

Children's Mercy Kansas City

SHARE @ Children's Mercy

Presentations

5-2021

Neurodevelopmental profiles of infants born < 30 weeks' gestation at 2 years of age

Marie Camerota

Elisabeth C. McGowan

Julie A. Hofheimer

T. Michael O'Shea

Brian S. Carter

See next page for additional authors

Follow this and additional works at: <https://scholarlyexchange.childrensmercy.org/presentations>



Part of the **Pediatrics Commons**

Creators

Marie Camerota, Elisabeth C. McGowan, Julie A. Hofheimer, T. Michael O'Shea, Brian S. Carter, Jennifer Helderman, Jennifer Check, Charles R. Neal, Steven L. Pastyrnak, Lynne Smith, Cynthia Loncar, Stephen Sheinkopf, Lynne Dansereau, Sheri A. DellaGrotta, and Barry Lester

Neurodevelopmental profiles of infants born < 30 weeks gestation at 2 years of age

Marie Camerota, PhD

Postdoctoral Research Fellow

Department of Psychiatry and Human Behavior

Alpert Medical School of Brown University

marie_camerota@brown.edu



PAS

2021 VIRTUAL



Disclosure

Funding Sources

- R01 HD072267
- R01 HD084515
- UH3 OD023347
- T32 MH019927

Authors

- Elisabeth C. McGowan MD
- Julie A. Hofheimer PhD
- T. Michael O'Shea MD, MPH
- Brian S. Carter MD
- Jennifer Helderman, MD, MPH
- Jennifer Check, MD, MS
- Charles R. Neal MD, PhD
- Steven L. Pastyrnak PhD
- Lynne M Smith MD
- Cynthia Loncar PhD
- Stephen J. Sheinkopf PhD
- Lynne M. Dansereau, MSPH
- Sheri A. DellaGrotta, MPH
- Barry M. Lester PhD

Marie Camerota

Has documented no financial relationships to disclose or Conflicts of Interest (COIs) to resolve.

Unapproved or Off Label

Disclosures for Marie Camerota

Presenter: [Marie Camerota](#) has documented this presentation ***will not*** involve discussion of unapproved or off-label, experimental or investigational use.

Background

- Survival and medical outcomes for infants born < 30 weeks gestation have improved in recent years
- Infants < 30 weeks are at increased risk for long-term health and developmental problems, including:
 - Deficits in cognitive, motor, and language development
 - Increased incident of mental health disorders (e.g., internalizing, externalizing problems)
 - Increased risk for cerebral palsy (CP) and autism spectrum disorders (ASD)

Background

- Previous studies take an individual variable approach
- “Child-centered” approach describes subgroups of children with similar patterns of behavior or impairment
- Latent profile analysis is one methodology for identifying subgroups of children
 - Captures similarities and differences between people rather than describing relationships among variables

Objective

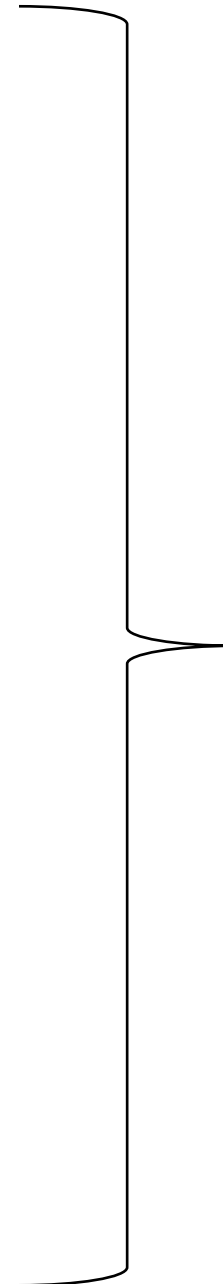
To determine distinct neurodevelopmental profiles in 2 year old children born <30 weeks PMA that include cognitive, language, motor, and behavioral characteristics.

Study Design

Neonatal Neurobehavior and Outcomes in Very Preterm Infants (NOVI) Study

- Infants born < 30 weeks gestational age, without major congenital anomalies
- Recruited from 9 university-affiliated NICUs
- Purpose: Identify predictors of impairment (cognitive, language, behavior) at earliest possible timepoint, through combination of medical risks, neonatal neurobehavior, and DNA methylation

<i>Bayley-III (scaled scores)</i>
Cognitive
Expressive communication
Receptive communication
Fine motor
Gross motor
<i>CBCL syndrome scales (raw scores)</i>
Emotionally reactive
Anxious/depressed
Somatic complaints
Withdrawn
Sleep problems
Attention problems
Aggressive behaviors
<i>Diagnosis/Risk</i>
Cerebral palsy diagnosis
ASD risk, MCHAT-R/F pos screen



**2 Year
Outcome Measures**

Methods

- Of 704 children enrolled in NOVI, 587 (83%) were seen for follow-up at 2 years.
- LPA classified infants into mutually exclusive groups
 - We fitted models with 1 to 5 profiles and compared their fit statistics
- We compared the groups in terms of their mean Bayley and CBCL scores, and incidence of CP and ASD risk.

Results

Sample Characteristics	Full Sample (N = 601)	Included (N = 507)	Excluded (N = 94)	P value
Maternal characteristics				
Maternal education: < HS/GED	13% (79/598)	13% (67/505)	13% (12/93)	0.92
Low SES: Hollingshead = 5	9.9% (59/599)	9.7% (49/506)	11% (10/93)	0.75
Minority race or ethnicity	58% (347/601)	57% (290/507)	61% (57/94)	0.54
No partner	25% (152/600)	26% (131/506)	22% (21/94)	0.47

Sample Characteristics	Full Sample (N = 704)	Included (N = 587)	Excluded (N = 117)	P value
Neonatal characteristics				
Infant gender = Male	56% (388/697)	54% (314/586)	67% (74/111)	0.01
Multiple gestation	26% (184/697)	30% (158/586)	23% (26/111)	0.44
Cesarean delivery	71% (495/696)	70% (408/585)	78% (87/111)	0.07
PMA at Birth (weeks)	27.0 ± 1.92	27.0 ± 1.92	27.0 ± 1.93	0.78
Birth weight (grams)	948.3 ± 280.6	944.7 ± 279.8	967.0 ± 285.4	0.44
Head circumference (cm)	24.5 ± 2.43	24.4 ± 2.40	24.7 ± 2.55	0.34
PMA at Discharge (weeks)	40.5 ± 5.43	40.5 ± 5.40	40.7 ± 5.62	0.67
Length of NICU stay (LOS days)	93.5 ± 41.9	93.8 ± 42.4	91.7 ± 39.7	0.64
Weight at discharge (grams)	3013 ± 905	3007 ± 899	3049 ± 939	0.65
Severe retinopathy of prematurity	5.9% (41/697)	5.6% (33/586)	7.2% (8/111)	0.52
Necrotizing enterocolitis/sepsis	18% (128/697)	18% (107/586)	19% (21/111)	0.87
Chronic lung disease	51% (357/697)	51% (297/586)	54% (60/111)	0.51
Serious brain injury ⁺	13% (92/694)	12% (71/585)	19% (21/109)	0.04

<i>Bayley-III (scaled scores)</i>	Mean	SD	Range	< 1SD (%)	< 2SD (%)
Cognitive	8.41	3.02	1 – 19	25%	6.3%
Expressive communication	7.89	2.86	1 – 17	27%	7.7%
Receptive communication	8.13	2.97	1 – 19	28%	5.2%
Fine motor	9.41	2.82	1 – 18	12%	4.6%
Gross motor	7.98	2.67	1 – 18	20%	7.8%
<i>CBCL syndrome scales (raw scores)</i>	Mean	SD	Range	T ≥ 65 (%)	T ≥ 70 (%)
Emotionally reactive	2.04	2.31	0 – 15	8.6%	2.2%
Anxious/depressed	2.22	2.06	0 – 10	4.1%	1.1%
Somatic complaints	1.72	2.01	0 – 12	10%	3.4%
Withdrawn	1.60	2.10	0 – 14	9.7%	6.5%
Sleep problems	2.55	2.60	0 – 14	5.8%	3.8%
Attention problems	3.12	2.25	0 – 10	16%	10%
Aggressive behaviors	9.04	6.99	0 – 38	7.9%	3.8%
<i>Diagnosis/Risk</i>	%		Range		
Cerebral palsy diagnosis	16%		0 – 1		
ASD risk, MCHAT-R/F pos screen	16%		0 – 1		

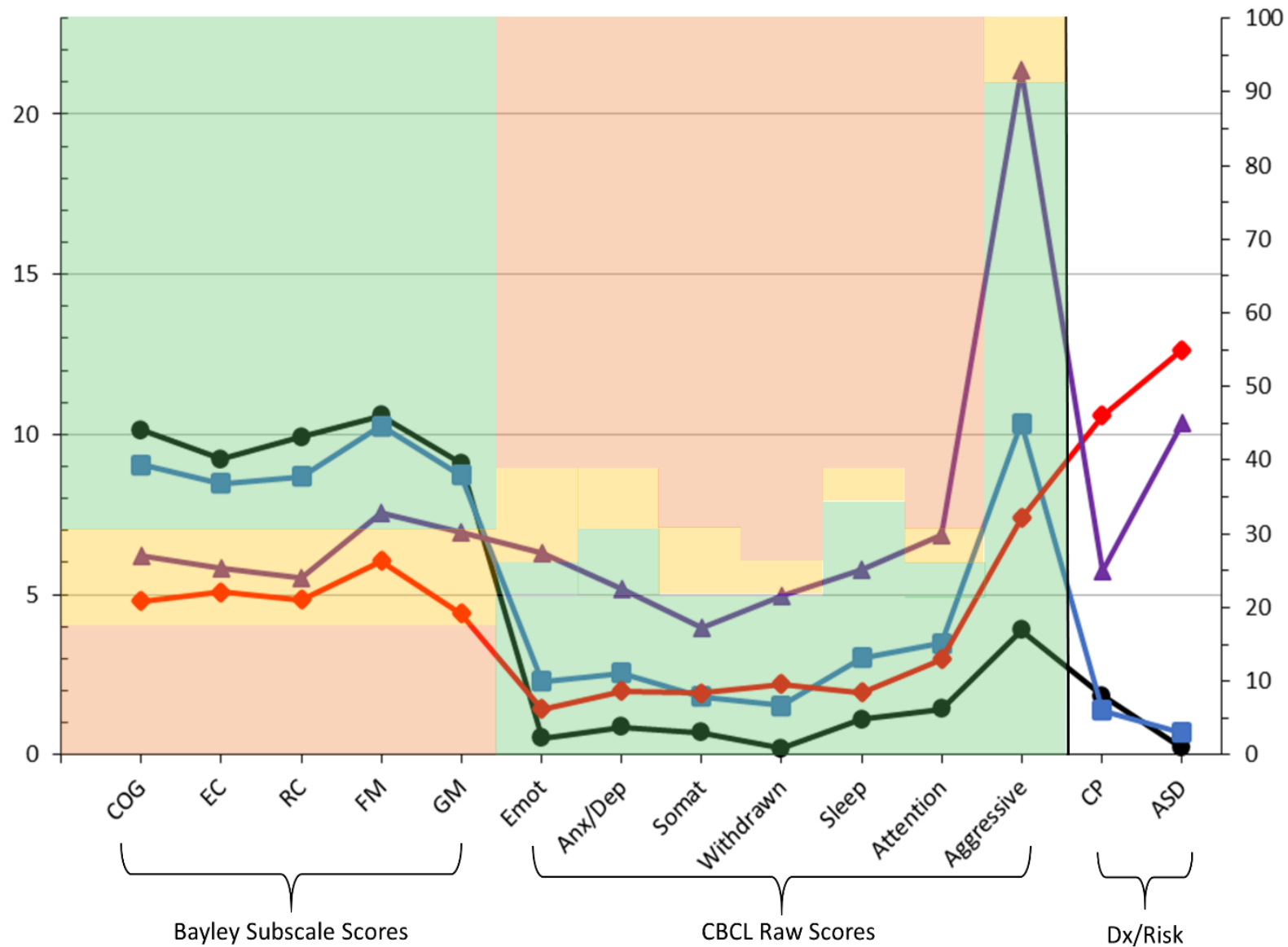
<i>Bayley-III (scaled scores)</i>	Mean	SD	Range	< 1SD (%)	< 2SD (%)
Cognitive	8.41	3.02	1 – 19	25%	6.3%
Expressive communication	7.89	2.86	1 – 17	27%	7.7%
Receptive communication	8.13	2.97	1 – 19	28%	5.2%
Fine motor	9.41	2.82	1 – 18	12%	4.6%
Gross motor	7.98	2.67	1 – 18	20%	7.8%
<i>CBCL syndrome scales (raw scores)</i>	Mean	SD	Range	T ≥ 65 (%)	T ≥ 70 (%)
Emotionally reactive	2.04	2.31	0 – 15	8.6%	2.2%
Anxious/depressed	2.22	2.06	0 – 10	4.1%	1.1%
Somatic complaints	1.72	2.01	0 – 12	10%	3.4%
Withdrawn	1.60	2.10	0 – 14	9.7%	6.5%
Sleep problems	2.55	2.60	0 – 14	5.8%	3.8%
Attention problems	3.12	2.25	0 – 10	16%	10%
Aggressive behaviors	9.04	6.99	0 – 38	7.9%	3.8%
<i>Diagnosis/Risk</i>	%		Range		
Cerebral palsy diagnosis	16%		0 – 1		
ASD risk, MCHAT-R/F pos screen	16%		0 – 1		

<i>Bayley-III (scaled scores)</i>	Mean	SD	Range	< 1SD (%)	< 2SD (%)
Cognitive	8.41	3.02	1 – 19	25%	6.3%
Expressive communication	7.89	2.86	1 – 17	27%	7.7%
Receptive communication	8.13	2.97	1 – 19	28%	5.2%
Fine motor	9.41	2.82	1 – 18	12%	4.6%
Gross motor	7.98	2.67	1 – 18	20%	7.8%
<i>CBCL syndrome scales (raw scores)</i>	Mean	SD	Range	T ≥ 65 (%)	T ≥ 70 (%)
Emotionally reactive	2.04	2.31	0 – 15	8.6%	2.2%
Anxious/depressed	2.22	2.06	0 – 10	4.1%	1.1%
Somatic complaints	1.72	2.01	0 – 12	10%	3.4%
Withdrawn	1.60	2.10	0 – 14	9.7%	6.5%
Sleep problems	2.55	2.60	0 – 14	5.8%	3.8%
Attention problems	3.12	2.25	0 – 10	16%	10%
Aggressive behaviors	9.04	6.99	0 – 38	7.9%	3.8%
<i>Diagnosis/Risk</i>	%		Range		
Cerebral palsy diagnosis	16%		0 – 1		
ASD risk, MCHAT-R/F pos screen	16%		0 – 1		

<i>Bayley-III (scaled scores)</i>	Mean	SD	Range	< 1SD (%)	< 2SD (%)
Cognitive	8.41	3.02	1 – 19	25%	6.3%
Expressive communication	7.89	2.86	1 – 17	27%	7.7%
Receptive communication	8.13	2.97	1 – 19	28%	5.2%
Fine motor	9.41	2.82	1 – 18	12%	4.6%
Gross motor	7.98	2.67	1 – 18	20%	7.8%
<i>CBCL syndrome scales (raw scores)</i>	Mean	SD	Range	T ≥ 65 (%)	T ≥ 70 (%)
Emotionally reactive	2.04	2.31	0 – 15	8.6%	2.2%
Anxious/depressed	2.22	2.06	0 – 10	4.1%	1.1%
Somatic complaints	1.72	2.01	0 – 12	10%	3.4%
Withdrawn	1.60	2.10	0 – 14	9.7%	6.5%
Sleep problems	2.55	2.60	0 – 14	5.8%	3.8%
Attention problems	3.12	2.25	0 – 10	16%	10%
Aggressive behaviors	9.04	6.99	0 – 38	7.9%	3.8%
<i>Diagnosis/Risk</i>	%		Range		
Cerebral palsy diagnosis	16%		0 – 1		
ASD risk, MCHAT-R/F pos screen	16%		0 – 1		

Results

-4 profile solution provided best fit to the data based on standard statistical criteria



Profile 1 (31%)
 Profile 2 (41%)
 Profile 3 (11%)
 Profile 4 (16%)

Bayley Subscale Scores

± 1SD WNL	≥ 1SD Low	≥ 2SD Very Low
--------------	--------------	-------------------

CBCL Raw Scores

T < 65 WNL	65 ≤ T < 70 Borderline	T ≥ 70 Elevated
---------------	---------------------------	--------------------

Dx/Risk

Results

- 4 distinct profiles with different patterns of cognitive and behavioral difficulties
- **Profile 1 and 2 (~73%): Most Bayley scores within normal range; low CP/ASD**
 - Profile 1 slightly higher Bayley cognitive, receptive, and expressive language and slightly lower CBCL than Profile 2 ($p < .002$)
 - Profile 2 had similar Bayley fine and gross motor than Profile 1 ($p > .05$), and second highest cognitive and receptive and expressive language of all profiles ($p < .002$)
 - Rates of CP and ASD risk were similarly low ($\leq 8\%$) in Profiles 1 and 2

Results

- **Profile 3 and 4 (~27%): Most Bayley scores below normal range; higher CP/ASD**
 - Profile 3 and 4 had lower Bayley scores than Profiles 1 and 2 ($p < .001$)
 - Profile 3 had highest behavior problems than any other profile ($p < .0001$)
 - Profile 4 had lowest Bayley scores (cognitive, fine and gross motor) of all profiles ($p < .001$)
 - Bayley expressive/receptive language were similarly low in Profiles 3 and 4 ($p > .05$)
 - Rates of CP were higher in Profile 4 (45%) than Profile 3 (25%) ($p = .006$)
 - Rates of ASD risk were similar in Profile 3 (44%) and Profile 4 (51%) ($p = .21$)

Conclusions

- We discovered four distinct profiles of children born < 30 week PMA at 24 month follow-up based on cognitive, behavioral, motor, and language development, as well as in prevalence of CP and ASD risk.
- The profiles provide a “whole child” snapshot that enables us to summarize child outcomes across multiple domains.
- Child-centered analysis techniques could facilitate the development of targeted intervention strategies and provide caregivers and practitioners with a more comprehensive understanding of child behavior.

Neurodevelopmental profiles of infants born < 30 weeks gestation at 2 years of age

Marie Camerota, PhD

Thank you!

