Pediatric Academic Societies
Neonatology Summer Webinar Series
WEBINAR

Week 2: Neonatal Health Services Research/Quality Improvement

Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation

Thursday, June 18 4:30-6:30 pm EDT

Moderators
Margaret Parker
Wanda Barfield

EDT	Abstract	Title	Presenting Author
4:30 pm	3379797	Predicting Length of Stay in the Neonatal Intensive Care Unit with Deep Learning and Chest Radiographs	Kristyn Beam
4:40 pm	3374956	Variations in length of stay for infants born at 24-31 weeks' gestation: an international comparison study	Prakesh Shah
4:50 pm	3376777	Neurodevelopmental Outcomes of Preterm Infants (<29 weeks Gestational Age) Conceived by Assisted Reproductive Technology	Smita Roychoudhury
5:00 pm	3340693	Chicago-born Latina women's upward economic mobility and preterm birth rates	John Feister
5:10 pm	3374422	Risk of Stratified Preterm Births by Maternal Nativity: Evidence Against an Immigrant Paradox	Teniola Egbe
5:20 pm	3379972	Epidemiology and outcomes of infants after cardiopulmonary resuscitation in the neonatal and pediatric intensive care unit in a national registry	Sara Handley
5:30 pm	3381150	Cumulative Cost of Clinician-Driven Tests and Treatments in Preterm Infants	Brian King
5:40 pm	3373871	Health Care Costs of Major Morbidities associated with Prematurity in United States Children's Hospitals	Kuan-Chi Lai
5:50 pm	3370757	Evaluating Care in Safety Net Hospitals: Clinical Outcomes and NICU Quality of Care in California	Emily Pang
6:00 pm	3379633	Everyday executive functioning of a national cohort of adults born very low birth weight	Alice Hyun Min Kim
6:10 pm	3376273	Association between gestational age at birth and neurodevelopmental disorders in children: a population-based cohort study in Taiwan	Chi-Nien Chen
6:20 pm	3376095	Outcomes of Outborn Very-Low-Birth-Weight Infants: A Propensity Score-Matched Analysis using Neonatal Research Network of Japan Database	Katsuya Hirata

Note: Schedule subject to change based on presenter availability.

CONTROL ID: 3379797

TITLE: Predicting Length of Stay in the Neonatal Intensive Care Unit with Deep Learning and Chest Radiographs

PRESENTER: Kristyn Beam

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CURRENT CATEGORY: Neonatology

CURRENT SUBCATEGORY: Neonatal Epidemiology, Health Services Research

KEYWORDS: Artificial Intelligence, Risk Prediction, Machine Learning .

SESSION TITLE: Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation |Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation

SESSION TYPE: Oral Poster Symposia|Webinar

ABSTRACT BODY:
Background: There are limited studies predicting length of stay (LOS) for infants admitted to the neonatal intensive care unit (NICU), despite this metric's importance for decision making. Recently, artificial intelligence based on deep learning has shown the ability to extract predictive information from medical imaging data. Infants admitted to the NICU often have many chest radiographs (CXR) taken within the first few days of life, which may hold information about their long-term prognosis.

Objective: To develop a deep learning model to predict LOS for NICU patients using a single CXR captured in the first week of life.

Design/Methods: Radiographic and clinical data were collected from two large NICUs from 7/2008 to 7/2018. The first CXRs after delivery was extracted by a trained physician and examined to ensure the entire chest was included. CXRs were excluded if there was marked artifact or rotation. Of 2000 candidate CXRs, 798 met the inclusion criteria. A deep neural network (DNN) based on the Densenet121 architecture was trained to predict LOS on the basis of the first CXR for each patient. A penalized linear regression model using gestational age (GA) and birth weight (BW) was fit as a baseline. Root mean squared error (RMSE) and Pearson correlation of the predictions were assessed using 10-fold cross-validation. GA and BW for each patient were estimated using ICD-9 and ICD-10 billing codes.

Results: The mean LOS for this cohort of 798 patients was 25.5 days (sd=33.55). Table 1 contains an overview of the cohort stratified by GA. The DNN achieved a RMSE 26.6 days (95% CI: 24.4 - 28.9) and a correlation between the true and predicted values of 0.62 (95% CI: 0.57 - 0.66). The baseline model achieved an RMSE of 26.0 days (95% CI: 24.2 - 27.9) and a correlation of 0.66 (95% CI: 0.62 - 0.69). Incorporating GA and BW information into the DNN yielded the most promising results, achieving an RMSE of 24.9 days (95% CI: 23.0 - 26.8) and a correlation of 0.67 (95% CI: 0.63 - 0.71).

Conclusion(s): We demonstrated the feasibility of predicting LOS using deep learning and CXRs. The model was able to make promising predictions on the basis of the first CXR after delivery. There was improved prediction when GA and BW were added to the deep learning model. This technique shows promise, but addition of more clinical data elements and exploration into the features that affect accuracy for LOS are needed.

Summary of Patients Included in Study

Gestational Age (weeks)	N	Average LOS	SD
< 24	13	39	46
24	23	61	56
25-26	59	70	46
27-28	80	65	43
29-30	99	52	27
31-32	99	34	24
33-34	73	23	16
35-36	124	16	10
Full Term	306	11	19
Unspecified	7	44	39

Scatter plot showing the true vs. predicted length of stay values from the deep neural network. Each prediction was made during cross-validation when that point was not part of the training set. The correlation between the true and predicted values is 0.674 (95% CI: 0.63 - 0.71)

IMAGE CAPTION:

Scatter plot showing the true vs. predicted length of stay values from the deep neural network. Each prediction was made during cross-validation when that point was not part of the training set. The correlation between the true and predicted values is 0.674 (95% CI: 0.63 - 0.71)

CONTROL ID: 3374956

TITLE: Variations in length of stay for infants born at 24-31 weeks' gestation: an international comparison study

PRESENTER: Prakesh Shah

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CURRENT CATEGORY: Neonatology

CURRENT SUBCATEGORY: Neonatal-Perinatal Health Care Delivery: Epidemiology/Health Services Research

KEYWORDS: newborn, premature, hospital stay, variations.

SESSION TITLE: Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation |Neo-Perinatal Care Delivery: Epi/HSR -

So Much Variation

SESSION TYPE: Oral Poster Symposia|Webinar

ABSTRACT BODY:

Background: As survival of very preterm infants has increased, prediction of length of hospital stay (LOS) has received increased attention as a determinant of health care utilisation. Data on LOS for very preterm neonates have generally been reported from either single centres or single networks/countries, but no research has provided international comparisons.

Objective: To compare LOS for infants born between 24 and 31weeks' gestation admitted to centres participating in the International Network to Evaluate Outcomes of Neonates (iNeo) (Australia-New Zealand, Canada; Finland, Israel, Japan, Spain, Sweden, Switzerland, UK and Tuscany, Italy).

Design/Methods: Median LOS was calculated for each country based on survival status prior to discharge home, death or transfer to a step-down centre. Survival analysis models and generalised linear models were used to investigate differences in LOS between countries after adjustment for gestational age, birthweight, sex and multiplicity. Analyses were adjusted for survival differences.

Results: A total of 60,545 infants born at 24 to 31 weeks' gestation from 2014 to 2016 were included [Table 1]. Median length of stay was highest for Japan and shortest for Tuscany. Predictors of LOS were country, gestational age, birth weight, sex and multiplicity [Table 2]. Variation in LOS persisted after considering infants who survived and died separately. LOS among survivors and non-survivors for each gestational week are shown in the [Figure1]. For each week increase in gestational age LOS decreased by 8.4 days. Multiplicity and male sex predicted a mean increase in LOS of 1.5 and 2.6 days respectively.

Conclusion(s): In this international cohort we identified differences in LOS between countries for preterm infants of 24-31 weeks' gestation. Substantial unexplained variation in LOS may be due to differences in clinical care practices, healthcare systems, availability of step-down units or community support. These differences require exploration in future studies.

Table 1: Summary statistics for infants born at 24-31 weeks gestational age (GA)

Country characteristics	N	GA (weeks), Mean(SD)	Birthweight (g), Mean(SD)	Male sex, n (%)	Died in neonatal unit, n (%)	Median (IQR) LOS for all infants
Australia and New Zealand	9900	28.5 (2.1)	1242 (385)	5503 (55.6)	586 (5.9)	59 (44, 83)
Canada	6695	28.0 (2.3)	1150 (390)	3645 (54.6)	583 (8.7)	60 (40, 88)
Finland	1046	28.8 (2.0)	1292 (395)	562 (53.7)	45 (4.3)	52 (38, 70)
Israel	3403	28.1 (2.1)	1069 (268)	1779 (52.3)	459 (13.5)	54 (40, 75)
Japan	9705	28.2 (2.2)	1017 (282)	5143 (53.0)	408 (4.2)	82 (62, 109)
Spain	5521	28.2 (2.0)	1068 (277)	2827 (51.2)	657 (11.9)	54 (39, 75)
Sweden	2848	28.5 (2.2)	1253 (406)	1586 (55.7)	184 (6.5)	56 (37, 79)
Switzerland	2175	28.6 (2.2)	1192 (376)	1191 (54.8)	160 (7.4)	55 (40, 77)
Tuscany, Italy	720	28.8 (2.1)	1189 (374)	387 (53.8)	59 (8.2)	52 (37, 73)
UK (England)	18532	28.6 (2.2)	1210 (374)	10002 (54.0)	1433 (7.7)	50 (34, 76)

Table 2: Multivariable analyses of length of stay in days

Variable	Coefficient (95%CI) for length of stay among survivors	Coefficient (95%CI) for length of stay among all neonates
Country of birth		
Australia/New Zealand	Ref.	ref.
Canada	-4.40 (-5.00, -3.80)	-4.46 (-5.47, -3.76)
Finland	-8.27 (-9.70, -6.84)	-9.28 (-11.3, -7.24)
Israel	-8.58 (-9.36, -7.81)	-13.4 (-14.4, -12.3)
Japan	+12.8 (12.2, 13.3)	+15.7 (14.9, 16.5)
Spain	-9.32 (-9.97, -8.67)	-4.95 (-6.10, -3.81)
Sweden	-5.20 (-6.00, -4.39)	-6.08 (-7.36, -4.81)
Switzerland	-4.12 (-5.02, -3.23)	-12.9 (-13.8, -12.0)
Tuscany, Italy	-3.46 (-4.98, -1.95)	-8.57 (-9.24, -7.90)
UK	-7.53 (-8.00, -7.06)	-6.85 (-8.98, -4.71)
Gestational age (week increase)	-8.42 (-8.53, -8.31)	-5.14 (-5.30, -4.99)
Birthweight (each 100g)	-2.22 (-2.28, -2.15)	-2.18 (-2.28, -2.08)
Male sex	+2.57 (2.25, 2.88)	+1.63 (1.19, 2.08)
Multiplicity	+1.52 (1.18, 1.87)	+1.25 (0.75, 1.74)

All p values <0.01

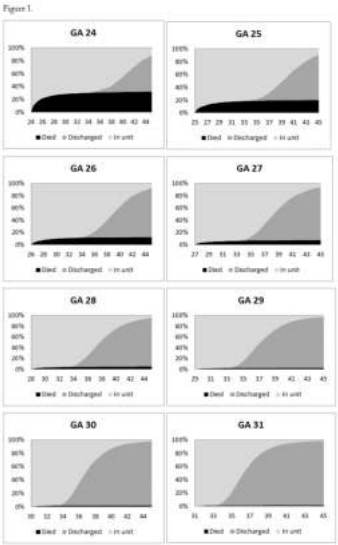

IMAGE CAPTION:

CONTROL ID: 3376777

TITLE: Neurodevelopmental Outcomes of Preterm Infants (<29 weeks Gestational Age) Conceived by Assisted Reproductive Technology

PRESENTER: Smita Roychoudhury

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CURRENT CATEGORY: Neonatology

CURRENT SUBCATEGORY: Neonatal-Perinatal Health Care Delivery: Epidemiology/Health Services Research

KEYWORDS: Assisted reproductive technology, mortality, neurodevelopmental impairment.

SESSION TITLE: Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation |Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation

SESSION TYPE: Oral Poster Symposia|Webinar

ABSTRACT BODY:

Background: Assisted reproductive technology (ART) accounts upto 4.75% of live births in North America, with an increased use by 50% in the last decade in Canada. There have been concerns about potential adverse consequences of ART on child development. There are limited and conflicting reports on the neurodevelopmental outcomes of infants conceived by ART.

Objective: To compare the neurodevelopmental (ND) outcomes at 18-24 months corrected age (CA) of preterm infants born <29 weeks gestational age(GA) who were conceived using ART and those conceived by natural conception (NC).

Design/Methods: In this retrospective cohort study, we included inborn preterm infants born at <29 weeks GA between January 1, 2010 and December 31, 2016, and completed a follow-up assessment at 18–24 months' CA at ten Canadian Neonatal Follow-up Network (CNFUN) clinics. We excluded outborn, moribund and infants with major congenital anomalies and those lost to follow up.
The primary outcome was neurodevelopmental impairment (NDI), defined as the presence of any one of the following: cerebral palsy with GMFCS ≥ I, Bayley-III score of <85 on any one of the components (cognitive, language, motor composite score), unilateral/bilateral visual impairment and sensorineural or mixed hearing impairment. Secondary outcomes included mortality, significant NDI and each individual component of the primary outcome. We compared outcomes between infants conceived by ART and NC using bivariate and multivariate analyses adjusting for potential counfounders.

Results: Of the 4073 eligible neonates, 571 were conceived using ART. Maternal and neonatal characteristics are reported in the table 1. Maternal age, educational level, maternal diabetes were higher among ART group compared to NC group. Receipt of antenatal steroid (93% vs 89%) and caesarean section rate (71% vs 59%) were higher among ART groups. Neonatal morbidity rates were comparable between the two groups except for all grade IVH which was lower among ART group (33% vs 38%, p =0.01).
Table 2 describes the ND outcomes. Multivariable logistic regression showed the odds of NDI (aOR 0.67, 95% CI 0.53-0.85) and composite of death/NDI was significantly lower in ART group (aOR 0.65, 95% CI 0.57-0.83) compared to NC.

Conclusion(s): In this cohort study, conception through ART was associated with lower odds of NDI and composite outcome of mortality or NDI at 18-24 months corrected age among preterm infants <29 weeks GA.

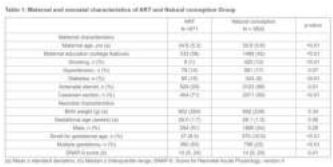

IMAGE CAPTION:

CONTROL ID: 3340693

TITLE: Chicago-born Latina women's upward economic mobility and preterm birth rates

PRESENTER: John Feister

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CURRENT CATEGORY: Neonatology

CURRENT SUBCATEGORY: Neonatal Epidemiology, Health Services Research

KEYWORDS: preterm birth, Latina, economic mobility.

SESSION TITLE: Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation |Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation

SESSION TYPE: Oral Poster Symposia|Webinar

ABSTRACT BODY:

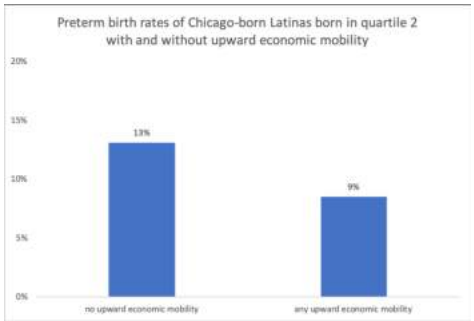
Background: The Latinx population is the second largest and fastest growing ethnic group in the U.S. For incompletely understood reasons, the preterm birth (< 37 weeks, PTB) rate of US-born Latina women exceeds that of their foreign-born counterparts. A well-established published literature supports a life-course conceptual model of reproductive outcome. To our knowledge, no study has examined the extent to which US-born Latina women's upward economic mobility (UEM) is associated with PTB rates.

Objective: To determine whether US-born Latina women's UEM from early-life impoverishment by adulthood is associated with PTB rates.

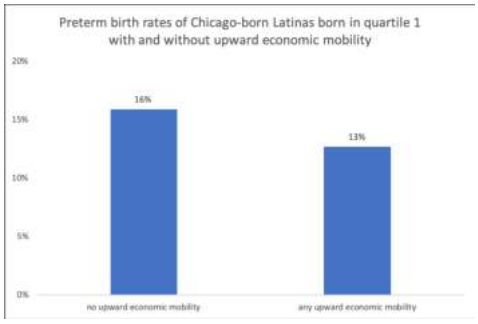
Design/Methods: We performed stratified and multilevel binominal regression analyses on the Illinois transgenerational data set of Chicago-born infants (born 1989-1991) and their Chicago-born Latina mothers (n=6,878, born 1956-1976) with appended US census income data. Median family income of census tract residence was divided into quartiles (Q1/2/3/4) to estimate income at mother's birth (i.e. early-life) and at her infant's birth (i.e. adulthood).

Results: Among mothers (n=5765) with early-life residence in Q2 (i.e. modestly impoverished) neighborhoods, those (n=2005) who experienced UEM by adulthood had a PTB rate of only 8.5% vs 13.1% for those (n=3760) with lifelong residence in Q2 neighborhoods (figure 1); RR=0.65 (0.47, 0.90). In contrast, among mothers (n=6878) with early-life residence in Q1 (i.e. extremely impoverished) neighborhoods, those (n=3001) who experienced UEM by adulthood had a PTB rate of 12.7% vs 15.9% for those (n=3877) with lifelong residence in Q1 neighborhoods (figure 2); RR=0.8 (0.63, 1.01). The incidence of maternal age < 20 years, unmarried status, inadequate prenatal care usage, and cigarette smoking tended to decrease with maternal UEM. In binomial regression models, the adjusted RR (controlling for maternal age, marital status, prenatal care usage, and cigarette smoking) of PTB for mothers with an early-life residence in either Q2 or Q1 neighborhoods who experienced UEM vs no UEM by adulthood equaled 0.66 (0.47, 0.93) and 0.95 (0.75, 1.22), respectively.

Conclusion(s): US-born Latina women's UEM from early-life residence in modestly impoverished urban communities is associated with lower PTB rates independent of traditional individual-level risk factors. A similar phenomenon fails to occur among their peers with early-life residence in extremely impoverished neighborhoods. These findings are salient to the US-born (compared to foreign-born) Latina women's pregnancy disadvantage.



Preterm birth rates of Latina mothers born into extremely impoverished Chicago-area neighborhoods (economic quartile 2) who underwent no vs any upward economic mobility (i.e., residing in a neighborhood in economic quartile 3 or higher) by time of giving birth.



Preterm birth rates of Latina mothers born into extremely impoverished Chicago-area neighborhoods (economic quartile 1) who underwent no vs any upward economic mobility (i.e., residing in a neigbhorhood in economic quartile 2 or higher) by time of giving birth.

IMAGE CAPTION:
Preterm birth rates of Latina mothers born into extremely impoverished Chicago-area neighborhoods (economic quartile 2) who underwent no vs any upward economic mobility (i.e., residing in a neighborhood in economic quartile 3 or higher) by time of giving birth.

Preterm birth rates of Latina mothers born into extremely impoverished Chicago-area neighborhoods (economic quartile 1) who underwent no vs any upward economic mobility (i.e., residing in a neigbhorhood in economic quartile 2 or higher) by time of giving birth.

CONTROL ID: 3374422

TITLE: Risk of Stratified Preterm Births by Maternal Nativity: Evidence Against an Immigrant Paradox

PRESENTER: Teniola Iwa Egbe

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CURRENT SUBCATEGORY: Neonatal-Perinatal Health Care Delivery: Epidemiology/Health Services Research

KEYWORDS: Health Disparities/Inequlities, Birth Outcomes, Epidemiology.

SESSION TITLE: Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation |Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation

SESSION TYPE: Oral Poster Symposia|Webinar

ABSTRACT BODY:
Background: Racial/ethnic minority women are known to have higher rates of preterm birth. Foreign-born immigrant women have lower rates of preterm births than US-born women despite more barriers to health care, a trend termed “the immigrant paradox.” However, it is unknown how women’s race, ethnicity and nativity together affect risk of delivering extremely, moderately, or late preterm infants. We assessed for disparities in extreme (<29 weeks’ gestation), moderate (29-33 weeks) and late (34-36 weeks) preterm birth rates by race, ethnicity and nativity.

Design/Methods: We conducted a retrospective cohort study of women delivering a live birth in Pennsylvania from 2011-2014 (n=490,998). Women were grouped into eight race/ethnicity/nativity categories: US non-Hispanic White (USNHW) and black (USNHB), US Hispanic White (USHW) and Black (USHB) vs. foreign-born (FB) for each racial/ethnic category. Log-binomial regression analyses determined the association between race/ethnicity/nativity category and risk of each preterm birth strata.

Results: The rates of premature delivery were lower for all foreign-born women compared to their US-born counterparts. Overall, FB women had a lower rate of prematurity (5.8%) compared to U.S-born women (7.2%), P=.001 (Table 1). In adjusted models (Figure 1), USNHB (adjusted Relative Risk 2.18, P = .001, 95% Confidence Interval 1.96-2.44), USHB (aRR 2.36, P = .017, 95% CI 1.17-4.80), FBNHB (aRR 2.19, P = .001, 95% CI 1.69-2.82), and women in the “other” category (aRR 1.40, P = .001, 95% CI 1.25-1.58) had a higher risk of extreme preterm delivery than USNHW.

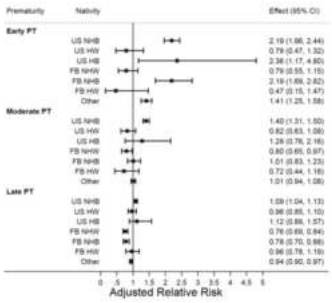
Conclusion(s): The risk of stratified prematurity for women varied by race, ethnicity, and nativity status. Nativity may not confer the same advantage for every strata of prematurity. Foreign nativity does not appear to be protective for Black women’s risk of extreme prematurity. The immigrant paradox held true only for certain women, with foreign-born white women having the lowest rates of prematurity across gestational age strata, irrespective of ethnicity. A better understanding of how nativity mediates birth outcomes and the different processes that lead to early, moderate and late

preterm birth may shed light on the varying disparities that exist within racial/ethnic groups. This may inform interventions and policies related to the care of diverse groups of women.

	TERM	PRETERM	EPT	MPT	LPT
US-Born		**7.2**			
NHW	93.4	6.6	0.3	1.2	5.1
NHB	89.7	10.3	1.0	2.3	6.9
HW	92.6	7.4	0.4	1.2	5.8
HB	90.2	9.8	1.0	1.9	6.9
Foreign-Born		**5.8**			
NHW	95.0	5.0	0.2	0.9	3.8
NHB	92.9	7.1	0.9	1.5	4.7
HW	94.2	5.8	0.1	0.8	4.9
Other	92.3	7.7	0.6	1.3	5.6
Total	92.8	7.2	0.5	1.4	5.4

EPT: Extreme prematurity (<29 weeks' gestation)
MPT: Moderate prematurity (29-33 weeks)
LPT: Late prematurity (34-36 weeks)

Table 1: Percent of Dyads in each prematurity category, by nativity/race/ethnicity



Non-Hispanic white was the reference group. These models were adjusted for maternal age, insurance, education, perinatal complications, and medical comorbidities.

Figure 1: Adjusted relative risk of extremely, moderate and late prematurity by race/ethnicity/ nativity

IMAGE CAPTION:
Table 1: Percent of Dyads in each prematurity category, by nativity/race/ethnicity

Figure 1: Adjusted relative risk of extremely, moderate and late prematurity by race/ethnicity/ nativity

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CONTROL ID: 3379972

TITLE: Epidemiology and outcomes of infants after cardiopulmonary resuscitation in the neonatal and pediatric intensive care unit in a national registry

PRESENTER: Sara Handley

AUTHORS (LAST NAME, FIRST NAME): Handley, Sara[1]; Passarella, Molly[1]; Lorch, Scott[1]; Ades, Anne[1]; raymond, tia[2]; Foglia, Elizabeth[1]

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CURRENT CATEGORY: Neonatology

CURRENT SUBCATEGORY: Neonatal Epidemiology, Health Services Research

KEYWORDS: CPR.

SESSION TITLE: Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation |Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation

SESSION TYPE: Oral Poster Symposia|Webinar

ABSTRACT BODY:
Background: Cardiopulmonary resuscitation (CPR) in hospitalized infants (≤365 days) is an uncommon event, which is associated with mortality. Ill infants may be admitted to the neonatal or pediatric intensive care unit (NICU or PICU) as admission criteria varies among hospitals. Knowledge of outcomes and associated factors among infants who receive CPR in the NICU or PICU are limited.

Objective: To determine the impact of patient, event, unit, and hospital factors on death prior to discharge among infants who receive CPR.

Design/Methods: Retrospective observational study using the American Heart Association's Get With The Guidelines-Resuscitation registry (n=133 sites: NICU=108, PICU=94). Inclusion criteria: index CPR events (>1 minute) in infants in the NICU or PICU. Exclusion criteria: delivery room events, infants with cardiac malformations, and those without hospital level data. Characteristics were compared between infants who did and did not die prior to discharge. Variables which differed significantly between groups and those previously associated with adverse in-hospital outcomes were included in the multivariate model with site as a random effect to account for clustering of outcomes by site. Secondary analyses were stratified by event location: NICU vs PICU.

Results: From 1/1/06 to 12/31/18, there were 3,927 infants with eligible CPR events, 58% (n=2,295) died prior to discharge. (Figure 1) Patient, event, unit, and hospital characteristics differed between groups. (Tables 1 & 2) In the multivariate analysis, intubation during a CPR event had the largest association with survival to discharge, whereas receipt of a vasoactive agent prior to the event, presence of a pulse prior to developing pulselessness, and an event in the NICU were associated with death prior to discharge. (Figure 2) The significance of an invasive airway prior to the event, initial condition (pulselessness vs pulse prior to pulselessness), and the availability of pediatric cardiology services in the hospital on death prior to discharge differed between the NICU and PICU.

Conclusion(s): Infants who receive CPR in the NICU or PICU experience high mortality rates. Patient pre-event and event characteristics reflective of increased acuity and intervention were associated with worse outcomes. Infants in the NICU had a four-fold higher odds of death prior to discharge after CPR compared with infants in the PICU. Further investigation is needed to understand the association between setting and survival.

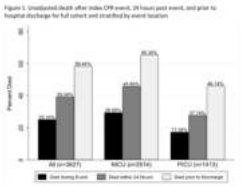

Figure 1. Unadjusted death after index CPR event, 24 hours post event, and prior to hospital discharge for full cohort and stratified by event location

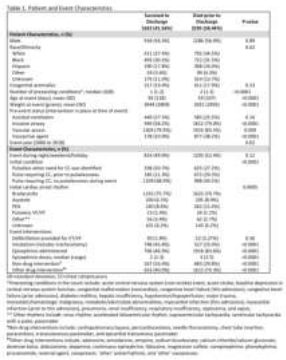

Table 1. Patient and Event Characteristics

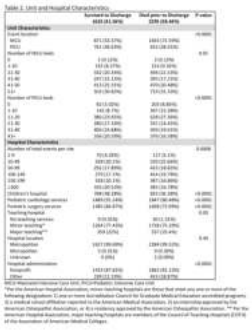

Table 2. Unit and Hospital Characteristics

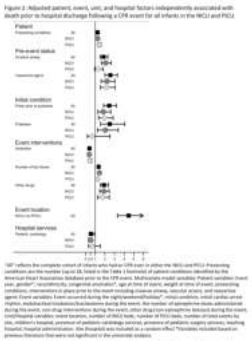

Figure 2: Adjusted patient, event, unit, and hospital factors independently associated with death prior to hospital discharge following a CPR event for all infants in the NICU and PICU.

IMAGE CAPTION:

Figure 1. Unadjusted death after index CPR event, 24 hours post event, and prior to

hospital discharge for full cohort and stratified by event location

Table 1. Patient and Event Characteristics

Table 2. Unit and Hospital Characteristics

Figure 2: Adjusted patient, event, unit, and hospital factors independently associated with death prior to hospital discharge following a CPR event for all infants in the NICU and PICU.

CONTROL ID: 3381150

TITLE: Cumulative Cost of Clinician-Driven Tests and Treatments in Preterm Infants

PRESENTER: Brian King

AUTHORS (LAST NAME, FIRST NAME): King, Brian[7]; Richardson, Troy[1]; Bamat, Nicolas A.[2]; Hall, Matt[1]; Lee, Henry[3]; Patel, Ravi M.[4]; Patrick, Stephen W.[5]; Slaughter, Jonathan L.[6]

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J.L. Slaughter, College of Medicine Dept of Pediatrics and College of Public Health Division of Epidemiology, Nationwide Children's Hospital/The Ohio State University, Columbus, Ohio, UNITED STATES;
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CURRENT CATEGORY: Neonatology

CURRENT SUBCATEGORY: Neonatal Epidemiology, Health Services Research

KEYWORDS: Value, Cost .

SESSION TITLE: Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation |Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation

SESSION TYPE: Oral Poster Symposia|Webinar

ABSTRACT BODY:

Background: Reducing overutilization of low-value care has been an area of increasing focus over the last decade. There is limited information about which clinician-driven tests and treatments (CTTs) are the primary cost-drivers during the birth hospitalization for preterm infants. Identifying these CTTs could guide comparative effectiveness research and quality improvement efforts aimed at improving the value of neonatal care.

Objective: To estimate the cumulative cost of CTTs during the birth hospitalization for preterm infants and identify the primary cost-drivers during resource intensive days.

Design/Methods: Retrospective cohort of preterm infants (birthweight <1500 g or <32 weeks' gestation) with birth hospitalizations between 2012-2018, using the Pediatric Health Information System (PHIS) database, an inpatient billing database of United States children's hospitals. Infants with serious congenital anomalies and outborn infants transferred after one day of life were excluded. Costs were estimated from cost-to-charge ratios, and inflated to 2018 dollars. CTTs were defined as all daily laboratory, pharmaceutical and imaging billing codes, and classified into clinically relevant categories, and ranked by cumulative cost. CTT categories were further classified as "high cost" (>$200) and "low cost" (<$200) based on mean cost per day. Resource intensive days were defined as days with the top 10% of CTT-related spending.

Results: 24,099 infants from 51 hospitals were included in the cohort. Total estimated costs from CTTs were $450 million. Pharmaceuticals accounted for the majority of costs ($271M, 60%), followed by laboratory ($119M, 27%) and imaging tests ($59M, 13%). Parenteral nutrition, blood gases and chest x-rays were the most costly CTTs in their respective groups (Tables 1-3). Resource intensive days accounted for 57% of total CTT costs, and 48% of that was attributed to low cost CTT's (Figure 1).

Conclusion(s): In a cohort of preterm infants admitted to US children's hospitals over half of CTT-related costs occurred during 10% of hospital days, and approximately half of that spending was from tests and treatments with low daily cost, but high exposure. Our data suggest targeted efforts to improve value in neonatal care may benefit most from focusing on reducing overuse of commonly used tests and treatments. Further study is needed to assess the relationship between resource utilization and neonatal outcomes to identify targets for comparative effectiveness research.

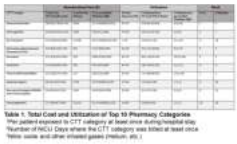

Table 1. Total Cost and Utilization of Top 10 Pharmacy Categories
*Per patient exposed to CTT category at least once during hospital stay
†Number of NICU Days where the CTT category was billed at least once
‡Nitric oxide and other inhaled gases (Helium, etc.)

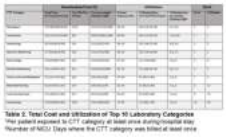

Table 2. Total Cost and Utilization of Top 10 Laboratory Categories
*Per patient exposed to CTT category at least once during hospital stay
†Number of NICU Days where the CTT category was billed at least once

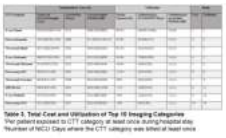

Table 3. Total Cost and Utilization of Top 10 Imaging Categories
*Per patient exposed to CTT category at least once during hospital stay
†Number of NICU Days where the CTT category was billed at least once

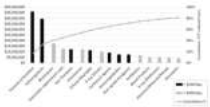

Figure 1. CTT Categories contributing the greatest portion of CTT-related costs on resource intensive NICU days

IMAGE CAPTION:

CONTROL ID: 3373871

TITLE: Health Care Costs of Major Morbidities associated with Prematurity in United States Children's Hospitals

PRESENTER: Kuan-Chi Lai

AUTHORS (LAST NAME, FIRST NAME): Lai, Kuan-Chi[1]; Lorch, Scott[1]

AUTHORS/INSTITUTIONS: K. Lai, S. Lorch, Pediatrics, The Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, UNITED STATES;

CURRENT CATEGORY: Neonatology

CURRENT SUBCATEGORY: Neonatal Epidemiology, Health Services Research

KEYWORDS: costs, bronchopulmonary dysplasia, quantile regression.

SESSION TITLE: Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation |Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation

SESSION TYPE: Webinar|Oral Poster Symposia

ABSTRACT BODY:

Background: Bronchopulmonary dysplasia (BPD), intraventricular hemorrhage (IVH), and retinopathy of prematurity (ROP) are major morbidities in preterm infants, and previous studies have found BPD to be the most significant cost burden compared to other complications associated with prematurity. However, these studies were single-center cohorts and/or from more than a decade ago. Costs in the setting of contemporary management changes are unknown.

Objective: To analyze costs of severe BPD (sBPD), severe IVH (sIVH), and severe ROP (sROP) from a contemporary cohort of large children's hospitals in the US.

Design/Methods: A retrospective cohort of preterm infants [gestational age (GA) 24-32 weeks with birth weight 500-2500g] admitted in the first 3 days of life in 2007-2018 who survived to 36 weeks postmenstrual age (PMA) or discharged home after 34 weeks PMA from hospitals participating in the Pediatric Health Information System was identified. Additional eligibility criteria are described in Table 1. Daily charges were adjusted by hospital geographical price/wage index, converted to costs using service-specific ratios of costs to charges for each hospital and year, then inflated to 2018 US$ using consumer price index, and accumulated for the initial hospitalization. Quantile regression was employed to examine morbidities costs across different total costs quantiles.

Results: 33,244 infants from 13 hospitals were eligible for analysis. Table 1 describes the cohort characteristics. Costs were higher in lower GA, and the costs associated with having each morbidity were higher ($p<0.001$) within each GA category (Figure 1A-1C). For example, in GA 25-26 weeks, median costs of sBPD were $478,390 vs. $287,710 in those without sBPD. Costs were also higher ($p<0.001$) with each additional morbidity (Figure 1D). In the fully adjusted median regression model (Table 2), sBPD had incremental costs of $33,354, sIVH $11,186, and sROP $11,760. Quantile process plots (Figure 2A-2C) show that sBPD had similar incremental costs from 40th-60th %tile, but started to have rising incremental costs after 60th %tile of the total costs. sIVH and sROP had relatively stable incremental costs across wider ranges of total costs.

Conclusion(s): sBPD remains the most costly morbidity in preterm infants and likely the contributing morbidity for increased costs, whereas sIVH and sROP do not contribute a greater effect as the total costs increase. Additional studies in characterizing resources used in sBPD may help to identify a cost saving strategy.

PATIENTS[a]	
TOTAL	33244 (100.0%)
sBPD[b]	3316 (10.0%)
sIVH[c]	1347 (4.1%)
sROP[d]	878 (2.6%)
Gestational age	
24 weeks	1449 (4.4%)
25-26 weeks	4342 (13.1%)
27-28 weeks	6096 (18.3%)
29-30 weeks	8037 (24.2%)
31-32 weeks	13320 (40.1%)
Birth weight	
500-749g	3123 (9.4%)
750-999g	5630 (16.9%)
1000-1499g	12294 (37.0%)
1500-1999g	9772 (29.4%)
2000-2499g	2425 (7.3%)
Gender	
Male	17697 (53.2%)
Female	15547 (46.8%)
Race/Ethnicity	
Non-Hispanic White	12750 (38.4%)
Non-Hispanic Black	5123 (15.4%)
Hispanic	3548 (10.7%)
Other/Unknown	11823 (35.6%)
Multiple gestation	7324 (21.7%)
Major congenital anomaly	6459 (19.4%)
Age at first admission	
0 DOL	31571 (95.0%)
1 DOL	1321 (4.0%)
2 DOL	205 (0.6%)
3 DOL	147 (0.4%)
Length of Stay, days (IQR)	52 (33-82)
Mechanical ventilation, days (IQR)	1 (0-7)

HOSPITALS[a]	
TOTAL	13 (100%)
Region	
Northeast	2 (15.4%)
Midwest	6 (46.2%)
South	3 (23.2%)
West	2 (15.4%)
Number of NICU Beds	
< 60	3 (23.1%)
60-79	4 (30.8%)
>= 80	6 (46.2%)
Associated with a NRN Center	
Yes	3 (23.1%)
No	10 (76.9%)
Has NPM Fellowship	
Yes	11 (84.6%)
No	2 (15.4%)
MSA population	
< 1 million	2 (15.4%)
1-3 million	8 (61.5%)
> 3 million	3 (23.1%)

[a] Hospitals that admitted fewer than 5 infants without major congenital anomalies in each GA category (24-26, 27-28, 29-30, 31-32) per year were excluded. Hospitals and patients without billing records were also excluded.

[b] sBPD was defined as need for at least 4 days of positive pressure ventilation and/or mechanical ventilation during the 35th week PMA, using daily respiratory services charges.

[c] sIVH was defined as grade III/IV from the International Classification of Diseases, Ninth Revision and Tenth Revision, Clinical Modification (ICD-9-CM and ICD-10-CM) codes.

[d] sROP was defined as ROP needing surgery (identified from ICD-9 and ICD-10 Procedure Codes) or anti-VEGF therapy (identified from daily pharmacy charges).

Note: IQR = interquartile range, NRN = Neonatal Research Network, NPM = neonatal-perinatal medicine, MSA = metropolitan statistical area.

Table 1: Patient and Hospital Characteristics

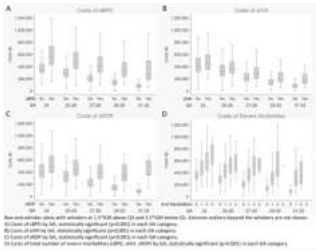

Figure 1: Distribution of Costs by Gestational Age

	Adjusted by Hospital		Adjusted by Hospital and All Covariates	
Covariates	Coefficient (95% CI)	p value	Coefficient (95% CI)	p value
sBPD (ref: no)	295417 (287890, 302915)	<0.001	33354 (30554, 36152)	<0.001
sIVH (ref: no)	193353 (181184, 203522)	<0.001	11186 (8159, 14213)	<0.001
sROP (ref: no)	303679 (288800, 318558)	<0.001	11760 (5807, 17713)	<0.001
Gestational age (ref: 31-32 weeks)		<0.001		<0.001
24 weeks	329165 (319748, 338582)		5912 (1700, 10124)	
25-26 weeks	285117 (231115, 299120)		1228 (-1303, 3758)	
27-28 weeks	129066 (127613, 132359)		-1963 (-3485, -440)	
29-30 weeks	54812 (52798, 56626)		-2959 (-3935, -1984)	
Birth weight (ref: 2000-2499g)		<0.001		<0.001
500-749g	298795 (292574, 305015)		1181 (-1508, 3870)	
750-999g	191368 (187759, 194976)		-1177 (-3193, 840)	
1000-1499g	74979 (72367, 77591)		-2518 (-3639, -396)	
1500-1999g	14977 (12856, 17098)		-1901 (-3007, -803)	
Male Gender (ref: Female)	4561 (1582, 7541)	0.003	-13 (-615, 589)	0.965
Race/Ethnicity (ref: non-Hispanic White)		<0.001		<0.001
Non-Hispanic Black	9908 (5085, 14731)		1941 (1025, 2857)	
Hispanic	3330 (-2527, 8187)		497 (-619, 1613)	
Other/Unknown	-9635 (-12803, -6466)		1691 (884, 2497)	
Multiple gestation (ref: singleton)	-14026 (-17587, -10464)	<0.001	211 (-581, 1004)	0.601
Major congenital anomaly (ref: not present)	108434 (103094, 113774)	<0.001	6813 (5750, 7876)	<0.001
Age at first admission (ref: 0 DOL)		<0.001		0.013
1 DOL	34229 (29823, 44637)		1485 (-401, 3372)	
2-3 DOL	35423 (15861, 54985)		4836 (910, 8762)	
Length of Stay (days)	3447 (3427, 3467)	<0.001	2925 (2893, 2957)	<0.001
Mechanical ventilation (days)	5163 (5074, 5253)	<0.001	1035 (980, 1091)	<0.001

Table 2: Median Regression of Costs

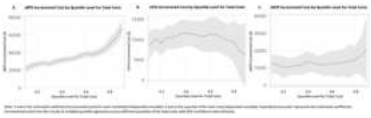

Figure 2: Quantile Process Plots for sBPD, sIVH, sROP

IMAGE CAPTION:
Table 1: Patient and Hospital Characteristics

Figure 1: Distribution of Costs by Gestational Age

Table 2: Median Regression of Costs

Figure 2: Quantile Process Plots for sBPD, sIVH, sROP

CONTROL ID: 3370757

TITLE: Evaluating Care in Safety Net Hospitals: Clinical Outcomes and NICU Quality of Care in California

PRESENTER: Emily M Pang

AUTHORS (LAST NAME, FIRST NAME): Pang, Emily M.[1]; Liu, Jessica[2]; Iacob, Alexandra[5]; Govindaswami, Balaji[6]; Simonian, Aida[3]; Bain, Lisa C.[1]; Profit, Jochen[4]

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CURRENT CATEGORY: Neonatology

CURRENT SUBCATEGORY: Neonatal-Perinatal Health Care Delivery: Quality Improvement

KEYWORDS: disparities, VLBW, quality improvement.

SESSION TITLE: Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation |Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation

SESSION TYPE: Oral Poster Symposia|Webinar

ABSTRACT BODY:

Background: The factors that underlie racial and ethnic disparities in care and outcomes among very low birth weight (VLBW; ≤ 1,500 grams) infants remain unclear. Site of care may be a key driver of disparities due to variations in hospital performance and quality of care. This study examines the characteristics of NICUs from safety net and non-safety net hospitals in California (CA) and the extent to which site of care is associated with racial/ethnic disparities.

Design/Methods: We studied 24,799 VLBW infants born at 139 CA hospitals from 2014-2018. Safety net hospitals were identified by starting with a list of county and public hospitals and narrowing down to those with >75% of patients on Medi-Cal (CA's Medicaid program) and sufficient numbers of VLBW infants through linkage to the California Maternal/Perinatal Quality Care Collaborative (CMQCC/CPQCC) databases. Public hospitals, defined in this study as the University of California hospital systems, were analyzed separately from county safety net hospitals. We examined

distribution of births by race/ethnicity across hospital types using the Kolmogorov-Smirnov test to compare Hispanic, Non-Hispanic Black, Asian/Pacific Islander, Other Race/Ethnicity, and All Minorities to Non-Hispanic White VLBW infants. We calculated risk adjusted rates of survival without major morbidity and infant mortality and compared quality of care using Baby-MONITOR scores, a composite indicator of NICU quality.

Results: We found significant differences in the distributions across safety net and non-safety net hospitals. Safety net hospitals care for higher concentrations of non-White infants, in particular non-Hispanic Black and Hispanic patients [Table 1]. Despite their higher concentration of Medi-Cal patients, safety net hospitals performed similarly in evaluations of NICU quality of care and infant survival without major morbidity compared to public hospitals and other non-safety net hospitals [Table 2; Figure 1a-b]. However, there was a small but significant difference in risk-adjusted infant mortality rates between safety net 7.2[6.4-8.1] per 100 infants) and other non-safety net CPQCC hospitals (5.8[5.4-6.2] per 100 infants) [Table 2; Figure 2]. This difference was driven by higher mortality rates in a small subset of safety net hospitals.

Conclusion(s): In California, birth in safety net hospitals is not associated with racial/ethnic disparities in quality of care or survival without major morbidity, but with an increase in neonatal mortality rate among non-White infants.

Table 1 – Distribution of births by race/ethnicity across hospital type

Race/Ethnicity n(%)	Safety Net Hospitals (n=19)	Public Hospitals (n=5)	Other CPQCC Hospitals (n=115)	p-value[a]
Non-Hispanic White	529 (9)	527 (9)	4867 (82)	
Hispanic	2457 (24)	471 (5)	7325 (71)	<.001
Non-Hispanic Black	513 (17)	133 (4)	2340 (78)	<.001
Asian/Pacific Islander	191 (6)	171 (5)	2760 (88)	<.001
Other	77 (11)	80 (11)	561 (78)	0.25
All Minorities	3238 (19)	855 (5)	12986 (76)	<.001

a. Kolmogorov-Smirnov test to test differences in racial/ethnic distribution across hospital types; each minority is tested against NH Whites

Table 2 – Quality scores and adjusted risk outcomes across hospital types

Outcome	Safety Net Hospitals (n=19) Adj Rate (95% CI)	Public Hospitals (n=5) Adj Rate (95% CI)	Other CPQCC Hospitals (n=115) Adj Rate (95% CI)	p-value[a]
Baby Monitor quality score[b]	-0.38 (1.2)	-0.34 (1.8)	-0.02 (1.1)	0.39
Survival without major morbidity	66.7 (64.0-69.5)	69.5 (64.9-74.4)	67.6 (66.4-68.9)	0.56
Infant mortality	7.2 (6.4-8.1)	6.8 (5.6-8.1)	5.8 (5.4-6.2)	<.001

a. ANOVA test for equal means across hospital type
b. Baby Monitor scores are represented as mean z-score (sd)

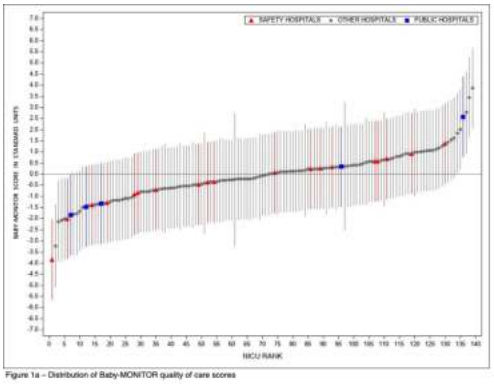

Figure 1a – Distribution of Baby-MONITOR quality of care scores

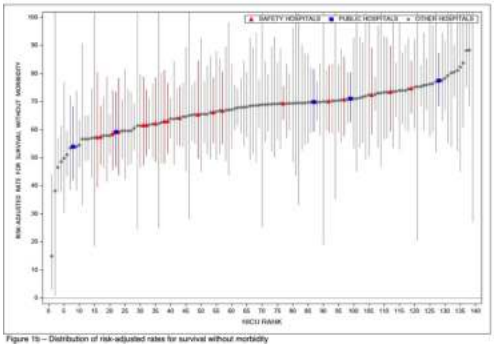

Figure 1b – Distribution of risk-adjusted rates for survival without morbidity

Figure 1a-1b

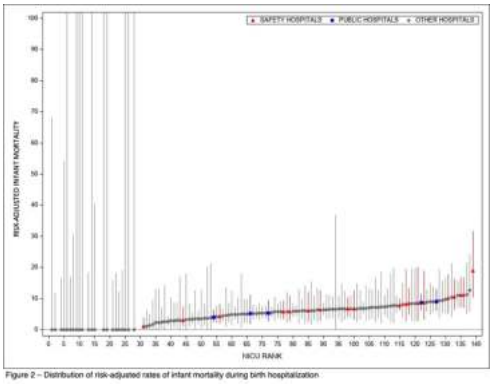

Figure 2

IMAGE CAPTION:

Figure 1a-1b

Figure 2

CONTROL ID: 3379633

TITLE: Everyday executive functioning of a national cohort of adults born very low birth weight

PRESENTER: Alice Hyun Min Kim

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CURRENT SUBCATEGORY: Neonatal Epidemiology, Health Services Research

KEYWORDS: Very Low Birth Weight, Executive Function, Brief-A.

SESSION TITLE: Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation |Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation

SESSION TYPE: Oral Poster Symposia|Webinar

ABSTRACT BODY:

Background: Executive difficulties are common amongst children born very preterm, but very little is known about whether these problems persist into adulthood.

Objective: To examine the trajectories of self-reported executive abilities of a national cohort of adults born very low birth weight (VLBW).

Design/Methods: All infants born VLBW (< 1500g) in New Zealand during 1986 were recruited (n = 413) with 250 (77% of 323 survivors) followed to age 28 years. At age 22 years, a full-term (FT) born comparison group (n = 100) was recruited from the national electoral roll and through peer nomination. Self-evaluations of executive functioning (EF) were measured repeatedly at 22 years (n = 230) (VLBW mean age = 22.4, SD = 0.5) and at 28 years (VLBW mean age = 28.5, SD = 1.1). The Brief-A clinical cut-off (standardized T score ≥ 65) was used to examine between group differences in the proportion of individuals presenting with clinical EF difficulties. The trajectories of self-reported EF outcomes in both groups from age 22 to 28 years were analyzed using Generalized Estimating Equations.

Results: At age 22-28 years, the mean Brief-A composite scores were not statistically different between groups (Table 1), although VLBW adults scored more frequently in the poorer/lower score range at both age assessments (Figures 1 and 2). At both assessments, VLBW adults had higher odds of experiencing clinical EF difficulties (OR: 4.6, 95% CI: 1.5, 11.5) compared to their FT born peers (Table 2). However, both groups had lower odds of presenting clinical executive difficulties at age 28 (OR: 0.4, 95% CI: 0.2, 0.9) than age 22. In an extended model with the interaction term for group and age, no group-specific effect was detected in the change in scores across the two time points (OR: 0.4, 95 %CI: 0.05, 2.7).

Conclusion(s): Executive difficulties persist into adulthood for VLBW survivors, raising concerns about impacts on everyday activities such as driving. But findings also suggest some reduction in the proportions of executive impairment from age 22 to 28 for both groups, suggestive of potential improvement in the perceived everyday executive functioning with increasing maturity.

Table 1: Group Mean Differences in Brief-A Standardized T Scores at 22-Year and 28-Year

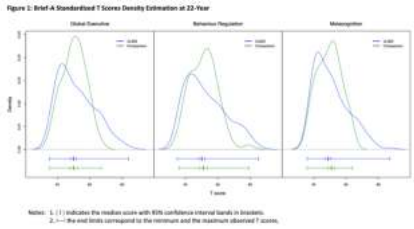
Brief-A Composite	22-Year Mean (SD)		Mean Difference (95% CI)	P	28-Year Mean (SD)		Mean Difference (95% CI)	P
	VLBW (n = 230)	Comparison (n = 88)			VLBW (n = 250)	Comparison (n = 100)		
Behavior Regulation	52.9 (12.5)	51.7 (9.3)	1.2 (-2.0, 4.4)	0.45	49.9 (11.1)	51.2 (9.1)	-1.4 (-3.8, 1.1)	0.27
Metacognition	51.0 (10.5)	50.1 (8.0)	0.9 (-1.8, 3.6)	0.49	48.6 (9.5)	48.3 (7.7)	0.4 (-1.8, 2.5)	0.74
Global Executive	52.0 (11.4)	50.8 (8.2)	1.2 (-1.7, 4.1)	0.40	49.1 (10.1)	49.6 (7.7)	-0.5 (-2.7, 1.8)	0.68

Table 2: Generalized Estimating Equations Coefficient Estimates

Coefficient	OR (95% CI)	P
Intercept[1]	0.05 (0.02, 0.1)	< 0.001
Group – Comparison	Reference	-
Group – VLBW[1]	4.6 (1.5, 11.5)	0.002
Time – 22-Year	Reference	-
Time – 28-Year[1]	0.4 (0.2, 0.9)	0.021
Group x Time Interaction[2]	0.4 (0.05, 2.7)	0.31

[1]. Coefficient estimates from Model 1: Clinical Global Executive Function ~ Group + Time
[2]. Coefficient estimate from Model 2: Clinical Global Executive Function ~ Group + Time + Group:Time

Figure 1: Brief-A Standardized T Scores Density Estimation at 22-Year



Notes: 1. ( ) indicates the median score with 95% confidence interval bands in brackets.
2. ---- the end limits correspond to the minimum and the maximum observed T scores.

Figure 2: Brief-A Standardized T Scores Density Estimation at 28-Year

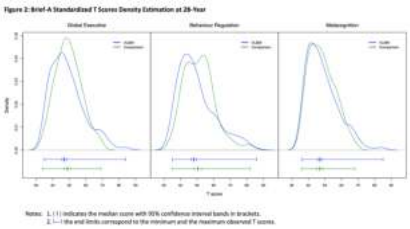


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IMAGE CAPTION:
Table 1: Group Mean Differences in Brief-A Standardized T Scores at 22-Year and 28-Year

Table 2: Generalized Estimating Equations Coefficient Estimates

Figure 1: Brief-A Standardized T Scores Density Estimation at 22-Year

Figure 2: Brief-A Standardized T Scores Density Estimation at 28-Year

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CONTROL ID: 3376273

TITLE: Association between gestational age at birth and neurodevelopmental disorders in children: a population-based cohort study in Taiwan

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CURRENT SUBCATEGORY: Neonatal Epidemiology, Health Services Research

KEYWORDS: preterm, ADHD, autism.

SESSION TITLE: Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation |Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation

SESSION TYPE: Oral Poster Symposia|Webinar

ABSTRACT BODY:

Background: The association between preterm birth and the risk of long-term neurodevelopmental disorders has been observed in European and American studies. However, there are few similar large-scale studies in Asian populations, and only few studies have controlled for the unmeasured genetic and environmental factors.

Objective: To investigate the association between gestational age (GA) at birth and the risk of ADHD and ASD in a large longitudinal cohort with a sibling comparison model to control for unmeasured factors.

Design/Methods: This was a population-based cohort study using health and welfare databases in Taiwan. Participants were singleton live-birth children born in Taiwan between 2004 and 2009 (N=1,047,381) (**Figure 1**). The data analysis was performed between January and December 2019. We divided GA at birth into seven categories: extremely preterm (EP: < 28 weeks), very preterm (VP: 28-31 weeks), moderate or late preterm (MLP: 32-36 weeks), early term (ET: 37-38 weeks), full term (FT: 39-40 weeks), late term (LT: 41 weeks) and postterm (PT: >42 weeks). We defined ADHD and ASD by two ambulatory visits with certain ICD-9 codes. Cox proportional hazards regression was performed, controlling for children's birth year, sex, parental age, small for GA status, cesarean delivery, 5-minute Apgar score <7, immigrant maternal status, maternal diabetes during pregnancy, maternal hypertensive disorders during pregnancy, parental psychiatric history and socioeconomic factors. The associations were also analyzed by using stratified Cox models in sibling cohort.

Results: The overall incidence rates of ADHD and ASD were 6.18% and 1%, respectively. Children with early GA had a significantly increased risk of ADHD and ASD compared with FT children. Clinical characteristics of the study population were summarized in **Table 1**. The adjusted hazard ratio (aHR) of ADHD was 2.61 (95% CI=2.24-3.03) in EP, 1.71 (95% CI=1.55-1.87) in VP, and 1.15 (95% CI=1.12-1.19) in MLP. The aHR of ASD was 1.86 (95% CI=1.24-2.78) in EP, 1.56 (95% CI=1.23-1.97) in VP, and 1.16 (95% CI=1.08-1.26) in MLP (**Figure 2**). However, in the sibling comparison model, the association between preterm birth and ASD was attenuated (**Figure3).**

Conclusion(s): Our findings suggest that early GA at birth is associated with an increased risk of ADHD and ASD in children. Health care professionals should provide comprehensive developmental screening and prompt early intervention programs for preterm children to mitigate impairment in later life.

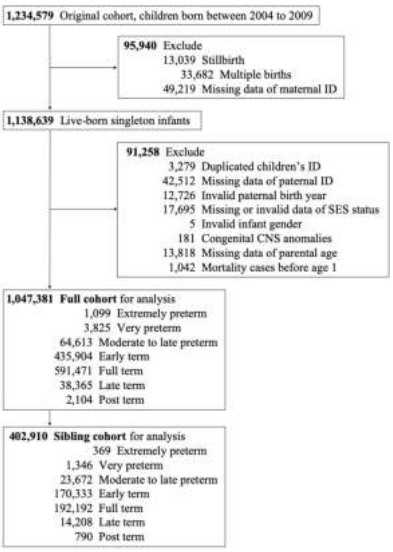

Figure 1. Flow chart of the study population.

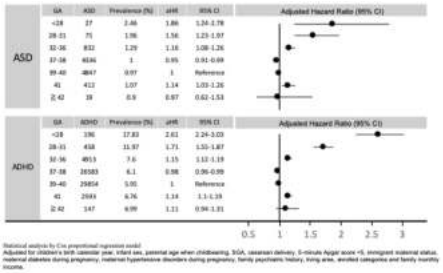

Figure 2. Association between gestational age at birth and offspring ASD and ADHD risk in the full cohort.

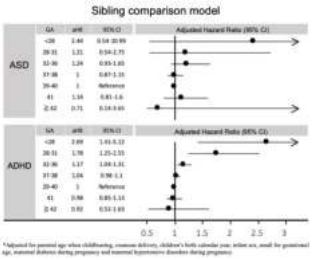

Figure 3. Association between gestational age at birth and offspring ASD and ADHD risk in the sibling cohort.

Table 1. Clinical characteristics of the study population.

Variables	Extremely preterm (EP)	Very preterm (VP)	Moderate to late preterm (MLP)	Early term (ET)	Full-term (FT)	Late term (LT)	Post-term (PT)
GA at birth	<28 weeks	28-31 weeks	32-36 weeks	37-38 weeks	39-40 weeks	41 weeks	≥ 42 weeks
n	N=1099	N=3825	N=64613	N=435904	N=501471	N=38365	N=2104
Maternal age, <25y	147 (13.4)	566 (14.8)	9313 (14.4)	60281 (13.8)	80154 (16)	6677 (17.4)	452 (21.5)
25-34y	727 (66.1)	2407 (62.9)	44040 (68.2)	307206 (70.5)	361620 (72.2)	27326 (71.2)	1402 (66.6)
≥ 35y	225 (20.5)	852 (22.3)	11260 (17.4)	68415(15.7)	59697 (11.9)	4362 (11.4)	250 (11.9)
Paternal age, <25y	44 (4)	181 (4.7)	2798 (4.3)	16668 (3.8)	21699 (4.3)	1767 (4.6)	117 (5.6)
25-34y	628 (57.1)	2042 (53.4)	37818 (58.2)	250633 (59.6)	311959 (62.2)	23473 (61.2)	1155 (54.9)
≥ 35y	427 (38.9)	1602 (41.9)	24197 (37.5)	158273 (36.6)	167914 (33.5)	13125 (34.2)	832 (39.5)
Maternal morbidities during pregnancy							
Diabetes	12 (1.1)	103 (2.7)	1251 (1.9)	2589 (0.6)	2437 (0.5)	129 (0.3)	7 (0.3)
HTD	74 (6.7)	505 (13.2)	3002 (4.6)	4385 (1)	2490 (0.5)	158 (0.4)	10 (0.5)
Other perinatal factors							
AS (5 mins) <7	461 (41.9)	478 (12.5)	588 (0.9)	485 (0.1)	663 (0.1)	77 (0.2)	8 (0.4)
Cesarean delivery	482 (43.9)	2066 (54)	27945 (43.2)	189989 (43.6)	113312 (22.6)	10852 (28.3)	718 (34.1)
SGA	59 (5.4)	508 (13.3)	5788 (9)	26534 (6.7)	50145 (10)	3950 (10.3)	217 (10.3)
Male	582 (53)	2223 (58.1)	37324 (57.8)	237933 (54.6)	251285 (50.1)	17971 (46.8)	1019 (48.4)
Immigrant mother	77 (7)	289 (7.6)	5638 (8.7)	42329 (9.7)	60357 (12)	5776 (15.1)	535 (25.4)
Parents' psychiatric history	8 (0.7)	18 (0.5)	347 (0.5)	1845 (0.4)	1997 (0.4)	165 (0.4)	12 (0.6)
Socioeconomical status							
Living area, urban	594 (54)	2202 (57.6)	37838 (58.6)	250584 (57.5)	281213 (56.1)	20924 (53.5)	1205 (57.3)
rural	373 (33.9)	1204 (31.4)	19547 (30.3)	135256 (31.2)	165598 (32.9)	13934 (36.3)	703 (33.4)
Enrollee category							
EC 1	65 (5.9)	250 (6.5)	3918 (6.1)	28876 (6.6)	33412 (6.7)	2276 (6)	88 (4.2)
EC 2	674 (61.3)	2197 (57.4)	38614 (59.8)	266288 (61.1)	314070 (62.6)	23302 (60.7)	1025 (48.7)
EC 3	230 (20.9)	854 (22.3)	14268 (22.1)	94413 (21.7)	102132 (20.4)	8326 (21.7)	610 (29)
EC 4	130 (11.8)	524 (13.6)	7623 (12)	46327 (10.6)	51857 (10.3)	4459 (11.6)	381 (18.1)
Monthly income							
<20,000 NTD	429 (38.2)	1510 (39.5)	24866 (38.5)	159925 (36.7)	180714 (36)	14629 (38.9)	1065 (50.6)
>40,000 NTD	239 (21.8)	798 (20.8)	12540 (19.4)	89826 (20.6)	106099 (21.2)	7627 (19.9)	282 (13.4)

Data are presented as number (%). Abbreviations: HTD, hypertensive disorder; AS, Apgar scores; SGA, small for gestational age; EC, enrollee category; NTD, new Taiwan dollar.

IMAGE CAPTION:
Figure 1. Flow chart of the study population.

Figure 2. Association between gestational age at birth and offspring ASD and ADHD risk in the full cohort.

Figure 3. Association between gestational age at birth and offspring ASD and ADHD risk in the sibling cohort.

CONTROL ID: 3376095

TITLE: Outcomes of Outborn Very-Low-Birth-Weight Infants: A Propensity Score-Matched Analysis using Neonatal Research Network of Japan Database

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CURRENT CATEGORY: Neonatology

CURRENT SUBCATEGORY: Neonatal-Perinatal Health Care Delivery: Epidemiology/Health Services Research

KEYWORDS: Neonatal transport, Neonatal transfer, very low birth weight infant.

SESSION TITLE: Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation |Neo-Perinatal Care Delivery: Epi/HSR - So Much Variation

SESSION TYPE: Oral Poster Symposia|Webinar

ABSTRACT BODY:
Background: Progress in perinatal management and centralization of perinatal care have improved outcomes in preterm infants. However, complications associated with premature birth still exist; in particular, intraventricular hemorrhage (IVH) greatly impacts the outcome of very-low-birth-weight infants (VLBWIs). Several studies have revealed that outborn birth and interhospital transport are risk factors for IVH in VLBWIs. However, there are limitations in the statistical methodologies of previous studies because perinatal characteristics are significantly different between inborn and outborn preterm neonates.

Objective: To compare the risk of morbidities and mortalities between outborn and propensity score (PS)-matched inborn VLBWIs.

Design/Methods: Singleton VLBWIs registered in the Neonatal Research Network Japan database with no major anomalies who were admitted to a neonatal intensive care unit between 2012 and 2016 were included. Outborn infants were restricted to those transported within 3 days of life. 1:1 PS matching was used to reduce imbalances in prenatal covariates (gestational age [GA], birth weight, small for GA, sex, premature rupture of membranes, chorioamnionitis, preeclampsia, maternal diabetes mellitus, non-reassuring fetus status, antenatal steroids, and cesarean section). Primary outcome was severe IVH. Secondary outcomes were outcomes at resuscitation and other neonatal morbidities and mortality.

Results: The full cohort comprised 16,150 VLBWIs (743 outborns). In the full cohort, outborn VLBWIs had a heavier birth weight (1124 [860–1349] vs. 1042 [758–1295] g, $p<0.001$), but fewer cases of small for GA (20.5% vs. 30.1%, $p<0.001$), premature rupture of membranes (19.4% vs. 30.9%, $p<0.001$), chorioamnionitis (15.3% vs. 20.3%, $p<0.001$), preeclampsia (15.7% vs. 27.6%, $p<0.001$), maternal diabetes mellitus (2.2% vs. 4.7%, $p=0.001$), antenatal steroids (17.6% vs. 60.5%, $p<0.001$), and cesarean section (49.4% vs. 79.4%, $p<0.001$). Analysis of 743 pairs in the PS-matched cohort showed that outborn VLBWIs had a lower 5-min Apgar score (7 [5–9] vs. 8 [6–9], $p=0.02$) and more cases of intubation at delivery (OR, 1.45; 95% CI, 1.16–1.82) and surfactant treatment (OR, 1.38; 95% CI, 1.09–1.73). Outborn VLBWIs had more cases of severe IVH (OR, 1.55; 95% CI, 1.03–2.36) and IVH of any grade (OR, 1.33; 95% CI, 1.01–1.77).

Conclusion(s): Outborn delivery of VLBWIs was correlated with an increased risk of severe IVH, which may be associated with initial resuscitation and neonatal transport.

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