise” model places the neonatologist at an advantaged point of view, due to their substantial understanding of prognosis and potential negative

outcomes without any emotional attachment (45). Consequently, the neonatologist is expected to evaluate decisions rationally and objectively compared to the family, which lacks medical knowledge, and is emotionally attached to the infant. According to the COFN, when deciding the infants “best interest”, an “individualized prognostic strategy” should be used. This strategy includes using an accurate and continuous re-evaluation of the infants’ response to interventions, the prognosis associated with the response in light of known outcome data, and the treating physician’s “best medical judgement”. The COFN does not recommend against communication with families or disregarding of their decisions, rather it affirms that scientific data and medical judgment necessitate physician’s adherence to ethical and legal obligations in order to provide the “standard of care” (45). A problem the author identifies with this model is that it effectively minimizes the moral contribution of the parents in determining the infant’s best interest whilst hiding the physician’s moral point-of-view under the guise of objective medical judgement, since no human physician exists without their own underlying morals that affect their choices and judgment. Another problem encountered with this model is that the physician’s moral judgement is obscured by appealing to “objective” outcome which leads to a “technical criteria fallacy” (45,49). The nature of the decision-making process can be misunderstood when technical abilities, data collection, and scoring systems are the primary focus (50). Finally, Leuthner asserts that the “expertise” model adopted by the COFN does not acknowledge that physicians bring important personal moral values into their “best medical judgement” decisions when they are faced with uncertainty. The population of extremely premature infants represents a “gray area” and so Leuthner

argues that physicians are essentially admitting to lacking objective data on which to base their final decision.

The “negotiated model” also involves shared decision-making (45). During the process of shared decision-making, the medical expertise of the physician serves as a guide for the family with recognition of the family’s value system (45). The physician’s role is to provide the scientific and medical knowledge regarding prognosis while the parents provide the moral knowledge of the burdens and benefits associated with the predicted outcome (45). The basis of the negotiated model is that parental values should determine which actions constitute the infant’s best interest (45). The most appropriate model for determining the infants “best interest,” according to Leuthner, is a “negotiated” model.

Leuthner outlines two aspects of the concept of “best interest” (45). The first aspect refers to the medical facts of a procedure, including data pertaining to its risk and outcome. The second aspect refers to the subjective or moral facts concerning the value or the meaning of those objective components for the patients. He argues that the COB adopts the “negotiated” model by incorporating subjective and objective aspects into the definition of best interest. Such a model accommodates parent’s interpretation of the meaning of the prognosis for their family and allows them to make a decision for their child. The author asserts that physicians have moral agency and as such, are permitted to agree or disagree with parental values. Nevertheless, Leuthner encourages physicians to work with parents, within societal and professional rules in deciding which actions will best support the infants’ best interest. A potential weakness that the author identifies with this preferred model is the prevalence of parental values in conflict situations. The private

love relationship between a parent and child has been proposed as potentially superseding the best interest of the infant (45). Conversely, moral parenting necessitates the responsibility to act in the best interest of the child (45). Leuthner argues that the choice a parent makes is reflective of the kind of person the parent wants to be. He states, “parents’ right to raise their children with their values is an extension of their own right to live by these same values. Best interest decisions are therefore driven by a combination of medical and moral values, and the burden of proof ought to lie with those who want to override the parents’ decision” (45). Substituted judgement is not appropriate in decision-making of newborns and young children. Rather, the best interest of the infant is most appropriate and Leuthner asserts that parental choices could actually reflect the best interest of the infant.

Patient autonomy is central to modern medical bioethics (2) . Competent adult patients reserve the right to refuse offered medical interventions and if a patient is found to be incompetent, a surrogate is sought in his/her stead (2). Parents are the natural surrogate decision-makers for children but this natural right can be opposed in very narrow circumstances by physicians who are legally and ethically charged with the best interest of the child (2). Physician could historically impose appropriate medical treatment according to their personal belief, with or without seeking the consent of the parents (2). This paternalistic approach was previously the norm in physician/patient decision making but has been replaced with autonomy of the patient (or substituted judgment in the case of newborns and children), with the exception of futile medical interventions (2,32).

According to Mercurio, the parental right to decide for their child should not be as absolute as the right to choose for themselves (32). Mercurio points out that while parents should decide the management choice for their newborn, the physician has an obligation to ensure that the treatment provided is not inhumane and there are extreme situations where not providing resuscitation and ongoing intensive care is humane. Mercurio reiterates there is valid justification in refusing to offer a requested treatment, if it cannot accomplish the desired goal as this embodies futility (32).

The “gray zone” characterizes that point at which futility and autonomy meet (2,32). Within the gray zone, physician/patient or physician/surrogate discussion, negotiation and compromise is thought to be the appropriate model for resolution of potential conflicts (51).

Limitations in Methodology

Our study is a retrospective evaluation of patients who have made a choice for the clinical management of their fetus at risk of delivery at the edge of viability. As such, we are limited in our ability to explore in depth the process through which patients arrived at their decision. In a prospective study, qualitative interviews could be conducted with patients to determine in better detail and with better accuracy which factors influence their decision to attempt or not attempt resuscitation. During a qualitative prospective study, the decision-making process experienced by the patient amidst consultations from several medical personnel including neonatologists and maternal-fetal-medicine (MFM) specialists could be better evaluated. Although in theory clinicians can indicate the evolving decision of a patient within the chart, given time pressures and the urgency of an

impending delivery, this can practically be very difficult. Additionally, the decision recorded in the chart is in most cases a joint decision between the father of baby and the patient. In this study, only once was it documented the split decision between a patient and her spouse, which may in fact occur more frequently. The opinions and beliefs of family members and/or friends also likely weigh into this decision-making process. The value of a support system is critical during the challenging period of impending periviable delivery. However, the support system can exert undue influence on the decision a patient makes, especially in an extremely stressful situation. There is little data available that explores the ethical implications of this influence. A prospective study potentially provides the opportunity to explore the impact on the patient's decision from the presence of a spouse, partner, family member or friend.

The reporting of identifying factors such as race, religion, employment, and education are not routinely done by healthcare providers. For patients in our cohort who are returning patients within the Yale Health System, this data may not be updated. In our study cohort, on average of 20% of the patients did not disclose their racial status, religion, educational attainment and/or employment status. This could be accounted for by any of these reasons: 1) The primary team did not obtain a social work consult, 2) a consult was obtained but patient declined, 3) patient was discharged/left AMA or 4) patient refused to answer the questions from either the primary team and/or social work staff. A more robust logistic regression model may have been obtained if the attrition rate for these factors was lower. Although a prospective study does not guarantee that patients would divulge such information when asked, it would certainly create more uniformity in the data by providing all study participants with an opportunity to share identifying

information. Similarly, when abstracting information such as religion from the medical chart, it does not take into account patient's dedication to the stated faith and the importance it holds in their decision-making process. A prospective study creates an avenue to explore the specificity behind vague and/or abstract identifying factors.

Although our model was able to correctly classify about 90% of the observations (outcomes) in our study, it is limited in its sample size. For example, in our sample, only 7 patients had multiple gestation with 3 requesting for an attempt at resuscitation, and 4, electing comfort care. We reported a lower likelihood at requesting resuscitation for multiple gestation, compared to singleton gestation. This result implies that women with multiple gestation are unanimously likely to opt for comfort care. The true significance of this result is questionable. Ideally, to create a more representative model of reality, a larger sample size ($n > 100$) with matched controls (e.g. age), would be important.

There were no significant associations found between race, ethnicity, religion, socio-economic status and our outcome. A similar study in comparison, noted significant associations between the aforementioned variables and neonatal intubation rates (41). Of note, the dataset for that study was significantly larger than ours, involved > 9000 patients which allows for a significant increase in the power of the study to detect small differences.

Our survey results were limited by a low capture rate. This occurrence impacts generalizations to be made from our reported fellow preferences for resuscitation. Our low capture rate also reduced our capacity to undertake extensive content analysis. Our capture rate was primarily due to time constraints and scheduling conflicts. To the best of

our knowledge, our survey questionnaire is novel in its conception. Consequently, our survey results are also limited by the lack of validation of our survey instrument.

Conclusion and Future Directions

Consultation with a neonatologist prior to delivery of a borderline viable fetus involves trying to understand the expectations of parents vis-à-vis their value system and helping the parents make an informed decision about whether to attempt resuscitation or provide comfort care only by providing emotional support and outcome data. The neonatologist also has the additional responsibility to the newborn and should ensure that aggressive resuscitation, if requested, is not futile but provides some increased chance of survival (32,40). There needs to be a consensus for an ethical model for which to define the infants' best interest.

While there is not yet a validated model widely accepted as best practice for engaging families in that challenging discussion, our study demonstrates that from the perspective of the parent, there are factors that predict the choice to resuscitate the borderline viable fetus. These factors match the key information utilized in the NICHD data tool to predict outcome: gestational age, corticosteroid administration, and singleton vs multiple birth (28). Our study also demonstrates that among our small sample of neonatologists-in-training, there was unanimous preference for comfort care at 22 weeks of gestation, mixed preferences at 23 weeks and a preference for resuscitation at 24 weeks. This is an interesting finding since resuscitation is always offered at 22 weeks of gestation in our institution.

Further work needs to be done in validating our variable selection and the regression model. It would be important to evaluate the influence of our three significant predictors in a larger population and multiple centers to validate our regression model. There is limited information in the literature regarding maternal characteristics and values which may potentially influence the choice for newborn management. The literature on this topic is overwhelmingly retrospective. The ethical difficulties for a prospective study conducted during this period of extreme stress for the expectant mother and her fetus, are enormous. However, this is arguably the preferred strategy for developing a more accurate methodology for SDM during counselling on management choice for a borderline viable infant.

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Appendix A: Patient Characteristics

Table 4: Patient Demographics

Patient Characteristics		Frequency	Percentage (%)	Descriptives	Statistics
<i>Age (Years)</i>	15-20	8	10	Mean	29.0
	21--24	10	13	Std. Error of Mean	0.7
	25-29	27	34	Median	29.0
	30-34	17	21	Minimum	15.0
	35-39	15	19	Maximum	43.0
	40-43	3	4	25th Percentiles	25.0
				50th Percentile	29.0
75th Percentile				34.0	
<i>Marital Status</i>	Single	42	52		
	Married	37	46		
	Other	1	1		
<i>Insurance</i>	Commercial	37	46		
	Medicaid	34	43		
	Uninsured	3	4		
	No Response	1	1		
<i>Race</i>	Black	34	43		
	White	26	33		
	Korean	1	1		
	Other	18	23		
	No Response	1	1		

Patient Characteristics		Frequency	Percentage (%)	Descriptives	Statistics
<i>Ethnicity</i>	Hispanic	17	21		
	No Response	1	1		
	Non-Hispanic	62	78		
<i>Education</i>	Less than High School	11	14		
	High School	21	26		
	Vocational Training	13	16		
	College	11	14		
	Post Graduate	7	9		
	No Response	5	6		
<i>Employment Status</i>	Full Time	41	51		
	Part Time	2	3		
	Unemployed	18	23		
	No Response	19	24		
<i>Preferred Language</i>	English	72	90		
	Spanish	4	5		
	French	1	1		
	Creole	1	1		
	Korean	1	1		
	No Response	1	1		

Patient Characteristics	Frequency	Percentage (%)	Descriptives	Statistics
<i>Religion</i>				
Christian				
-Catholic	23	29		
-Protestant	4	5		
-Pentecostal	4	5		
-Baptist	3	4		
-Presbyterian	2	3		
-SDA	1	1		
-Unspecified				
Denomination	11	14		
-Orthodox	1	1		
Mormon	1	1		
Jewish	2	3		
Buddhist	1	1		
Spiritual	1	1		
No Religion	18	23		
No Response	8	10		

Appendix B: Physician Survey and Results

Physician Survey Tool

1) Do you introduce yourself and clearly state your role?

- Almost always
- Often
- Sometimes
- Rarely
- Never

2) On average, can you estimate what percentage of borderline viability cases you respond to in under 4 hours?

3) On average, can you estimate what percentage of borderline viability cases you respond to between 4 to 12 hours?

4) On average, can you estimate what percentage of borderline viability cases you respond to between 12 to 24 hours?

5) On average, can you estimate what percentage of borderline viability cases you respond to in greater than 24 hours?

6) How long do you usually spend in the room with the family for a new periviable consult?

7) In your opinion, given the time constraints, do you think your patient's questions are appropriately addressed during the initial consult?

8) Is there a member of the obstetric team usually present during your consult?

Yes, if so, whom? _____ / No

9) Is there a member of the nursing staff usually present during your consult?

10) Do you have a conversation with any staff (e.g. nursing, and obstetricians) prior to speaking with the patient?

Yes, if so, whom? _____ / No

11) How often do you give your personal recommendation at the initial consult?

- Almost always
- Often
- Sometimes
- Rarely
- Never

12) How is the patient's knowledge and understanding assessed?

13) How often is the patient's spouse/significant other present?

- Almost always
- Often
- Sometimes
- Rarely
- Never

14) What is your personal recommendation for resuscitation vs comfort care only at each of the following gestational ages?

- 22 completed weeks
- 23 completed weeks
- 24 completed weeks

15) If you or a close family member was about to deliver, what would you recommend at each of the following gestational ages:

- 22 completed weeks

- 23 completed weeks
- 24 completed weeks

Table 5: Neonatal Fellow Survey Responses

Question	Response	Frequency (%)	Comments
1. During your initial consult for periviable pregnancy, do you introduce yourself and clearly state your role? Almost Always, Often, Sometimes, Rarely, Never. Can you provide an excerpt of what you say	Almost Always	5 (100)	1. <i>I state that I am a neonatologist but always mention that there are more senior physicians than myself. I don't usually say "fellow" or try to explicitly explain medical hierarchy or training.</i> 2. <i>Hi I'm Dr. X, the NICU fellow that means I'll be the baby's doctor once they are born. Your OB doctors asked me to come talk with you about what things might look like and what having a baby in the NICU means.</i>
	95%	1 (20)	
2. On average, can you estimate what percentage of borderline viability cases you respond to in Under 4 hours	99^%	1 (20)	
	100%	3 (60)	
	5%	1 (20)	
3. On average, can you estimate what percentage of borderline viability cases you respond to in Under 4-12 hours	1%	1 (20)	
	0%	1 (20)	
	Unanswered	2 (40)	
	0%	4 (80)	
4. On average, can you estimate what percentage of borderline viability cases you respond to in 12-24 hours	Unanswered	1 (20)	
	0	3 (60)	
5. On average, can you estimate what percentage of borderline viability cases you respond to in Greater than 24 hours	Unanswered	2 (40)	

6. How long do you usually spend in the room with the family for a new peri-viable consult?	30 minutes	2 (40)	1) It depends on the situation, but usually anywhere from 30 minutes to an hour. Some families know what they want right away, and I'll still go through all the options but they tend not to ask as many questions so their consults are overall shorter than families that are unsure who have a lot of questions	
	30-45 minutes	2 (40)	2) Often- If they are in active labor it's difficult to answer all their questions, I try to focus on the most pressing questions that directly relate to whether or not they want resuscitation. If they are not in labor I always ask them to write down any additional questions if they have any, and I tell them when my shift is over and if they want to speak to me again to please give me a call and I'm happy to come back if I'm still in the hospital but if not there is always someone available to answer their questions. I also acknowledge that we are giving them a lot of information and it can take some time for that to sink in, so not to feel bad about calling if they have more questions!	
	30-60 minutes	1 (20)		
7. In your opinion, given the time constraints, do you think your patient's questions are appropriately addressed during the initial consult? Almost Always, Often, Sometimes, Rarely, Never. Can you elaborate on the answer above	Almost	3 (60)	1) Only when they have specific questions which I don't know the answer to are things left hanging. Sometimes I defer to the attending that will present at delivery or offer to come back later with additional information. Sometimes they want information that doesn't exist such as more specific prognostic information for a complicated case.	
	Always			2 (40)
	Often			
8. Is there a member of the obstetric team (Med Student, Resident, Fellow, Attending) usually present during your consult? Can you identify who below? Almost Always, Often, Sometimes, Rarely, Never. Can you identify who, as per above response	Sometimes	2 (40)	1) Bedside OB nurse and OB resident occasionally, OB attending rarely 2) Resident or fellow very rarely. L&D nurse sometimes.	
	Rarely	2 (40)		
	Never	1 (20)		
9. Is there a member of the nursing team usually present during your consult? Almost Always, Often, Sometimes, Rarely, Never.	Almost Always	1 (20)	1) I usually obtain all additional information I need by questioning the person calling the consult.	
	Often	2 (40)		

	Sometimes	1 (20)	
	Rarely	1 (20)	
10. After the consult request, do you have a conversation with any staff, i.e nursing, and obstetricians prior to speaking with the patient?	Almost Always	4 (80)	1) I usually walk over and check in at the BA desk, find the nurse of the patient and try to get a sense of where they are emotionally before I go in the room and to see if there are any questions that they have already been asking. I also ask the OB if the patients have discussed their thoughts about resuscitation with them so I know if it's something that has been discussed at all and try to get a sense of where the patient is coming from. Often my conversations with the OB resident/fellow are via phone and nursing is in person, but both happen before I enter the room.
	Often	1 (20)	
11. How often do you give your personal recommendation at the initial consult? Almost Always, Often, Sometimes, Rarely, Never.	Sometimes	1 (20)	
	Rarely	4 (80)	
12. How is the patient's knowledge and understanding assessed?			1) Based on the questions they ask I can usually gauge their level of understanding 2) I will ask her to describe what she has been told or understands up to this point in the beginning of our conversation. Then I see what questions she asks during the conversation and allow her questions/comments to help guide the discussion. At the end, I recap what we discussed and what interventions she wants done, and ask if she has any remaining questions. 3) I usually base it upon the sort of questions they ask me in response to the information I have given them. I also ask them what things I could better clarify for them before the conclusion of the consult. I always offer to return to speak with them a second time once they have had a chance to process the information I have given them (even if it is an emergent situation) so that they have a chance to formulate their own questions in a private setting and after speaking with support persons/family members etc.

4) *This is difficult to do, many parents will sort of recap what I said after each section of the talk so I know they have a good understanding. I always pause after each mini section and ask if they have questions, but often times in this situation parents are a bit shell-shocked and cant verbalize their questions very well, so I try to get a sense of what they might be thinking by what they do say, and give information I think might be helpful to them and help them understand. It's a lot of watching their facial expressions, trying to gauge their health literacy, being aware when they look like they might want to say something that I stop and ask if they have a question or need me to explain something differently. It's hard because I feel like even if you ask parents directly if they understand or if something makes sense, they usually say yes and you just have to try to judge for yourself and explain things a different way if you think they aren't getting it.*

5) *Asking them what they understand about the situation or need clarified.*

13. How often is the patient's spouse/significant other present? Almost Always, Often, Sometimes, Rarely, Never

Often 2 (40)

Sometimes 3 (60)

*14. What is your personal recommendation for resuscitation vs comfort care only at EACH of the following gestational ages? 22, 23 and 24 completed weeks

1) *22 & 23 weeks: Per parent's wishes; 24 weeks: resuscitate*

2) *22 weeks - would not recommend resuscitation, but willing to respect wishes of parents if they seem well informed; 23 – 24 weeks - recommend resuscitation*

3) *I use the NICHD calculator and our hospital data to help guide and try to take each case by an individual basis depending on the data that goes into the calculator and the mother's preference as well. Overall, closer to 22 weeks I tend to lean towards comfort care only and at 24 weeks I lean towards full resuscitation.*

4) I honestly don't like to give recommendations because it has to be whatever decision feels right to the parents so they don't regret whatever decision they make. I will give them numbers from both the NICHD calculator and our personal Yale NICU numbers to help put in perspective how these patients do. **But in general for 22 weeks I would recommend comfort care only** (I have never seen one of these babies do well and they always seem to suffer from many complications before they pass away); **at 23 weeks depending on the size of the baby and other prenatal complications, I think limited resuscitation is ok** (breathing tube only). But the vast majority of these children don't do well and complication rates can be high so **I sometimes lean towards comfort care for this group as well; at 24 weeks if the baby has a >50% chance of having no or only mild developmental issues (based on the NICHD calculator), I lean towards resuscitation.** Honestly though it is the parent's choice, and my job is to help them feel supported in whatever they choose, and I don't have a problem with resuscitation or comfort care at any of these age groups if it's what the parents really want.

5) Depends entirely on family goals. If they want a child no matter what condition then I would always recommend resuscitation. If quality of life considerations are paramount then I would likely recommend against at 22 weeks and 23 weeks and for resuscitation at 24 weeks.

*15. If you or a close family member was about to deliver, what would you recommend in terms of resuscitation vs comfort care only at EACH of the following gestational ages? 22, 23 and 24 completed weeks

1) 22 weeks: comfort care; 23 & 24 weeks: Resuscitation

2) Same as last answer - take all data and current feelings of myself or close family member into consideration at that time, leaning toward comfort care closer to 22 weeks and resuscitation at 24.

3) 22 weeks - no resuscitation; 23& 24 - trial of life/resuscitation

4) If it was me I would probably choose comfort care for all those ages, but I also live this every day and see all the complications and know that that is not something I would want. Also I say that now, but it's an impossibly difficult situation and who knows what I would really end up choosing if that happened to me.

5) I would attempt initial steps of resuscitation at all three ages.

*Of note comments in Question 14 and 15 are paired with respective response by the same participant

Appendix C: Logistic Regression and Analysis

Table 6: Variable Selection Using a P-value Cut-off of 0.1

Variable	P Value	Variable	P Value	Variable	P Value
<i>Maternal Demographics</i>		<i>Employment Status</i>		<i>Maternal Obstetric History</i>	
Age	0.335	Full Time	0.969	Gravidity	0.066
		Part Time	0.999	Term Births	0.11
<i>Marital Status</i>		Unemployed	0.999	Premature Births	0.807
Single	0.858			Abortions (Spontaneous/Induced)	0.11
Married	0.58	<i>Education Level</i>		Living Children	0.149
Other	1	Less than High School	0.999		
		High School	0.568	<i>Fetal Characteristics</i>	
<i>Racial Identity</i>		Vocational Training	0.644	Consult Gestational Age	0.011
Black	0.074	College	0.226	Multiple Birth (vs Singleton)	0.008
White	0.443	Post Graduate	0.298	Prenatal Anomalies	0.22
Korean	1			<i>Gender</i>	
Other	0.214	<i>Insurance</i>		Male	0.711
Ethnicity		Commercial	0.467	Female	0.31
Hispanic/Latino	0.658	Medicaid	0.322	Both	0.507
non-Hispanic/Latino	0.907	Uninsured	0.52	Steroid Status (Mother)	0.008

<i>Preferred Language</i>	P-Value
English	0.999
Spanish	1
French	1
Creole	1
Korean	0.999
 <i>Religion</i>	
Christian	
-Catholic	0.38
-Protestant	0.999
-Pentecostal	0.44
-Baptist	0.318
-Presbyterian	0.999
-SDA	1
-Unspecified	
Denomination	1
-Orthodox	1
Mormon	1
Jewish	0.999
Buddhist	1
Spiritual	1
No Response	0.812
None	0.571

In bold are variables selected for inclusion in regression model

Table 7: Variables with p cut-off of 0.1 per Table 7, selected for logistic regression

	B	S.E.	Wald	df	Sig.	Exp(B)
Gravidity	0.11	0.26	0.20	1.00	0.66	1.12
Race			0.76	4.00	0.94	
Black/African American	0.74	0.92	0.64	1.00	0.42*	2.10
Korean	-22.31	4.0*10 ⁵	0.00	1.00	1.00	0.00
Other	0.74	1.11	0.44	1.00	0.51	2.09
Consult GA	1.15	0.56	4.21	1.00	0.04*	3.15
Multiple Gestation	-2.68	1.21	4.90	1.00	0.03	0.07
Absence of Steroid	-2.30	1.08	4.50	1.00	0.03*	0.10

*In bold are significant variables with $p < 0.05$