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Very preterm born infants into Adulthood

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Small Beginnings

Ben 2013



Preterm Birth

- Immaturity Organ Development
- Complications/Insult



Impact

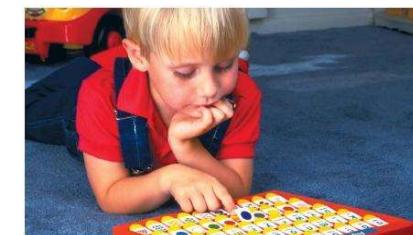


Immediate

- Parents
- PTSD
- Longterm?

Longterm

- Preterm Phenotype



Forever premature

As more babies born early enter adulthood, the lifelong effects are finally becoming clear, finds Linda Geddes

| NewScientist | 20 February 2016

Babies are increasingly surviving premature birth – but researchers are only beginning to understand the lasting consequences for their mental development.

BY ALISON ABBOTT



Overview: Focus on Adulthood

Questions:

CHILDREN

1. Do VP outgrow their problems? Which?
2. What new problems arise?
3. Effects of the environment and parenting?



PARENTS

- ▶ Quality of Life: Will it be ok in the End?

Learning Outcomes: Knowledge on

- areas of functioning with *long term (adverse) impact* (e.g. cognition)
(either stable or definitely present in adulthood)
- *new/emerging areas* of adverse/positive impact (e.g. sexual relationships)
- outcomes that are central to *several areas of functioning/impact*
- *mechanisms* – away from simple neonatal – outcome models
- outcomes strongly *related to quality of life* (children and parents)

From Birth to Adulthood - Melanie



26 weeks
30 cm
750 g





<http://recap-preterm.eu/>

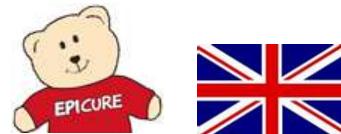
Cohorts

- **Bavarian Longitudinal Study**

<32 weeks or < 1500g, born 1985/86



- **EPI Cure Study**

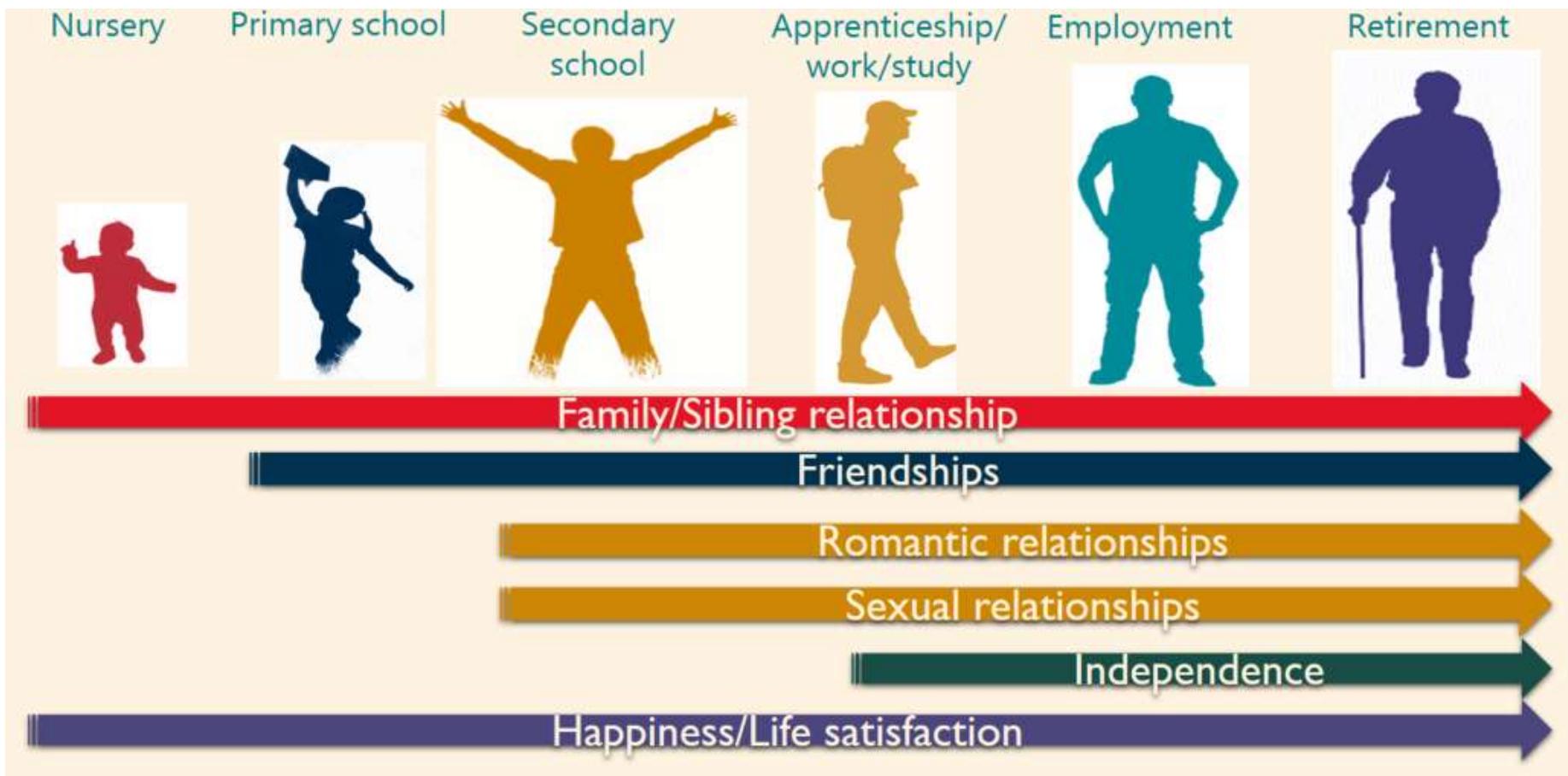


<26 weeks gestation, born 1995



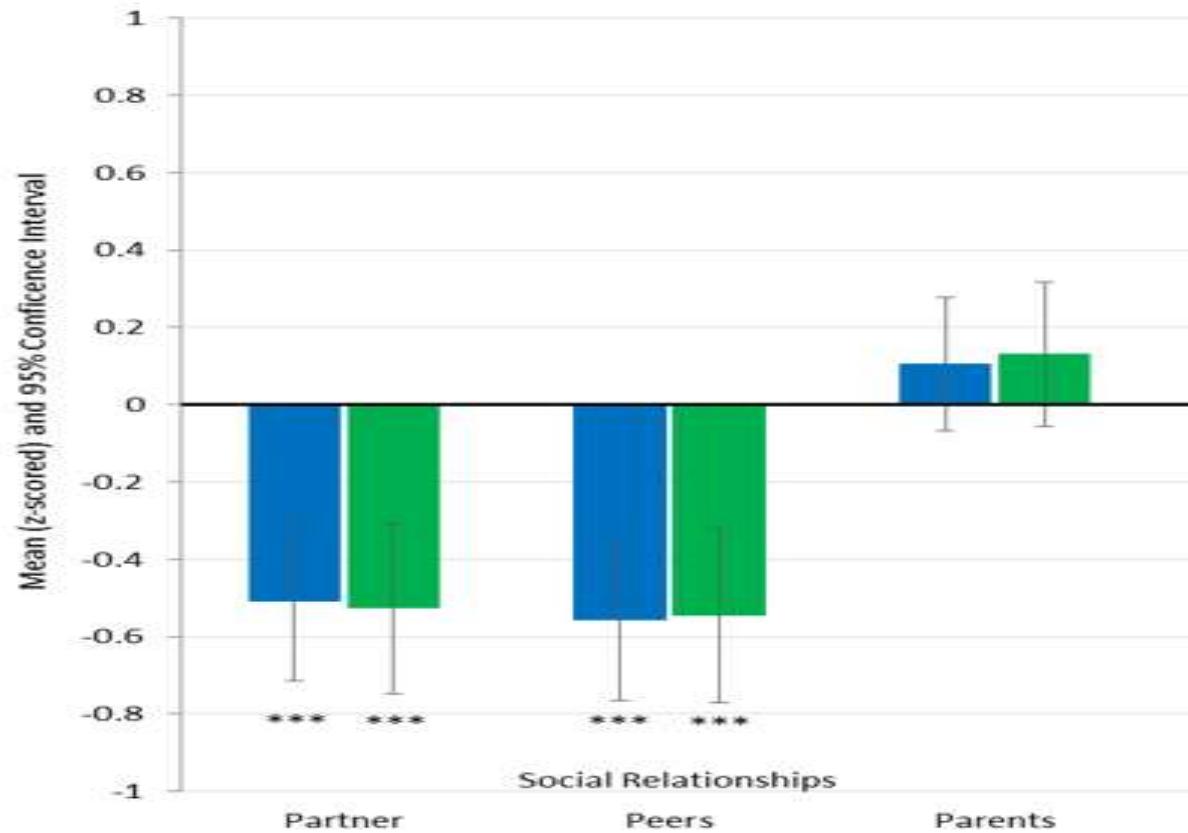
Life Course Tasks

9





Adulthood: Parents, Peers and Partnering



In blue unadjusted differences, in green differences adjusted for SES, sex, multiple birth, marital status at birth and participant's age.

Social Relationships: Sex & Romance



Reaching Life Course Goals: Social *



Romantic Partnership

Preterm Less Likely

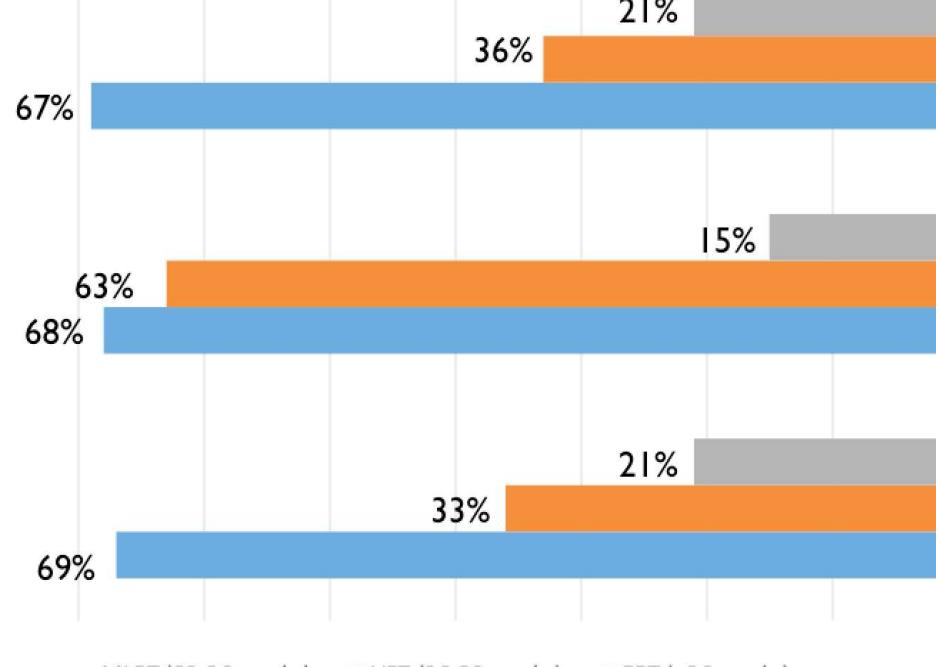


Sexual Intercourse



Parenthood

ODDS



Mendonça, M., Bilgin, A., & Wolke, D. (2019). Association of Preterm Birth and Low Birth Weight With Romantic Partnership, Sexual Intercourse, and Parenthood in Adulthood: A Systematic Review and Meta-analysis. *JAMA Network Open*, 2(7), e196961-e196961. doi:10.1001/jamanetworkopen.2019.6

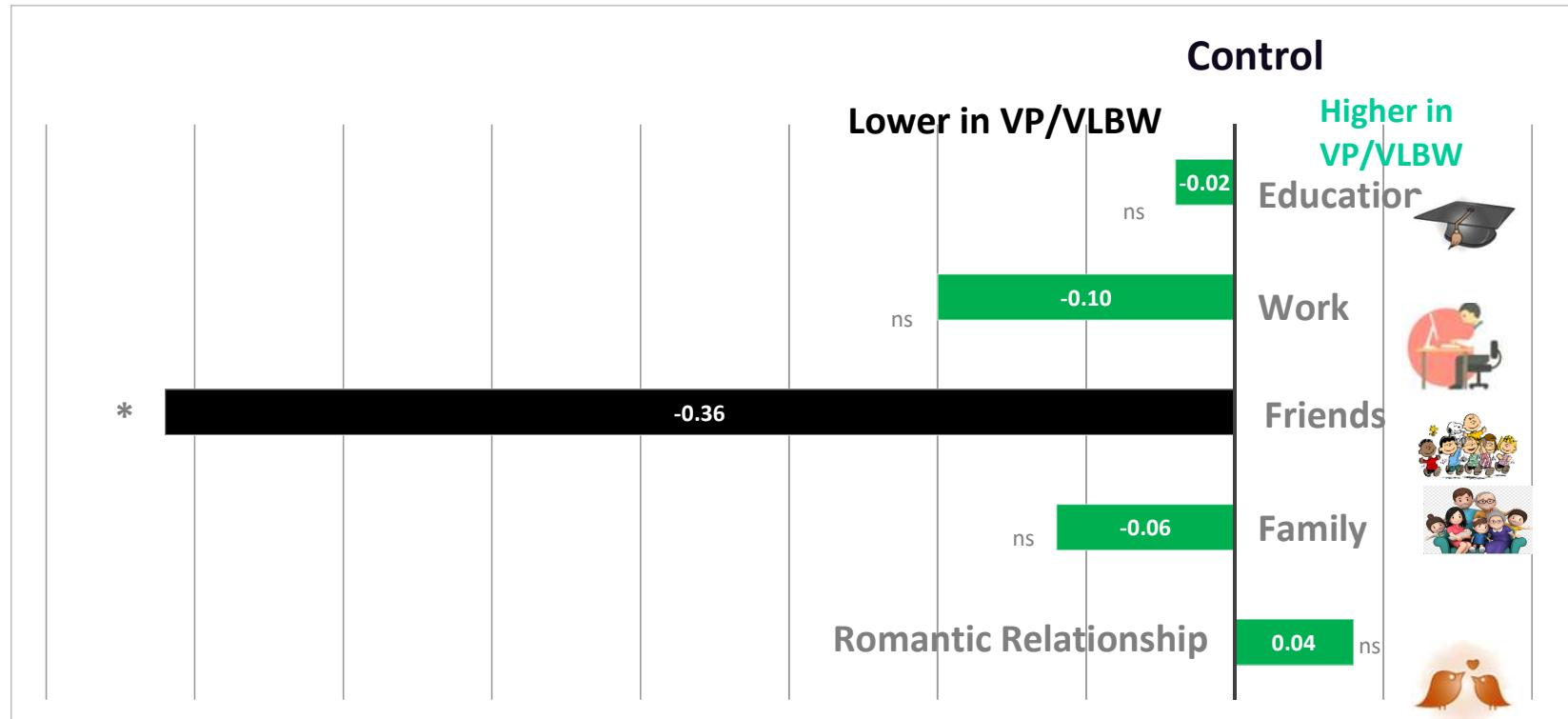
Romance, Sexual Experience and Children (IPD)

VP adults have **less often experienced**:

- ▶ **Ever** sexual intercourse and if, then later
- ▶ **Ever** had a longer romantic relations (especially *male* VP)
- ▶ **Less likely** to have children of their own (especially *male* VP/VLBW)
- ▶ Those with disability are least likely to make these experiences



Social Relationships: Adult Friends



Fewer friends; lower friendship relationship

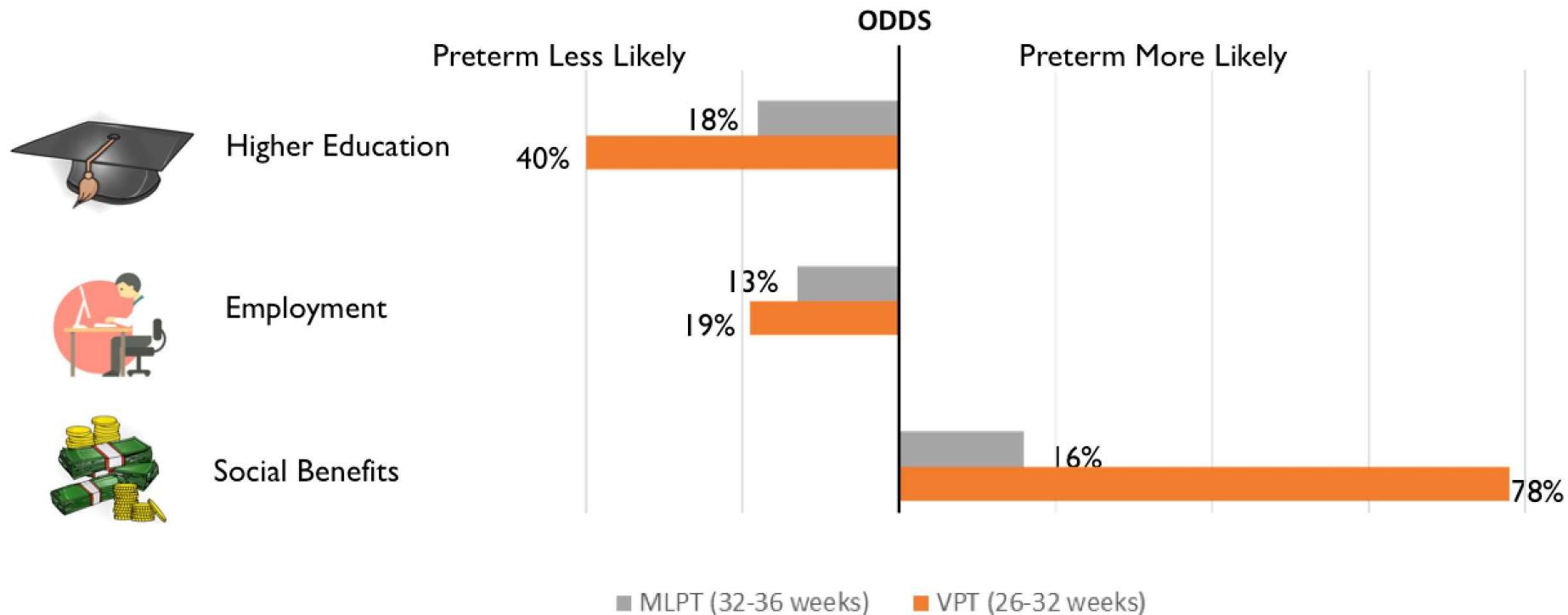


Ni, Y., Mendonça, M., Baumann, N., Eves, R., Kajantie, E., Hovi, P., . . . Wolke, D. (2021). Social Functioning in Adults Born Very Preterm: Individual Participant Meta-analysis. *Pediatrics*, e2021051986. doi:10.1542/peds.2021-051986

Independence and Wealth



Reaching Life Course Goals: Wealth*

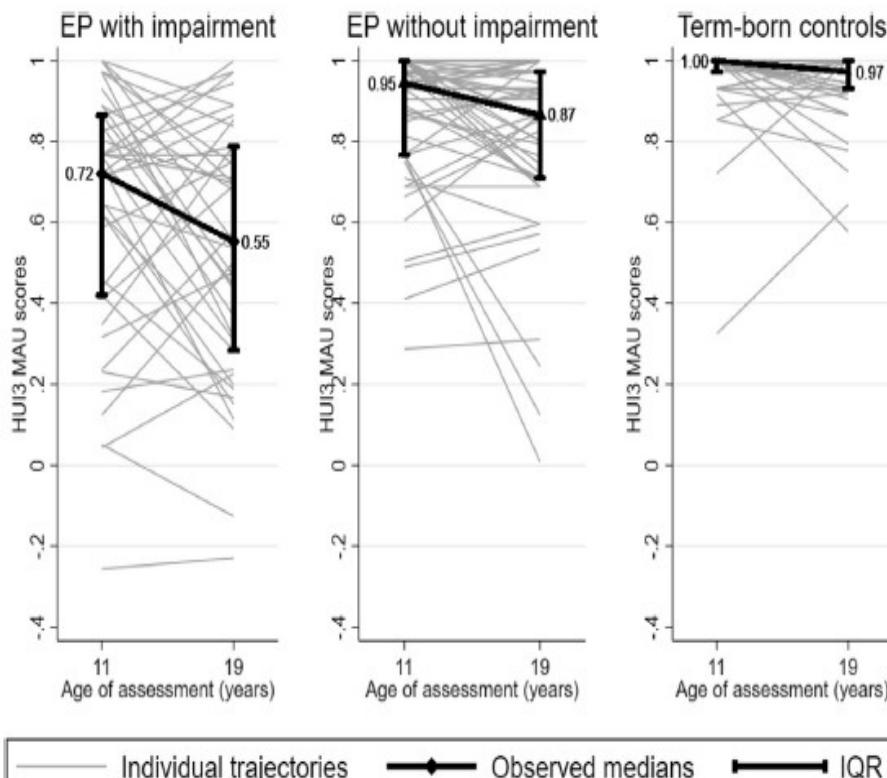


Bilgin, A., Mendenca, M., & Wolke, D. (2018). Preterm Birth/Low Birth Weight and Markers Reflective of Wealth in Adulthood: A Meta-analysis. *Pediatrics*. doi:10.1542/peds.2017-3625. (RECAP Preterm, funded by the European Union's Horizon 2020 research and innovation programme)



Quality of Life

EPICure



Ni et al. (2021). Journal of Pediatrics

BLS

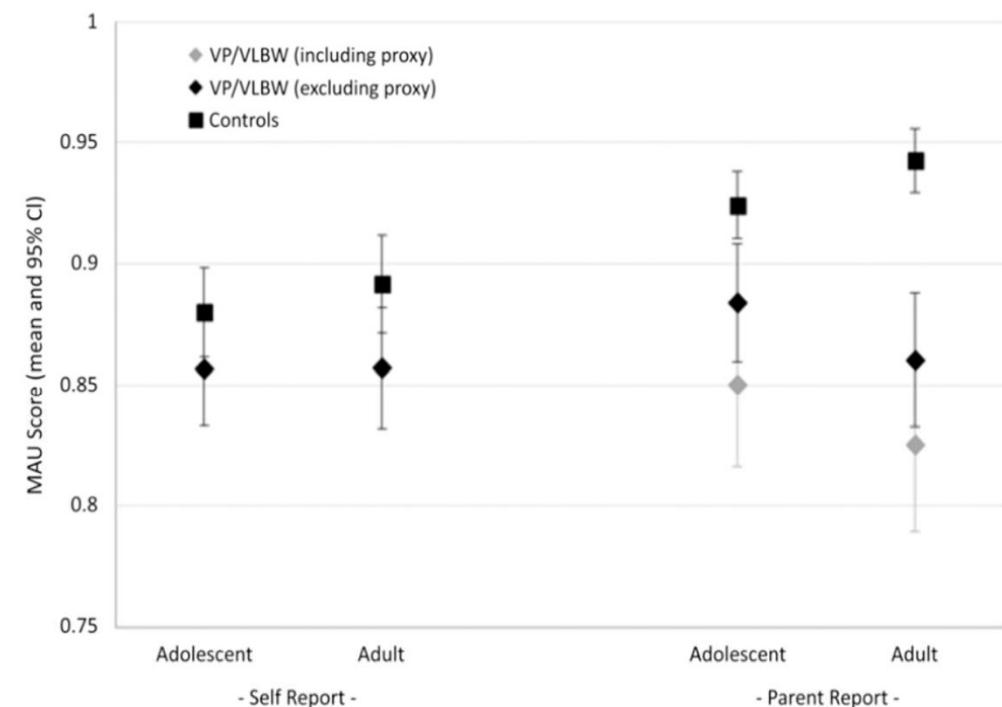


FIGURE 2
Self- and parent-reported HRQL MAU scores from adolescence to adulthood.

Baumann et al. (2016). Pediatrics 137 (4)



Health-Related Quality of Life Into Adulthood After Very Preterm Birth

Nicole Baumann, BSc,^a Peter Bartmann, MD, Dr rer nat,^b Dieter Wolke, PhD, Dr rer nat hc^{a,c}

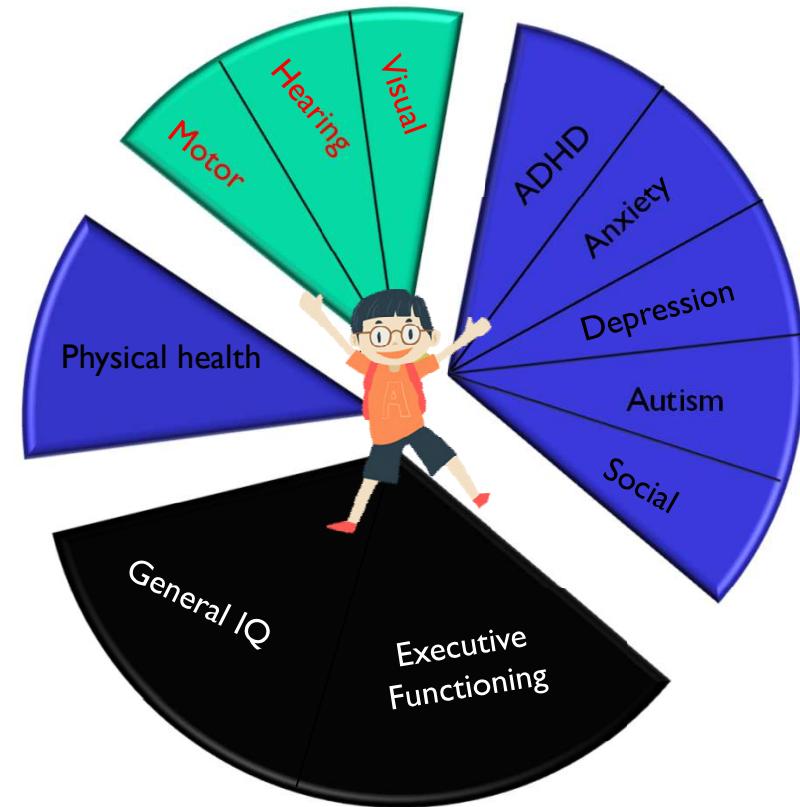
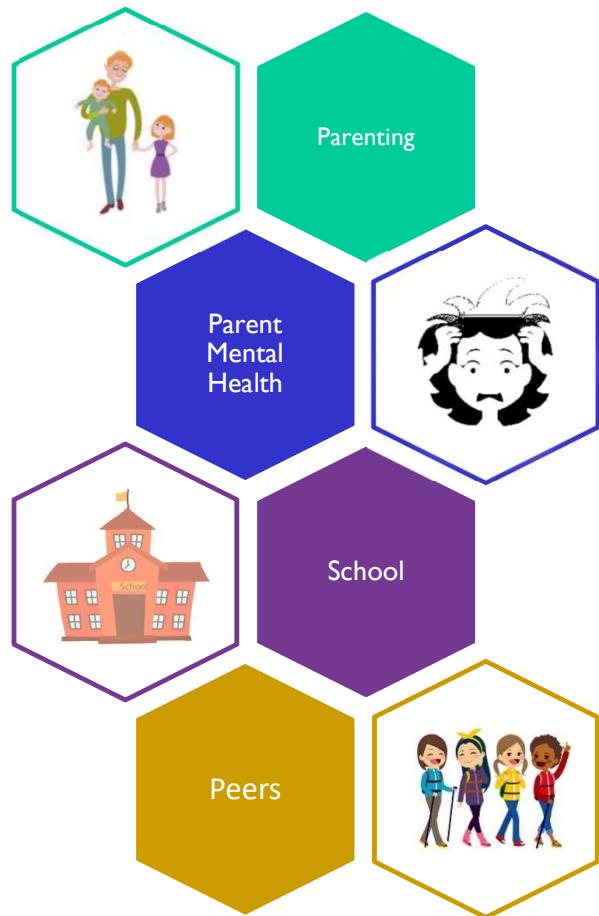
Pediatrics. 2016;137(4):e20153148

WHAT THIS STUDY ADDS: Those born very preterm perceive their HRQL as lower than their parents and as poorer than term born controls in adolescence and adulthood. Lower HRQL is related to lower economic functioning and poorer social relationships with peers and partners.

The Quality of Life reduces with age

A decorative purple line graphic consisting of several sharp, upward-pointing peaks, resembling a sawtooth or a series of small waves.

Childhood Functioning and reaching Life Course Goals *



*Johnson, S., & Wolke, D. (2017). Prematurity and low birthweight. In B. Hopkins, E. Geangu, & S. Linkenauger (Eds.), *The Cambridge Encyclopedia of Child Development* (2 ed., pp. 705-716). Cambridge: Cambridge University Press.

Adult Outcomes

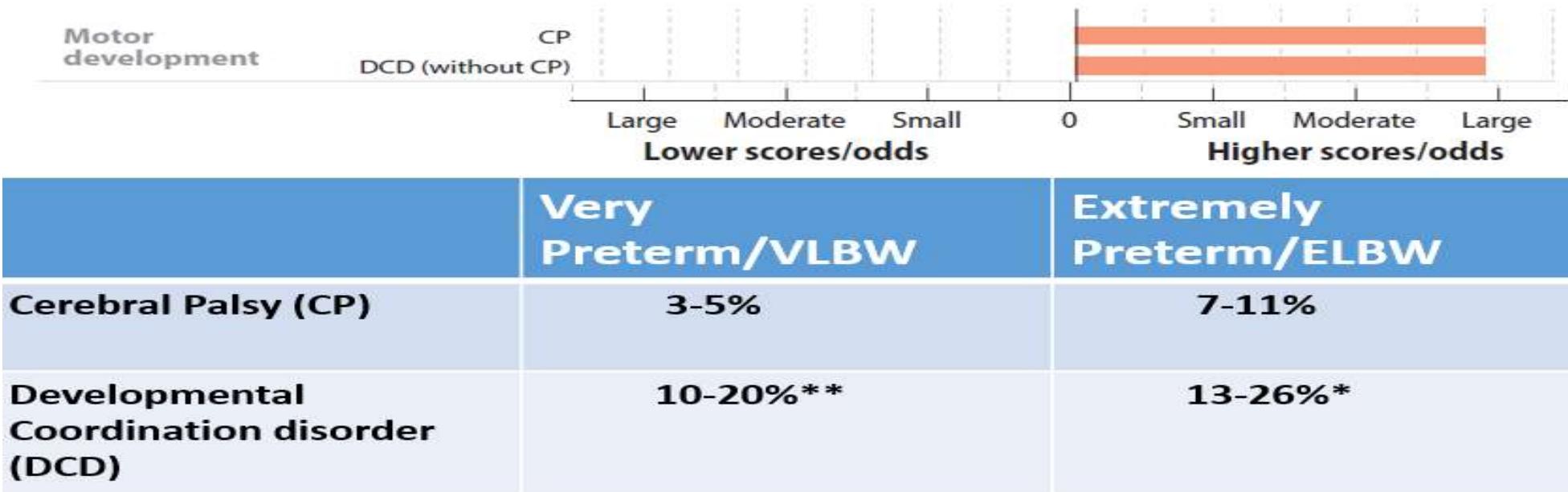
Annual Review of Developmental Psychology

The Life Course Consequences
of Very Preterm Birth

<https://doi.org/10.1146/annurev-devpsych-121318-084804>

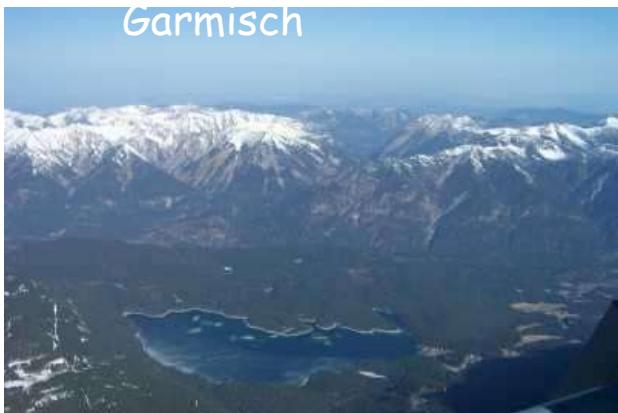
Dieter Wolke,^{1,2} Samantha Johnson,³
and Marina Mendonça¹

Motor



Into Adulthood: Severe Motor Problems (CP) persist; DCD show low stability

Garmisch



Birth cohort 1985/86



Munich

Cognitive status,
language attainment,
and prereading skills
of 6-year-old very
preterm children
and their peers: the
Bavarian Longitudinal
Study

Dieter Wolke* PhD DipPsych
Renate Meyer DipPsych, University of Munich Children's
Hospital, Bavarian Longitudinal Study, Munich, Germany



Passau



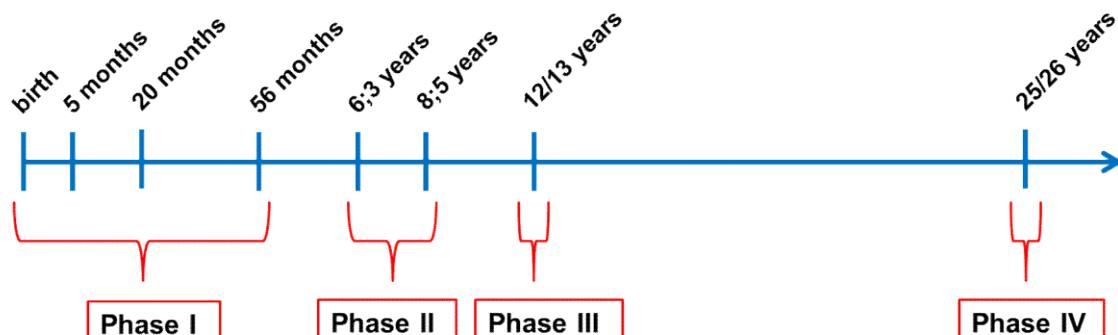
Bavarian Longitudinal Study



Design: Prospective longitudinal study of neonatal at risk children

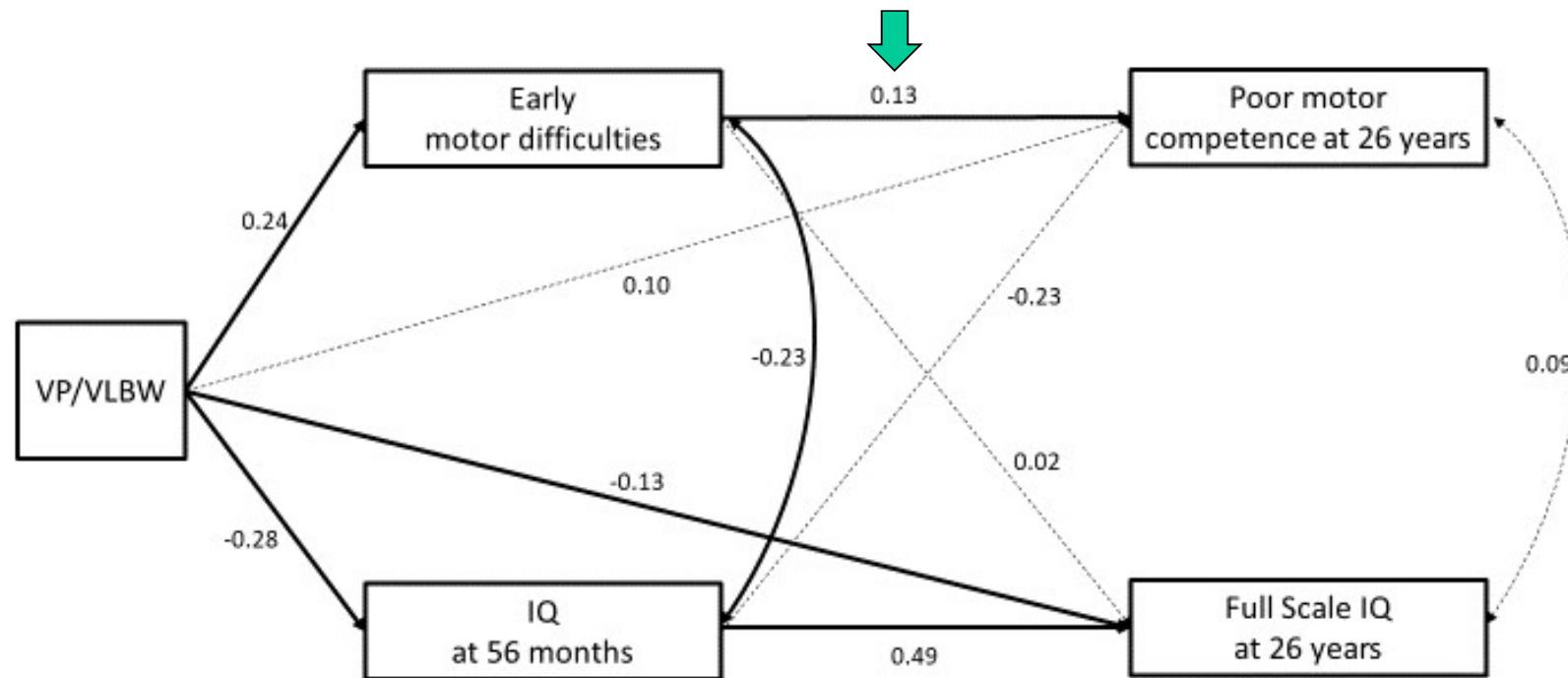
Population: Children born in South Bavaria (02/1985 - 03/1986) and admitted to a hospital within 10 days of birth; controls were recruited from the same hospitals.

Assessments:





Motor Problems – Persistence into Adulthood (no severe neurological impairment)



Baumann, N., Tresilian, J., Bartmann, P., & Wolke, D. (2020). Early Motor Trajectories Predict Motor but not Cognitive Function in Preterm- and Term-Born Adults without Pre-existing Neurological Conditions. *Int J Environ Res Public Health*, 17(9), 3258.

Summary Motor Outcome

- **In adulthood:** Only self-report data on Daily Functioning— still increased motor problems
- Once severe child motor problems excluded – **homotypic association** child to adult motor outcome

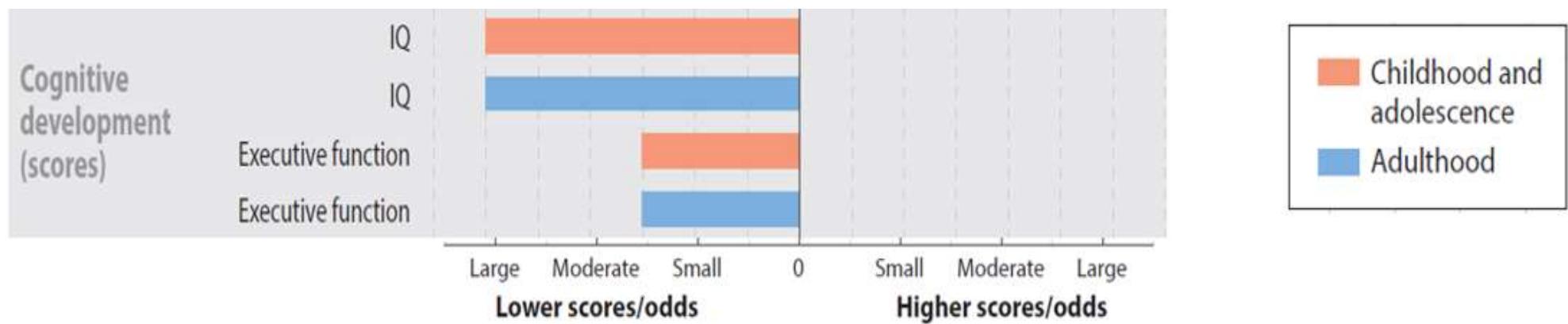
Poole, K. L., Schmidt, L. A., Missluna, C., Saigal, S., Boyle, M. H., & Van Lieshout, R. J. (2015). Motor Coordination Difficulties in Extremely Low Birth Weight Survivors Across Four Decades. *Journal of Developmental & Behavioral Pediatrics*, 36(7), 521-528. doi:10.1097/dbp.0000000000000199

Baumann, N., Tresilian, J., Bartmann, P., & Wolke, D. (2020). Early Motor Trajectories Predict Motor but not Cognitive Function in Preterm- and Term-Born Adults without Pre-existing Neurological Conditions. *Int J Environ Res Public Health*, 17(9), 3258.

Into Adulthood: Severe Motor Problems (CP) persist; DCD show low stability

Adult: Cognitive Outcomes

<https://doi.org/10.1146/annurev-devpsych-121318-084804>



Association of Very Preterm Birth or Very Low Birth Weight With Intelligence in Adulthood

An Individual Participant Data Meta-analysis

Published 28 May 2021



Robert Eves, MSc; Marina Mendonça, PhD; Nicole Baumann, BSc; Yanyan Ni, PhD; Brian A. Darlow, MD; John Horwood, MSc; Lianne J. Woodward, PhD; Lex W. Doyle, MD; Jeanie Cheong, MD; Peter J. Anderson, PhD; Peter Bartmann, MD, PhD; Neil Marlow, DM; Samantha Johnson, PhD; Eero Kajantie, DMedSc; Petteri Hovi, MD, PhD; Chiara Nosarti, PhD; Marit S. Indredavik, MD, PhD; Kari-Anne I. Evensen, PhD; Katri Räikkönen, PhD; Kati Heinonen, PhD; Jennifer Zeitlin, DSc; Dieter Wolke, PhD, Dr rer nat hc



8 cohorts from 7 countries

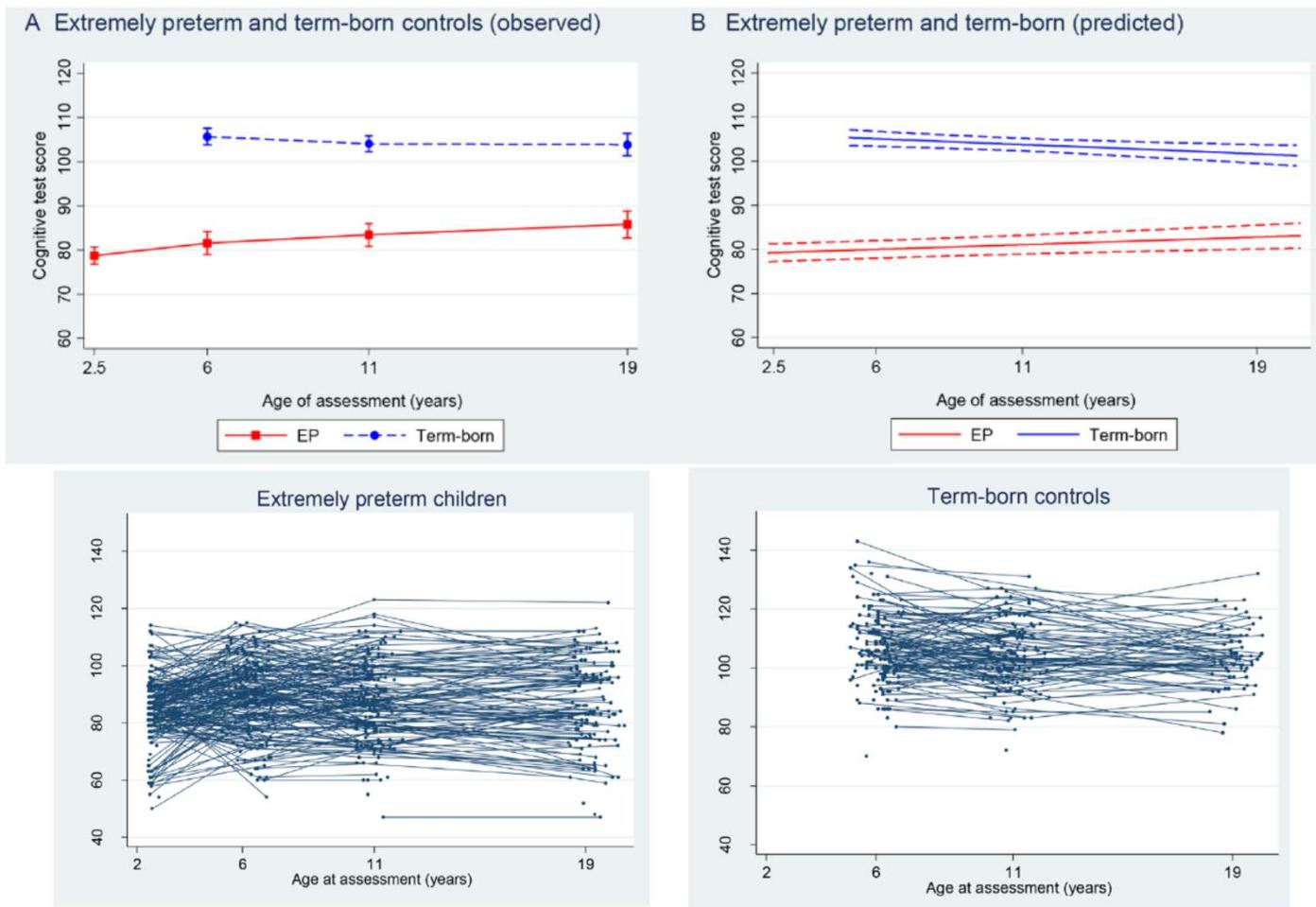


© Dieter Wolke



Epicure: IQ from 2.5 to 19 years of age

Impaired cognitive function persist from infancy to adulthood in EP



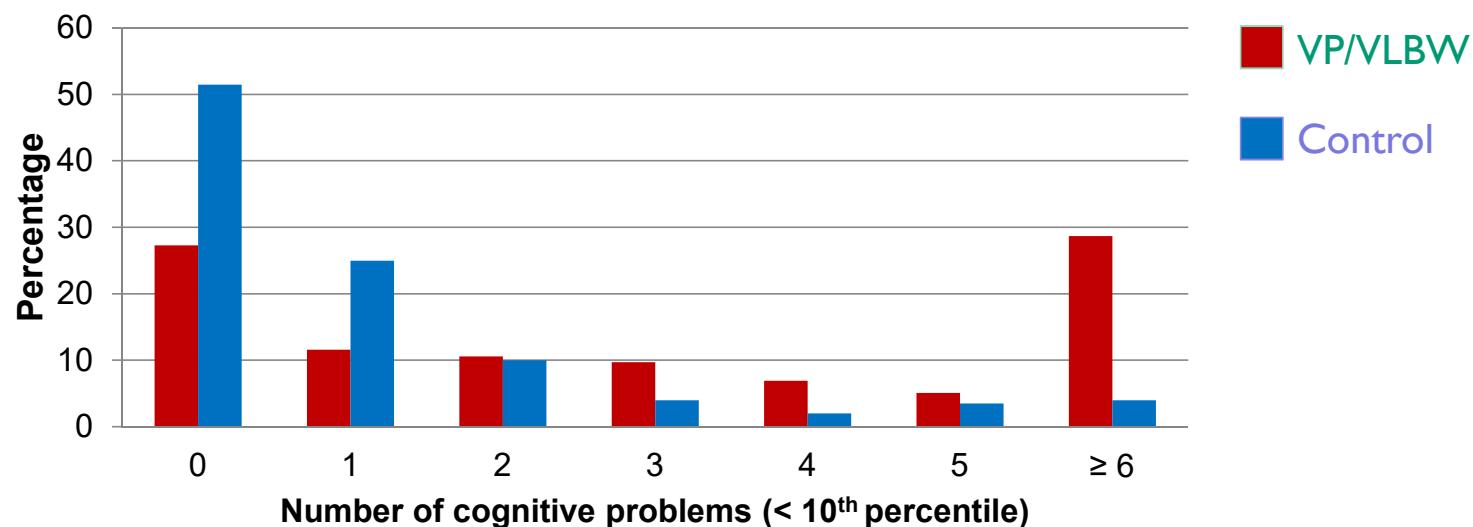
Linsell, L., Johnson, S., Wolke, D., O'Reilly, H., Morris, J. K., Kurinczuk, J. J., & Marlow, N. (2018). Cognitive trajectories from infancy to early adulthood following birth before 26 weeks of gestation: a prospective, population-based cohort study. *Archives of Disease in Childhood*, 103(4), 363-370. doi:10.1136/archdischild-2017-313414

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VP/VLBW adults have more often multiple cognitive deficits not specific EF! YES

Fig.2. Relative frequency of multiple cognitive problems of VP/VLBW adults in comparison to their full-term counterparts.

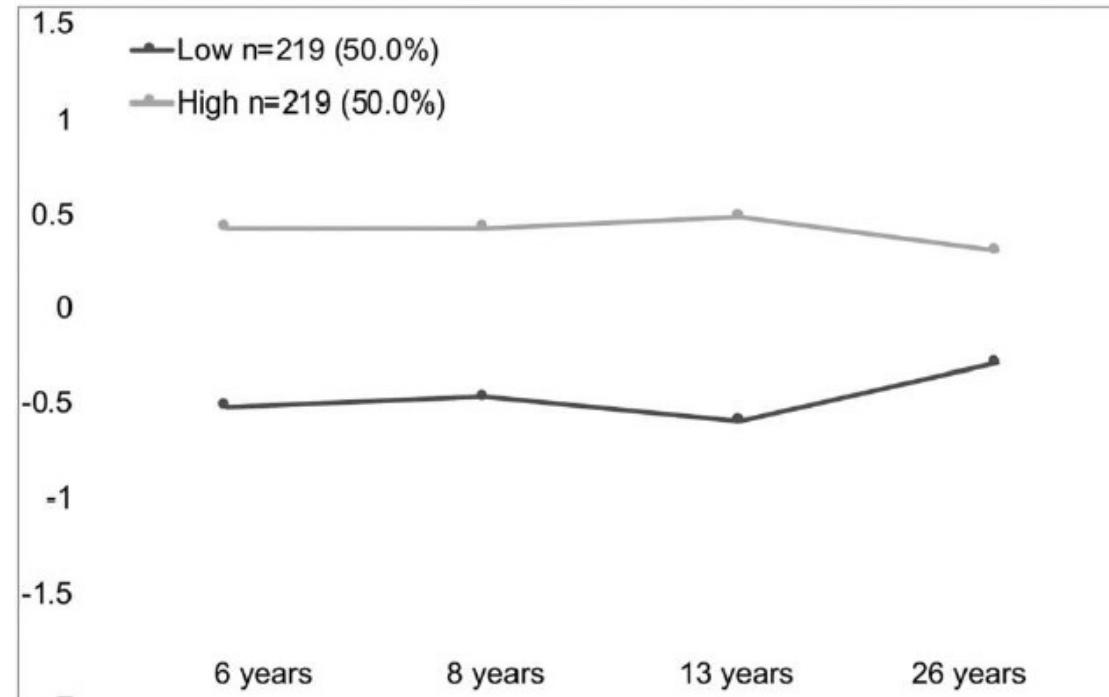


Note. The number of cognitive outcome measures (out of 10) with a score below the 10th percentile of control distribution were counted in weighted, population representative control and VP/VLBW samples.

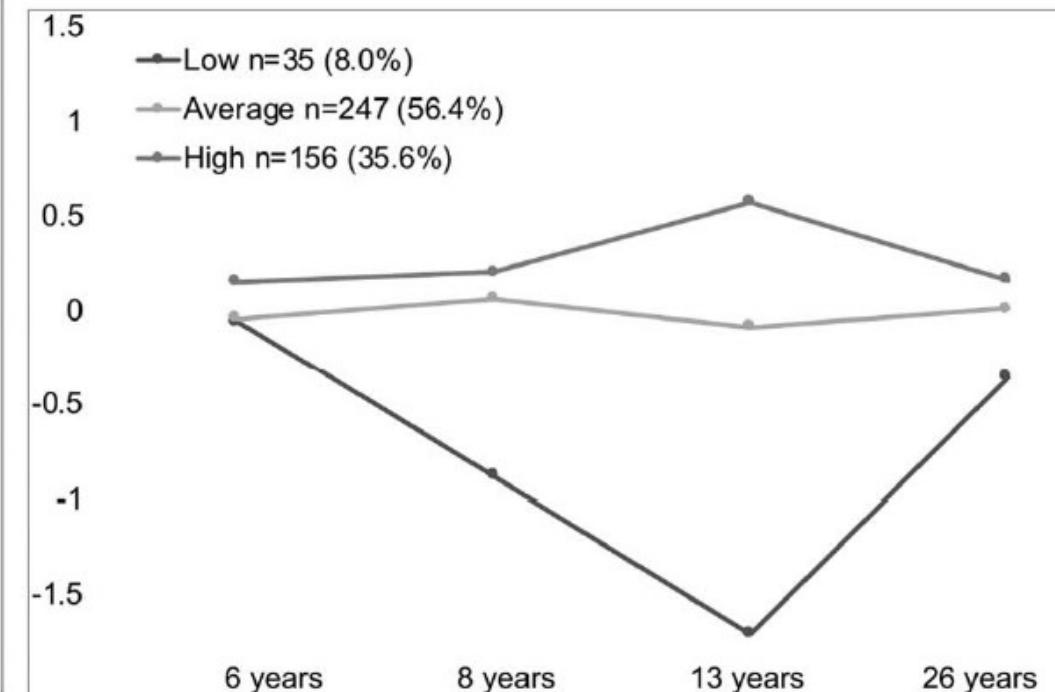
Peer trajectories: IQ several impacts



B Peer problems trajectories



C Friendships trajectories



Not VP/VLBW but **IQ in childhood** predicts trajectories: Higher IQ-score more friends, less peer problems

Reyes, L. M., Jaekel, J., Bartmann, P., & Wolke, D. (2021). Peer Relationship Trajectories in Very Preterm and Term Individuals from Childhood to Early Adulthood. *Journal of Developmental & Behavioral Pediatrics*, 42(8), 621-630. doi:10.1097/dbp.0000000000000949

Summary Cognition

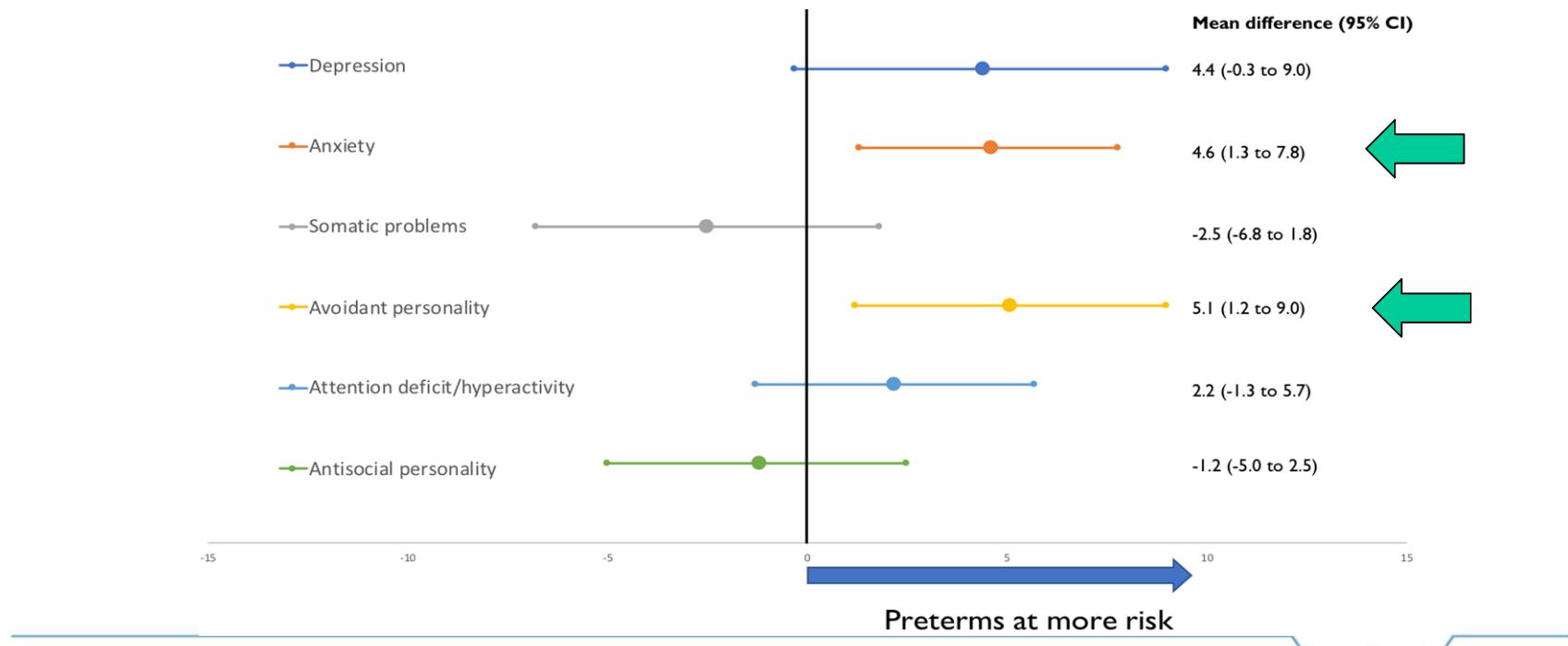
VP/VLBW adults

1. Perform **poorer** in all aspects of IQ and EF, on average.
2. Have more often **multiple cognitive deficits** rather than specific EF deficits
3. IQ affects a wide range of areas of life course functioning – from schooling to peer relationships
4. At **age 2 years** adult IQ deficits **can be predicted** in VP/EP children

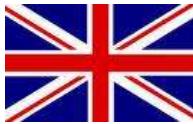


Mental Health

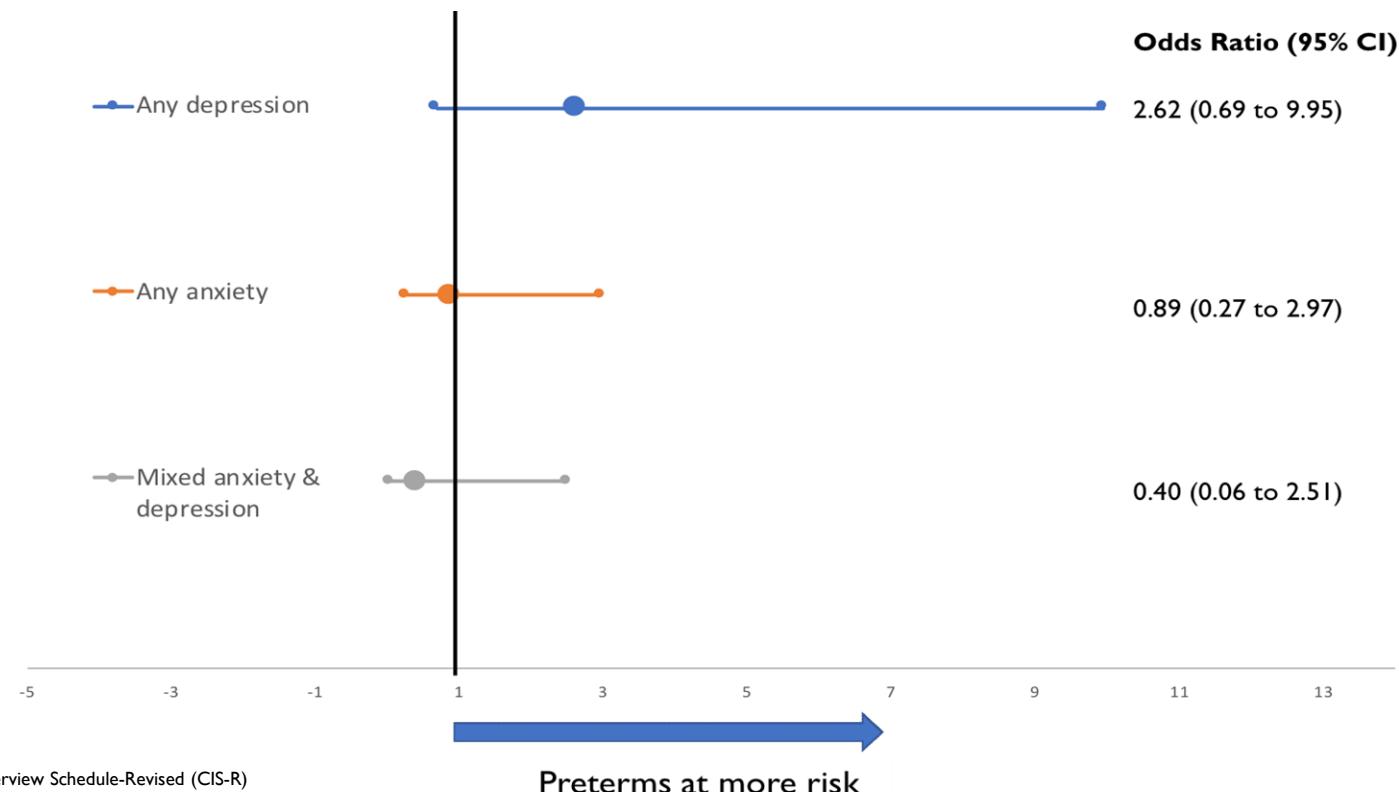
EPIcure @ 19: DSM-oriented Scales (self-report)



Johnson, S., O'Reilly, H., Ni, Y., Wolke, D., & Marlow, N. (in press). Psychiatric symptoms and disorders in extremely preterm young adults at 19 years of age and longitudinal findings from middle childhood. *Journal of the American Academy of Child and Adolescent Psychiatry (JAACAP)*.



EPI Cure @ 19: Primary CIS-R* Diagnosis



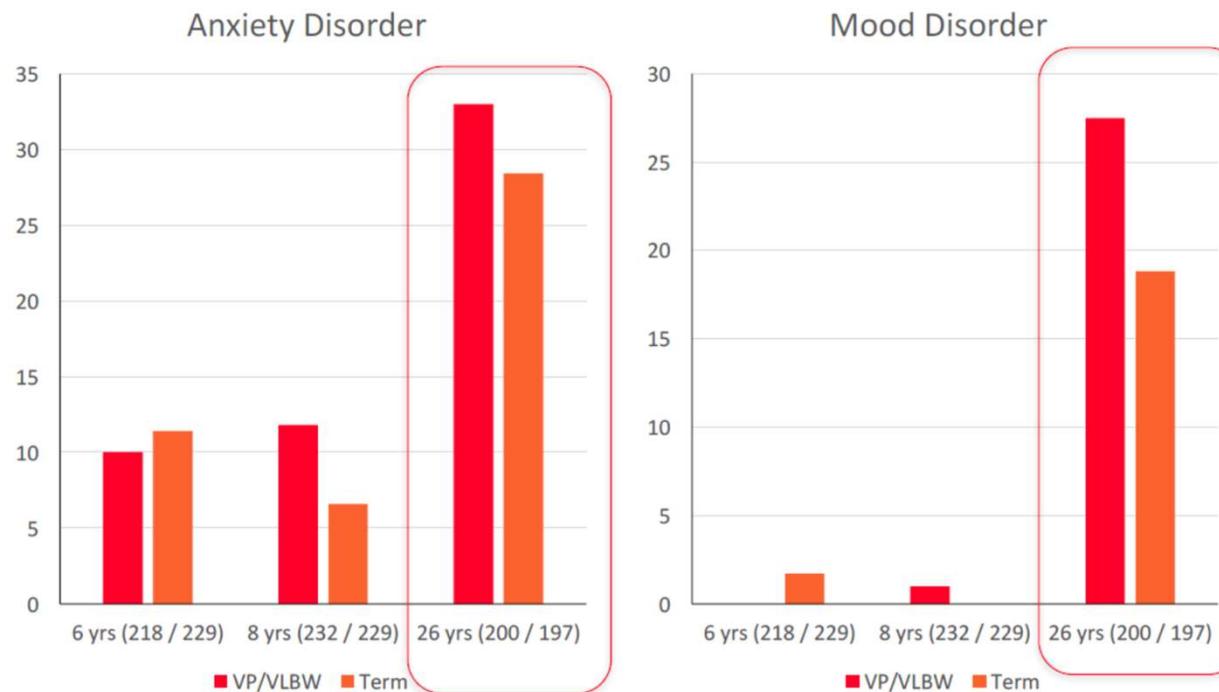
Johnson, S., O'Reilly, H., Ni, Y., Wolke, D., & Marlow, N. (in press). Psychiatric symptoms and disorders in extremely preterm young adults at 19 years of age and longitudinal findings from middle childhood. *Journal of the American Academy of Child and Adolescent Psychiatry (JAACAP)*.



Mood and anxiety disorders in very preterm/very low-birth weight individuals from 6 to 26 years

Julia Jaekel,^{1,2} Nicole Baumann,² Peter Bartmann,³ and Dieter Wolke²

¹Department of Child and Family Studies, University of Tennessee Knoxville, Knoxville, TN, USA; ²Department of Psychology, University of Warwick, Coventry, UK; ³Institute of Neonatology, University Hospital Bonn, Bonn, Germany

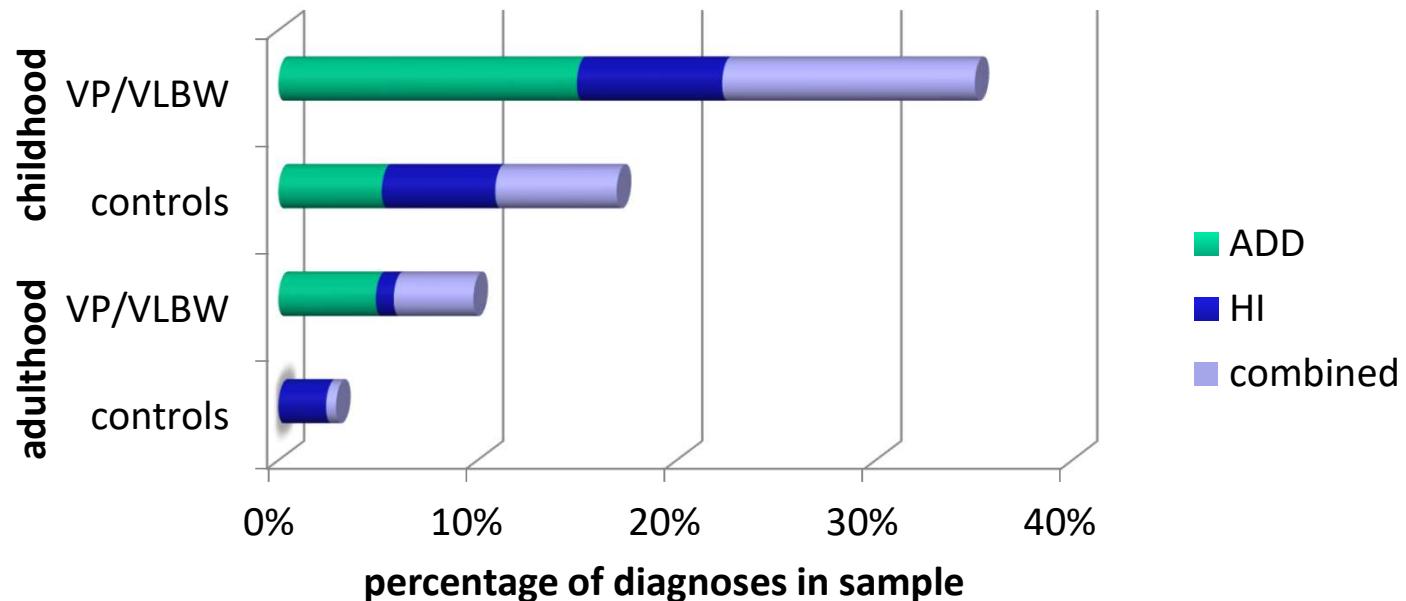




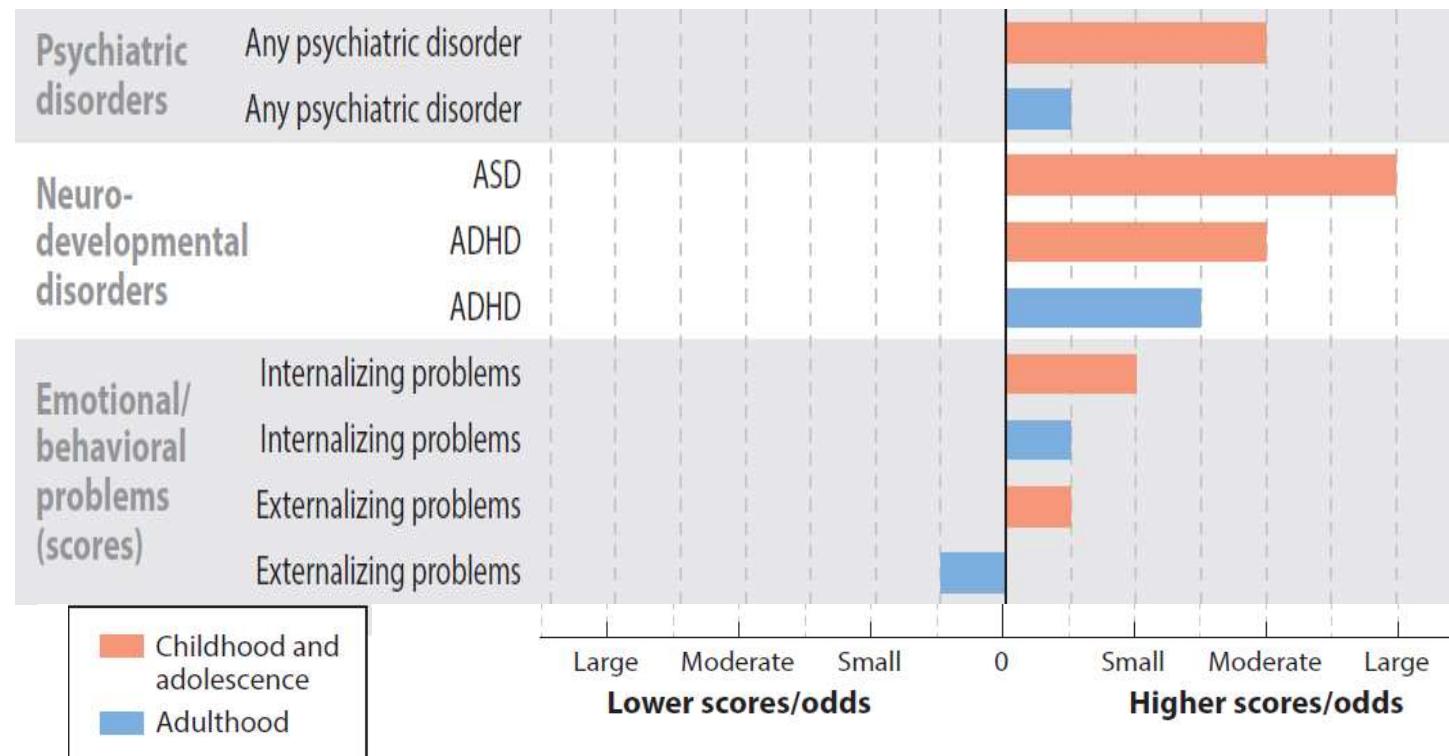
Attention problems in very preterm children from childhood to adulthood: the Bavarian Longitudinal Study

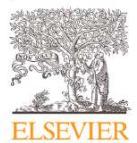
Linda D. Breeman,¹ Julia Jaekel,^{1,2} Nicole Baumann,¹ Peter Bartmann,³ and Dieter Wolke^{1,4}

ADHD diagnoses



Mental Health in Childhood and Adulthood





Contents lists available at ScienceDirect

EClinicalMedicine

journal homepage: www.elsevier.com/locate/eclim

Psychiatric disorders in individuals born very preterm / very low-birth weight: An individual participant data (IPD) meta-analysis

Peter J Anderson, PhD^{a,b,*}, Debora Marques de Miranda, MD^c,
Maicon Rodrigues Albuquerque, PhD^c, Marit Sæbø Indredavik, PhD^d,
Kari Anne I. Evensen, PhD^{d,e,f}, Ryan Van Lieshout, MD^g, Saroj Saigal, MD^h,
H. Gerry Taylor, PhDⁱ, Katri Raikonen, PhD^j, Eero Kajantie, DMedSc^{d,k,l,m},
Neil Marlow, DMⁿ, Samantha Johnson, PhD^o, Lianne J. Woodward, PhD^p,
Nicola Austin, DM^q, Chiara Nosarti, PhD^{r,s}, Julia Jaekel, PhD^{t,u}, Dieter Wolke, PhD^u,
Jeanie LY Cheong, MD^{b,v,w}, Alice Burnett, PhD^{b,y}, Karli Treyvaud, PhD^{b,x},
Katherine J Lee, PhD^{b,y}, Lex W Doyle, MD^{b,v,w}

Published December 2021

- ▶ IPD of 10 cohort studies
- ▶ Psychiatric diagnoses in adulthood

Added value of this study

This individual participant data meta-analysis suggests that individuals born VP/VLBW might have higher odds of meeting criteria for Autism Spectrum Disorder, Attention Deficit Hyperactivity Disorder, and Anxiety Disorder than term/NBW controls.

Summary Mental Health

- Continued increased risk of ADHD and ASD symptoms
- Small increased risk for overall anxiety and mood disorders after VP/VLBW birth once carefully controlled for multiple comparisons
- Avoidant Personality (anxious social interactions/withdrawn)



Wellbeing and Self-Esteem

Subjective Wellbeing

an individual's positive evaluation of different aspects of his or her life such as: peer relationships, family relationships, school context, one's own physical appearance, and well-being in general²

Global self-esteem

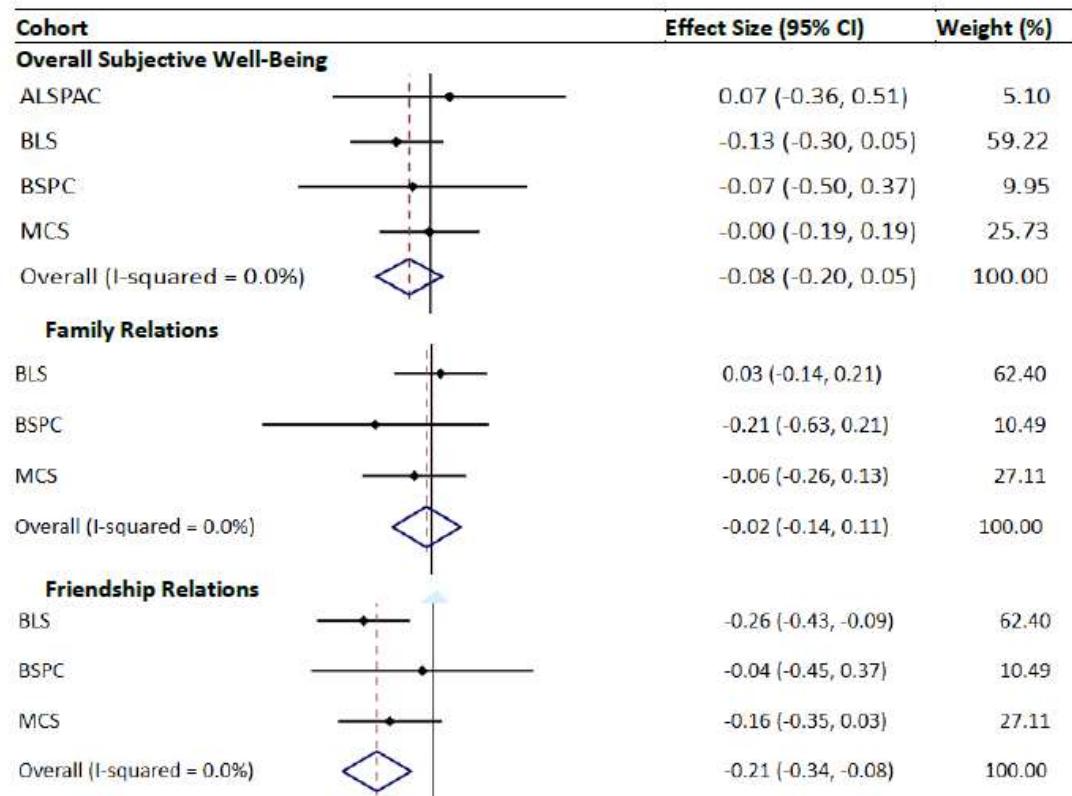
one's positive or negative attitude toward one's self or general feeling of self-worth as a person

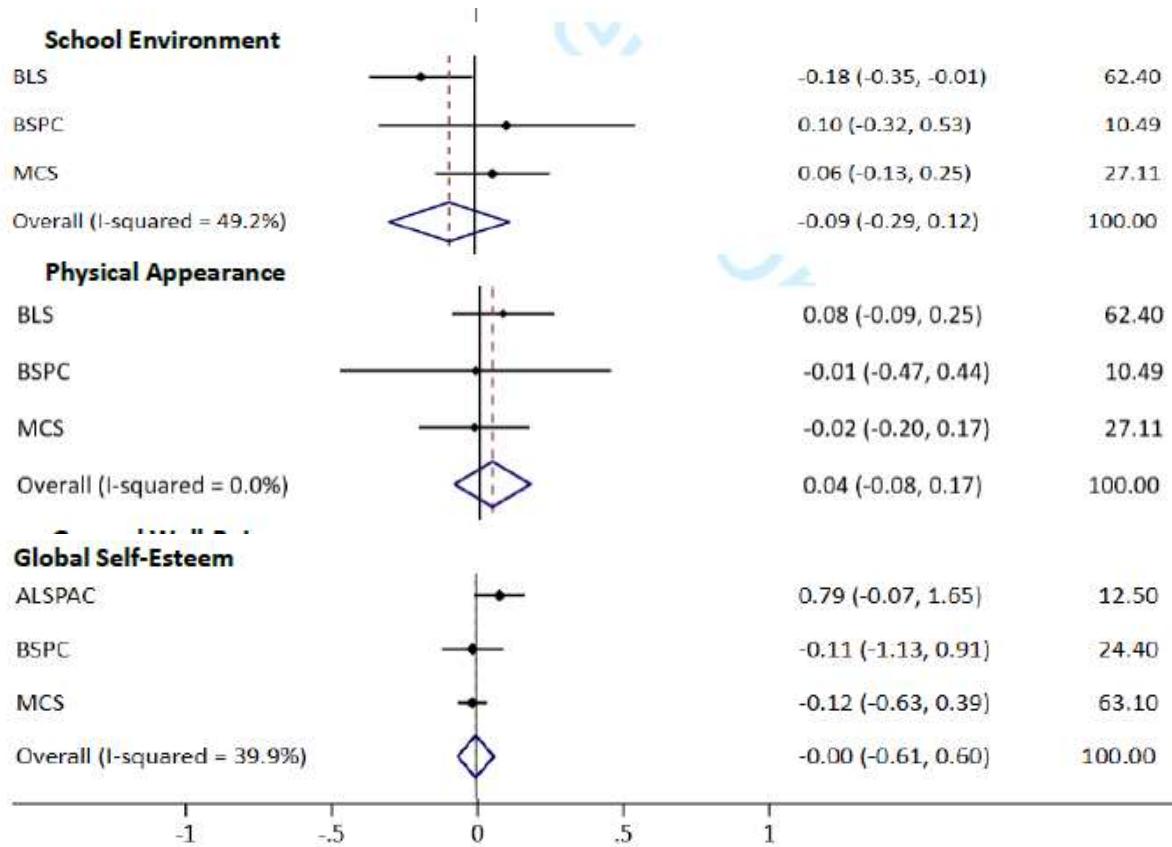
Subjective Well-Being and Self-Esteem in Preterm Born Adolescents: An Individual Participant Data Meta-Analysis

Ayten Bilgin, PhD,^{*†} Asteria Brylka, PhD,[†] Dieter Wolke, PhD,^{†‡} Hayley Trower, PhD,[†]
Nicole Baumann, BSc,[†] Sakari Lemola, PhD^{†§}

(*J Dev Behav Pediatr* 42:613–620, 2021)

Wellbeing and Self-esteem in Adolescence (VP/VLBW)





Summary Self-Esteem

- No differences in general self-rated self-esteem/wellbeing: family, school. Physical appearance, global self-esteem
- However, perceive their **peer relationships** as poorer
- No differences SGA, ethnicity, sex or social class

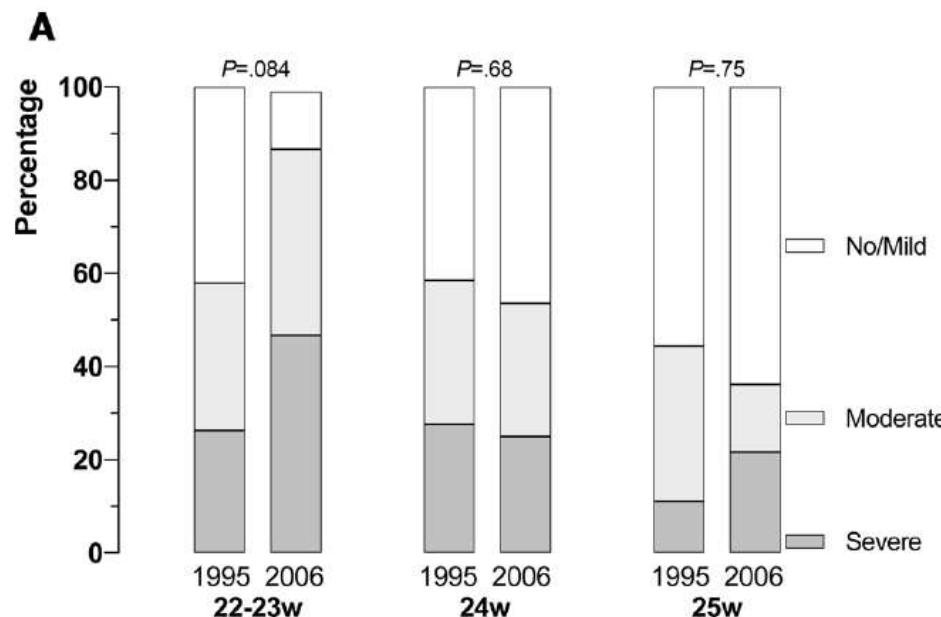




Is everything better now? Survival: YES; Outcome: NO

No change in neurodevelopment at 11 years after extremely preterm birth

Neil Marlow ¹, Yanyan Ni ,^{1,2} Rebecca Lancaster,³ Emmi Suonpera,¹ Marialivia Bernardi,¹ Amanda Fahy,¹ Jennifer Larsen,³ Jayne Trickett,³ John R Hurst,⁴ Joan Morris,⁵ Dieter Wolke ,⁶ Samantha Johnson³



Impairment, motor or IQ – no improvement

Reduced health-related quality of life in children born extremely preterm in 2006 compared with 1995: the EPICure Studies

Yanyan Ni ,^{1,2} Samantha Johnson,³ Neil Marlow ,¹ Dieter Wolke ,^{2,4}

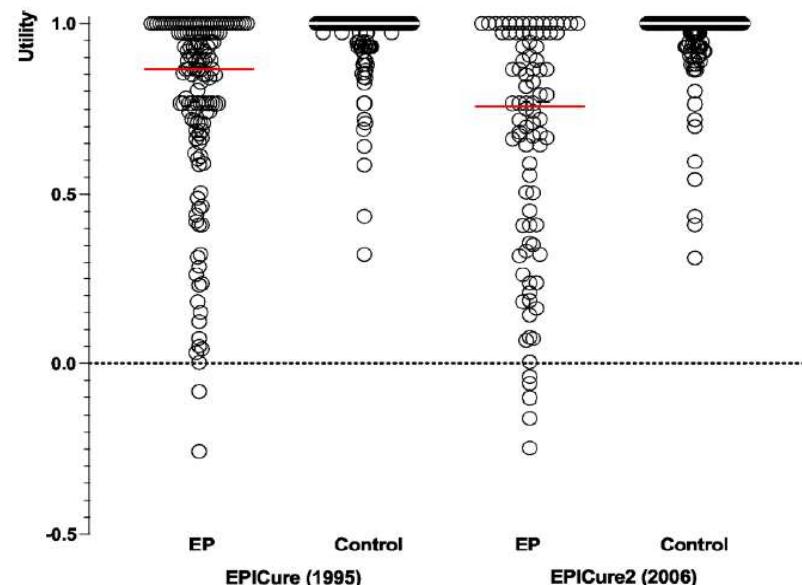
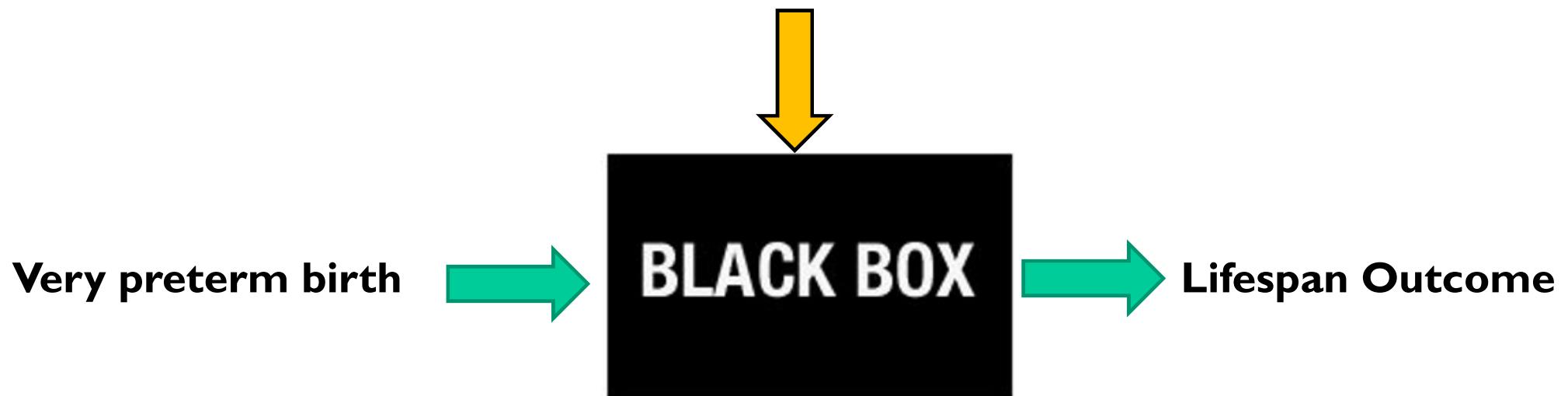


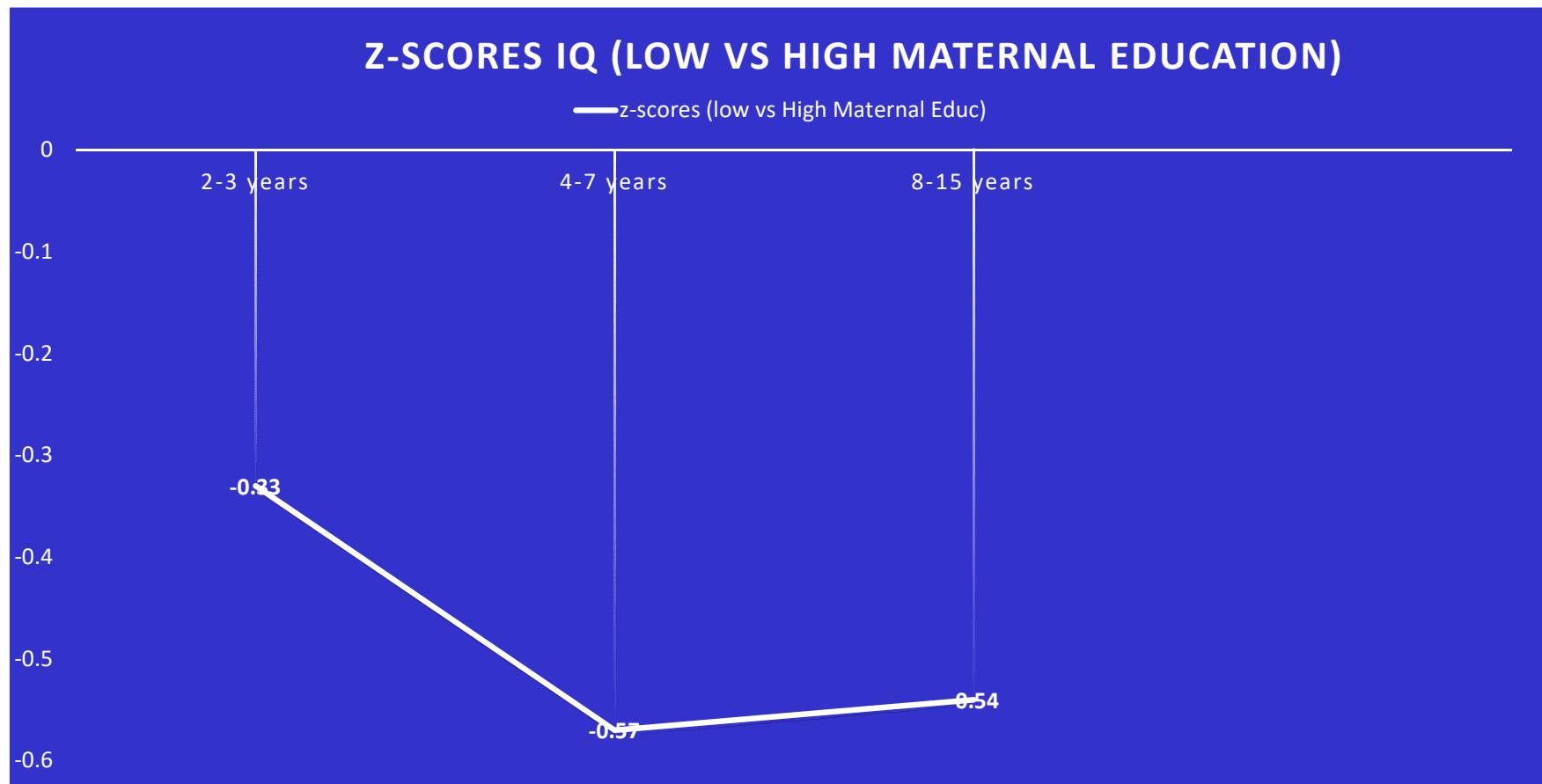
Figure 1 Distribution of the HUI3 utility scores for children born <26 weeks of gestation in England and term-born controls. EP, extremely preterm; HUI, Health Utilities Index.

Prematurity to Life Course Outcomes

Social Influences/
Social Neuroprotection

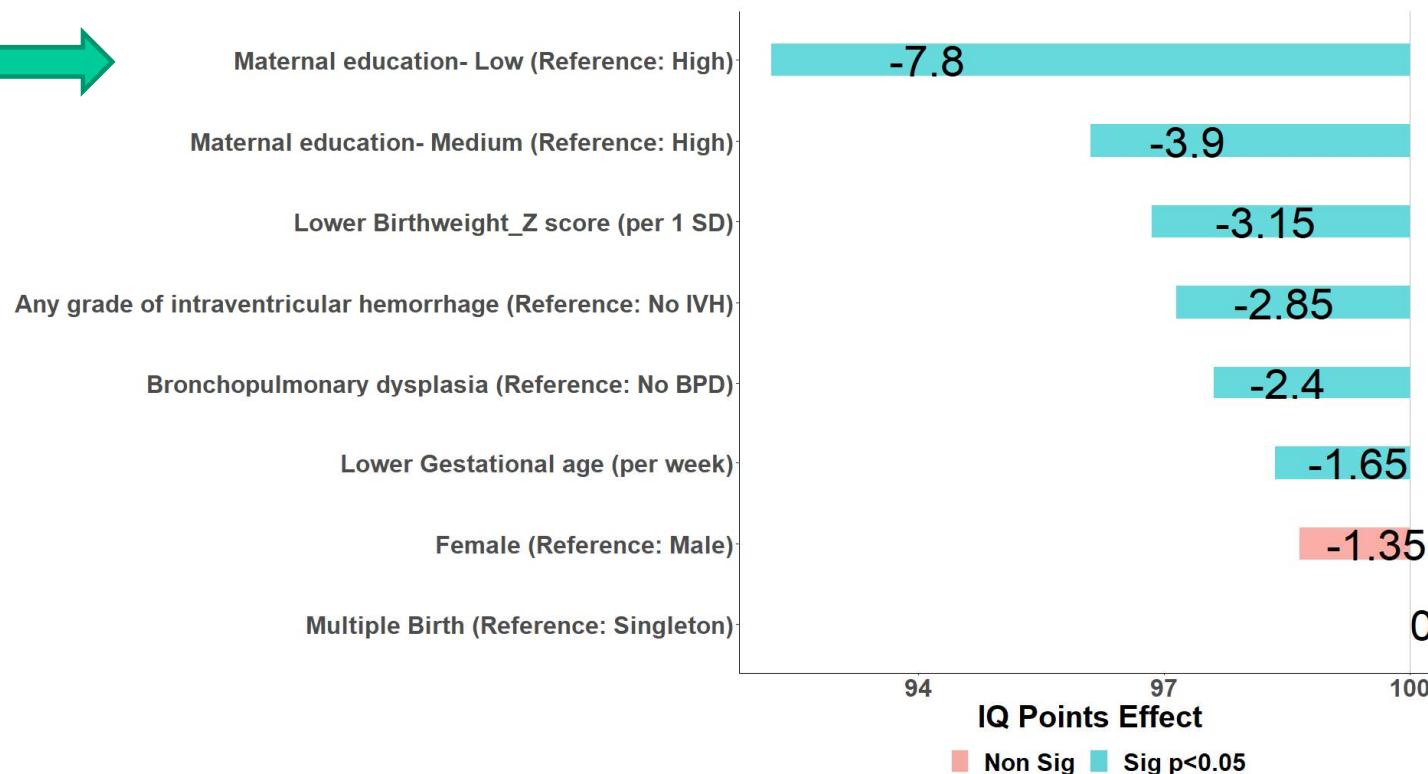


Family of Origin: Maternal Education – IQ – Child Age



Sentenac, M., Benhammou, V., Aden, U., Ancel, P.-Y., Bakker, L. A., Bakoy, H., . . . Zeitlin, J. (2021). Maternal education and cognitive development in 15 European very-preterm birth cohorts from the RECAP Preterm platform. *INTERNATIONAL JOURNAL OF EPIDEMIOLOGY*. doi:10.1093/ije/dyab170

Association of Individual Level Factors with Adult IQ in VP/VLBW

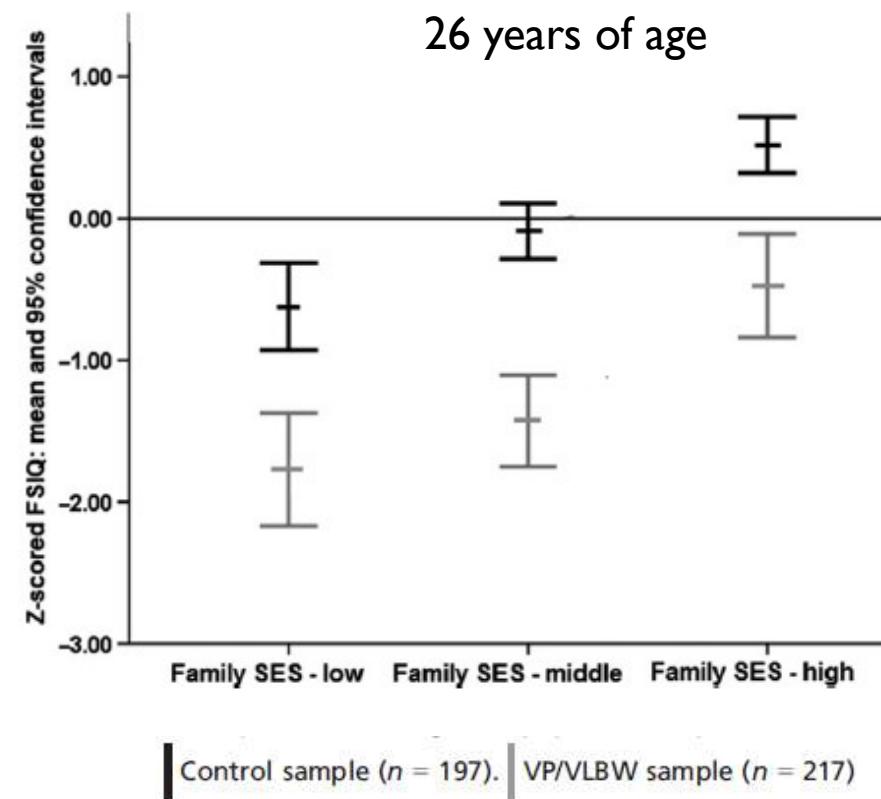
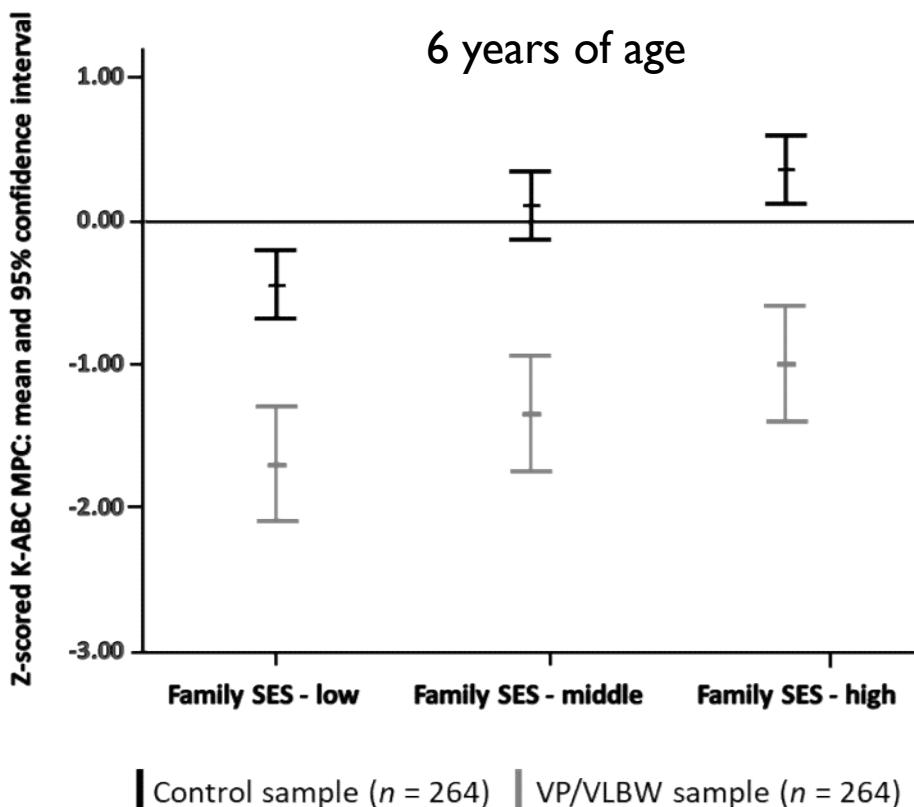


**Term Born
Controls:
Mean 100,
SD 15**



Full Scale IQ-scores according to family SES at 6 years and at 26 years of age in VP/VLBW and Full-term Controls (BLS)

Main Effect



© Dieter Wolke

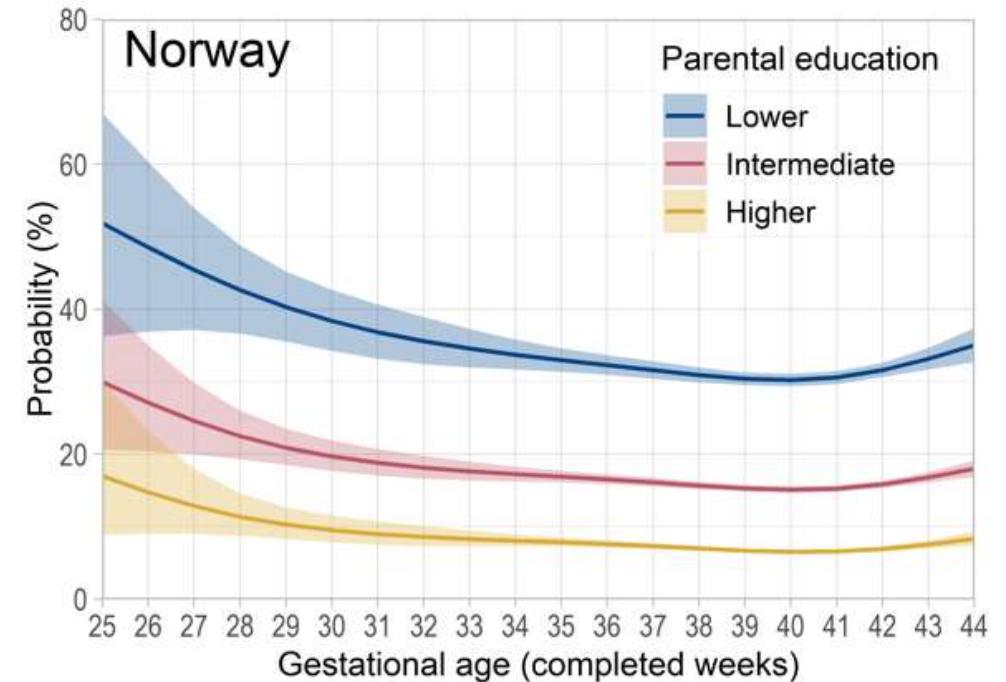
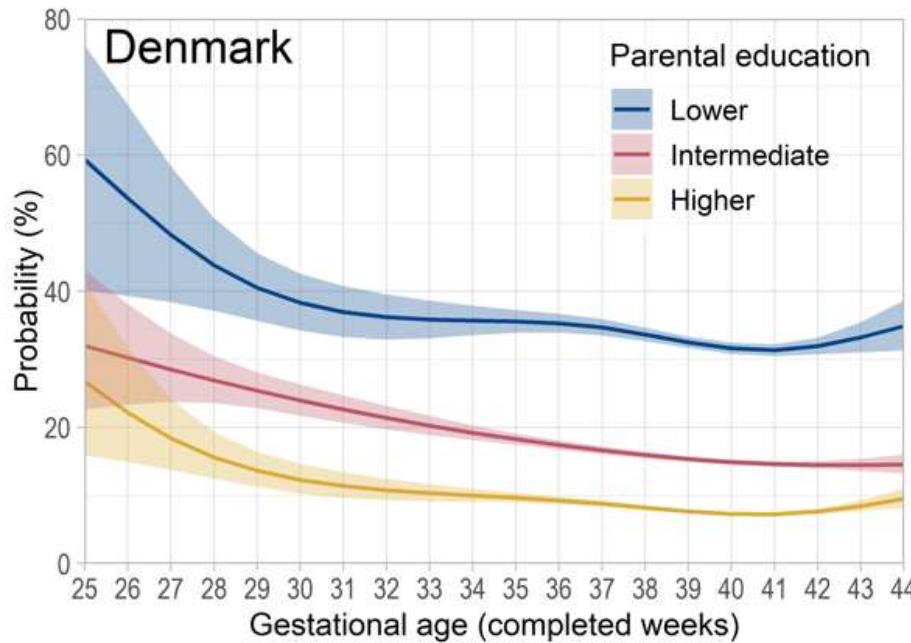
Wolke, D., & Meyer, R. (1999). Cognitive status, language attainment and prereading skills of 6-year-old very preterm children and their peers: The Bavarian Longitudinal Study. *Developmental Medicine and Child Neurology*, 41(2), 94-109.

Eryigit Madzwamuse, S., Baumann, N., Jaekel, J., Bartmann, P., & Wolke, D. (2015). Neuro-cognitive performance of very preterm or very low birth weight adults at 26 years. *Journal of Child Psychology and Psychiatry*, 56(8), 857-864. doi:10.1111/jcpp.12358

Parental Education: Offspring Educational Attainment at 25 years

Probability of Low Educational Attainment: Gestation and Family of Origin

Main Effect





Parenting at 6 years: Educational attainment at 13 years

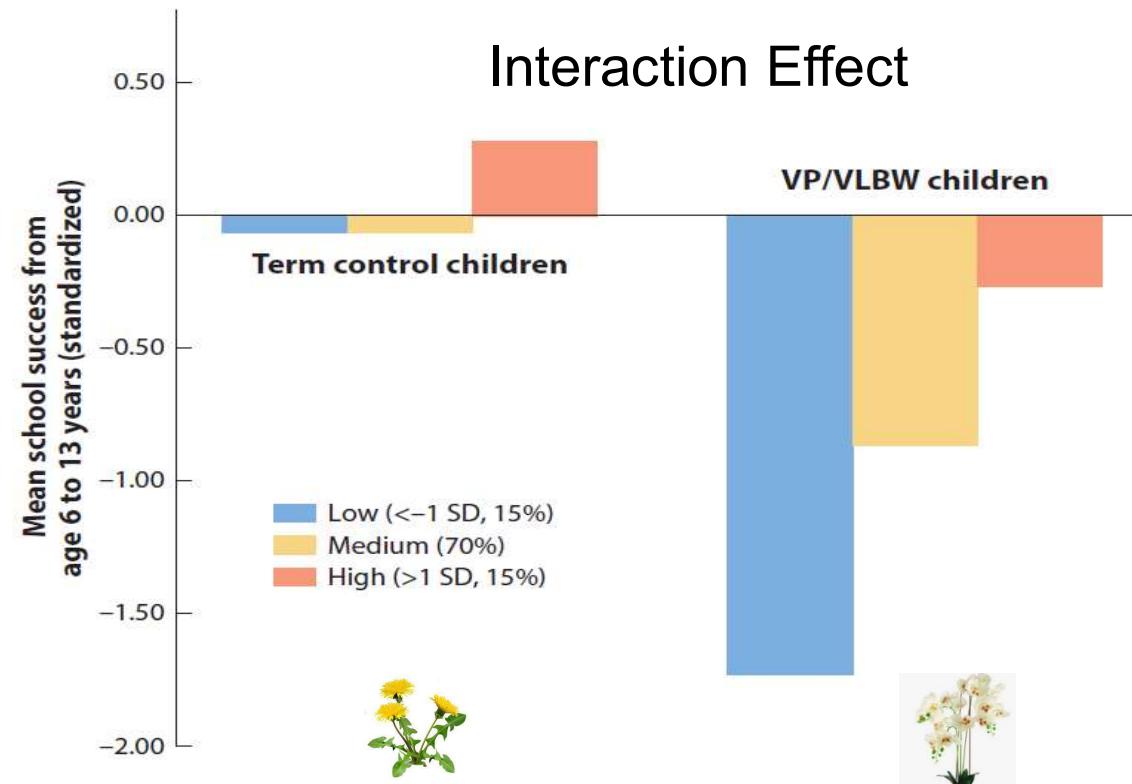


Figure 2

Effect of sensitive parenting (low, medium, or high) at 6 years of age on school success at 13 years of age. Variation by very preterm (VP)/very low birthweight (VLBW) versus term-born status. Abbreviation: SD, standard deviation. Adapted with permission from Wolke et al. (2013).

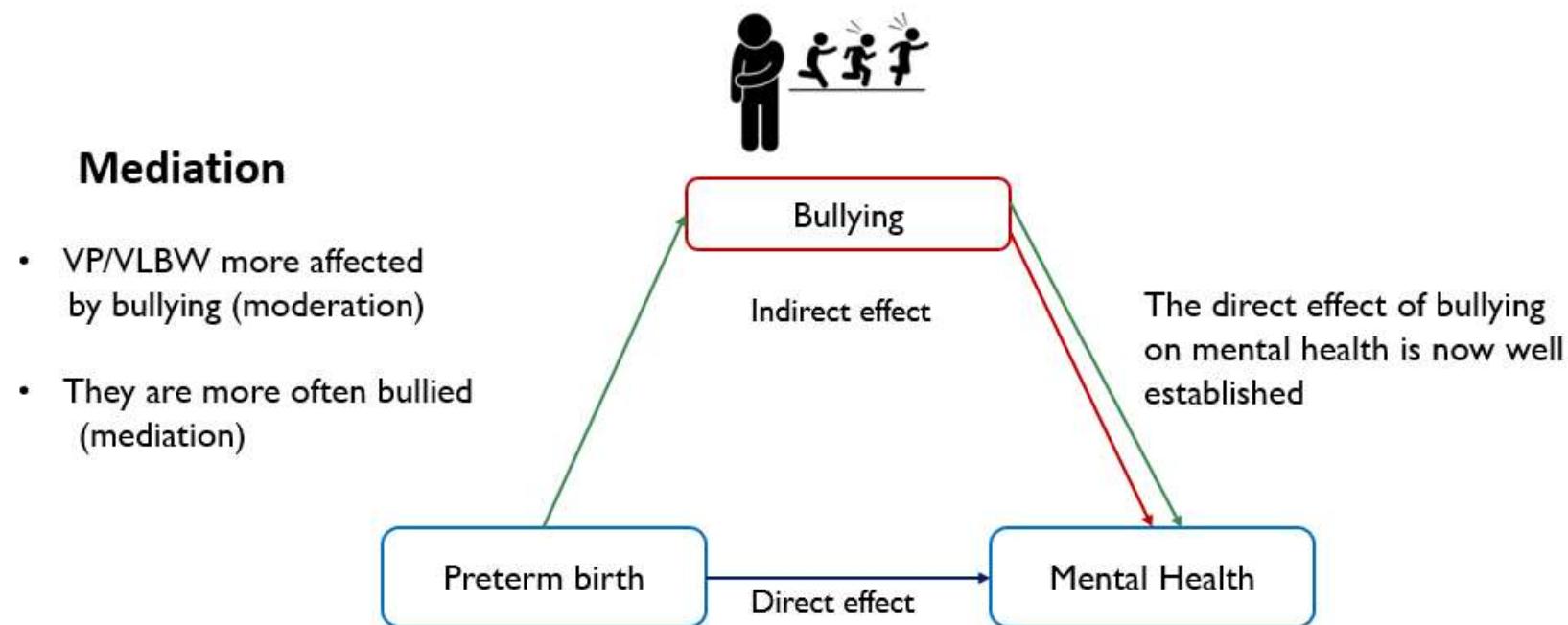
Wolke, D., Jaekel, J., Hall, J., & Baumann, N. (2013). Effects of Sensitive Parenting on the Academic Resilience of Very Preterm and Very Low Birth Weight Adolescents. *Journal of Adolescent Health, 53*(5), 642-647.
doi:<http://dx.doi.org/10.1016/j.jadohealth.2013.06.014>

WD1

Wolke, Dieter, 21/10/2021

Mental Health: Mechanism Victimisation

Mediation Model: Prematurity, Trauma and Mental Health

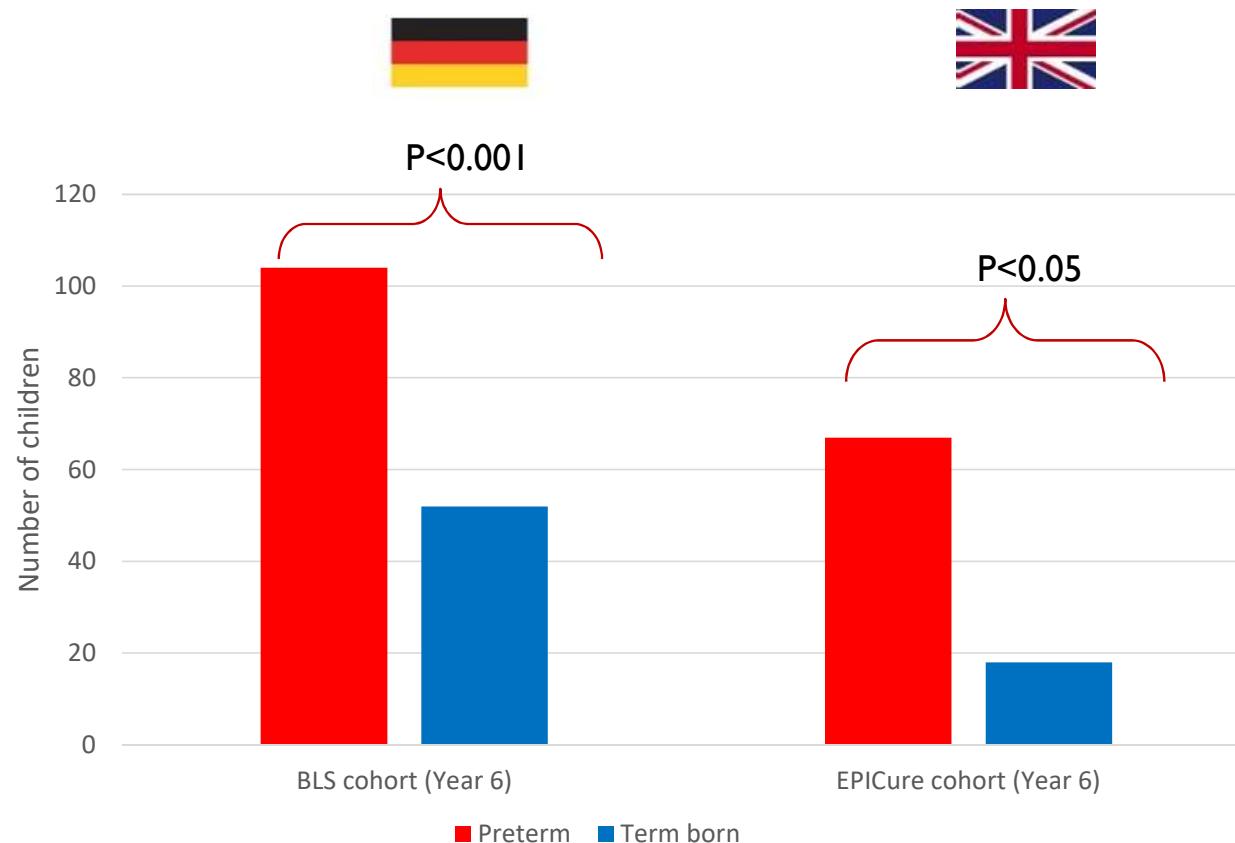


Wolke, D., Baumann, N., Strauss, V., Johnson, S., & Marlow, N. (2015). Bullying of Preterm Children and Emotional Problems at School Age: Cross-Culturally Invariant Effects. *The Journal of Pediatrics*, 166(6), 1417-1422. doi:<http://dx.doi.org/10.1016/j.jpeds.2015.02.055>

Liu, Y., Mendonça, M., Johnson, S., O'Reilly, H., Bartmann, P., Marlow, N., & Wolke, D. (2019). Testing the neurodevelopmental, trauma and developmental risk factor models of psychosis using a naturalistic experiment. *Psychological Medicine*, 1-10. doi:[10.1017/S0033291719003349](https://doi.org/10.1017/S0033291719003349)



Frequency of being bullied in preterm children



Wolke, D., Baumann, N., Strauss, V., Johnson, S., & Marlow, N. (2015). Bullying of preterm children and emotional problems at school age: Cross-culturally invariant effects. *The Journal of Pediatrics*, 166(6), 1417–1422. <https://doi.org/10.1016/j.jpeds.2015.02.055>

Bullying and emotional problems

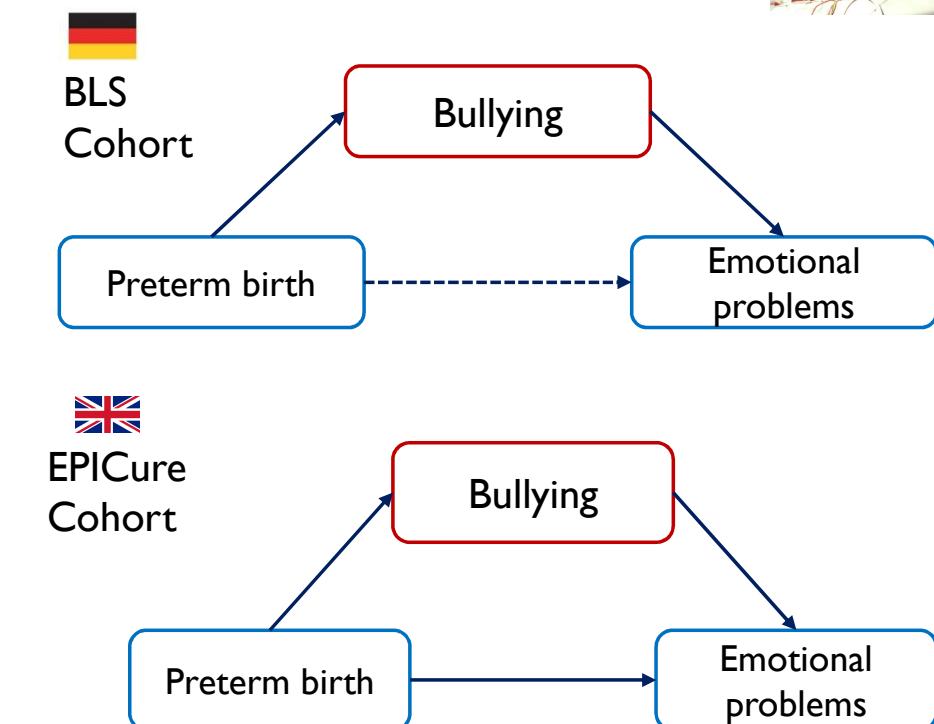


Table III. Regressions of prematurity and being bullied at 1 or 2 time points on emotional problem scores in year 6/7 of schooling

Predictors	Model 1 (unadjusted), main effects, B (95% CI)	Model 2 (adjusted*), effects, B (95% CI)
BLS cohort		
VP/VLBW	0.48 (0.15-0.81) [†]	0.25 (-0.06 to 0.57)
Being bullied at 1 time point	0.68 (0.32-1.04) [‡]	0.26 (-0.08 to 0.60)
Being bullied at 2 time points	1.46 (0.94-1.97) [‡]	0.78 (0.28-1.27) [†]
EPI Cure cohort		
EP	0.91 (0.39-1.42) [†]	0.73 (0.22-1.24) [†]
Being bullied at 1 time point	1.37 (0.80-1.95) [‡]	1.33 (0.60-1.67) [‡]
Being bullied at 2 time points	2.43 (1.68-3.18) [‡]	1.55 (0.79-2.30) [‡]

[†] $P < .01$.

[‡] $P < .001$.



Wolke, D., Baumann, N., Strauss, V., Johnson, S., & Marlow, N. (2015). Bullying of preterm children and emotional problems at school age: Cross-culturally invariant effects. *The Journal of Pediatrics*, 166(6), 1417–1422. <https://doi.org/10.1016/j.jpeds.2015.02.055>

Summary: Peer Bullying



Preterm born
children have more
psychiatric problems



Bullying increases
risk of psychiatric
problems



Preterm born
children are bullied
more often



Bullying mediates the
relationship between
preterm birth and
psychiatric outcomes

Core Assessments

51

- Family of Origin
 - *Parental Education*
 - or Socio-economic status
- *Parenting* measure – *Best observed – sensitivity*;
 - or Parenting style reported
- Need to assess *Peer Relationships*

Parenting and peer measures are completely missing but needed

Preterm birth – Stress on Parents



Priorities for collaborative research using very preterm birth cohorts

Jennifer Zeitlin ,¹ Mariane Sentenac ,¹ Andrei S Morgan,¹ Pierre Yves Ancel,¹ Henrique Barros,² Marina Cuttini ,³ Elizabeth Draper,⁴ Samantha Johnson,⁴ Jo Lebeer,⁵ Rolf F Maier,⁶ Mikael Norman,^{7,8} Heili Varendi,⁹ the RECAP Preterm child cohort research group

DOI: [10.1136/archdischild-2019-317991](https://doi.org/10.1136/archdischild-2019-317991)

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PLOS ONE

Rethinking Stress in Parents of Preterm Infants: A Meta-Analysis

Renske Schappin^{1*}, Lex Wijnroks², Monica M. A. T. Uniken Venema¹, Marian J. Jongmans^{2,3}

DOI: [10.1371/journal.pone.0054992](https://doi.org/10.1371/journal.pone.0054992)

- Parental Stress listed as 5th most important area to be researched



- Parents report more stress for infants with lower gestational ages and lower birth weights
- Differences to parents of full term infants are small
- Normalise by year 2

What About Quality of Life (QoL) For Parents?



**Very Preterm Birth and Parents'
Quality of Life 27 Years Later**

Dieter Wolke, PhD, Dr rer nat hc,^{a,b} Nicole Baumann, BSc,^b Barbara Busch, MD,^c Peter Bartmann, MD, Dr rer nat^c



Parents Quality of Life when their Children's are Adults: What predicts it?

► What is the Quality of Life?

World Health Organization Quality of Life assessment
Global score of quality of life and general health
Physical health
Psychological health
Social relationships
Environment
Life satisfaction (global score)

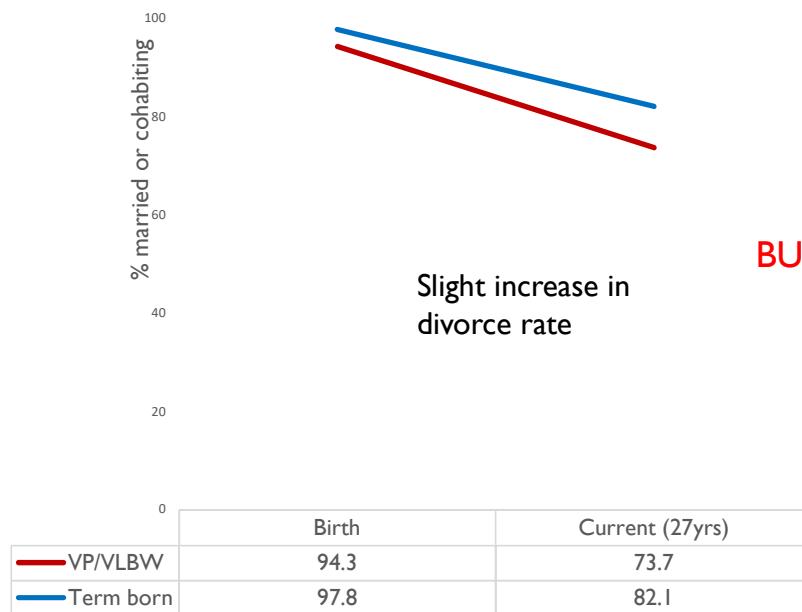
► What in Children's childhood functioning predicts Quality of Life of Parents?

VP and VLBW versus term
Any disability
Mental health
Academic achievement
Parent-child relationship
Peer relationship



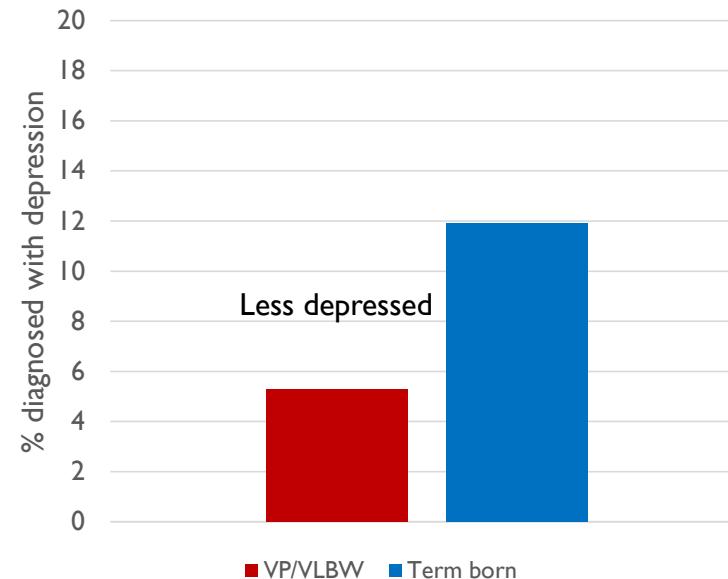
Make it or Break it!

Marital Status



BUT

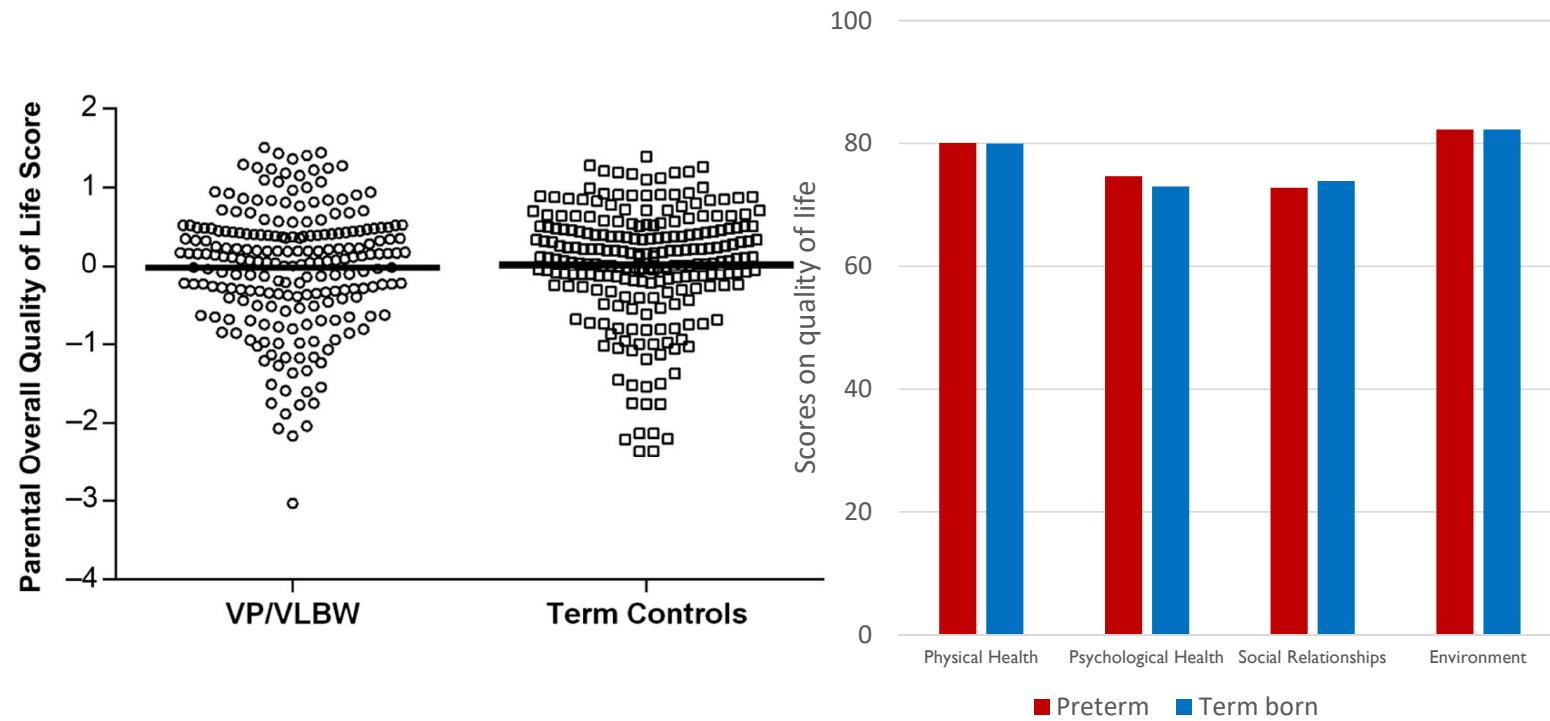
Maternal Depression first 6 years of Life





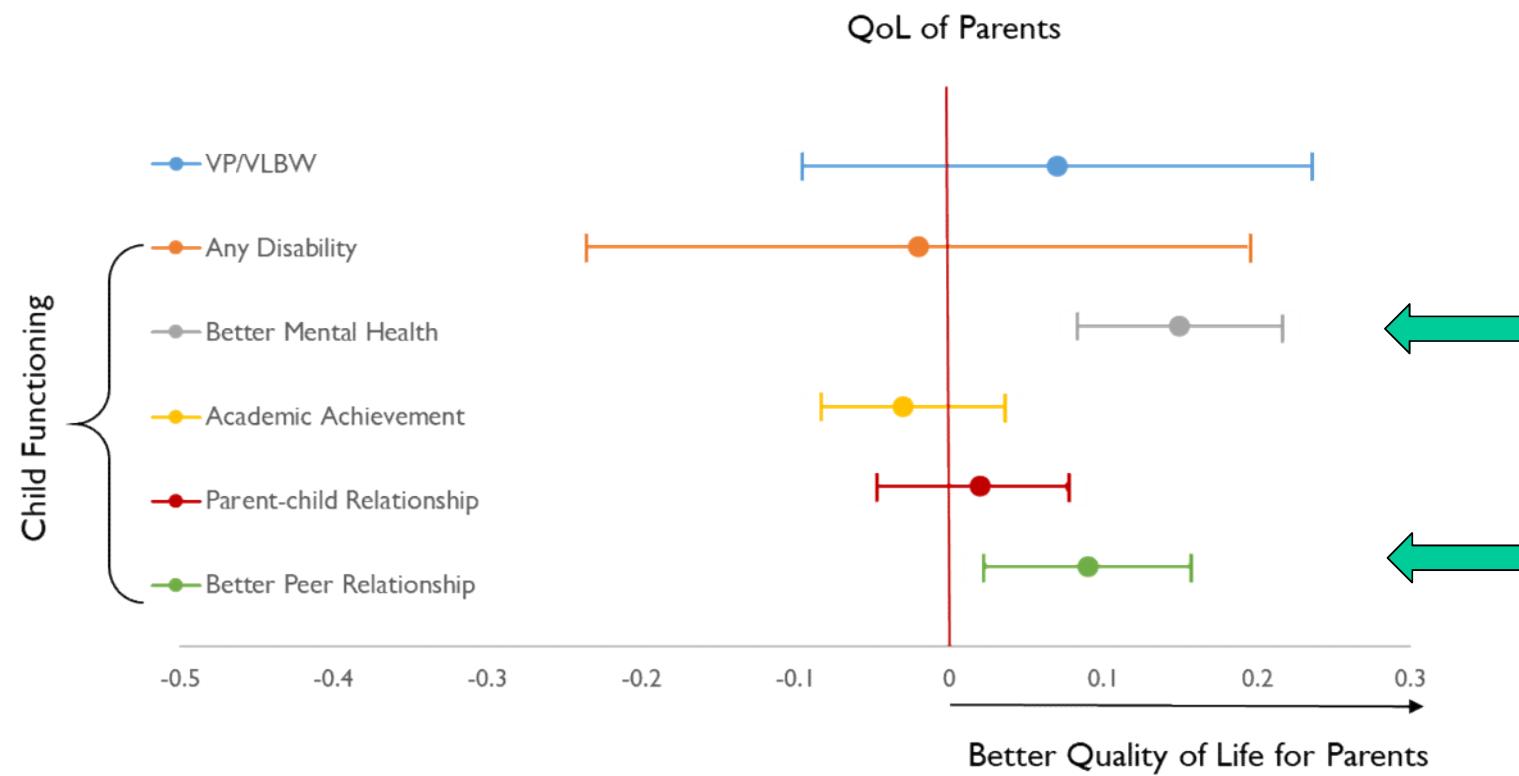
Parents' QoL 27 Years Later

No Difference



Wolke, D., Baumann, N., Busch, B., & Bartmann, P. (2017). Very Preterm Birth and Parents' Quality of Life 27 Years Later. *Pediatrics*, e20171263. <https://doi.org/10.1542/peds.2017-1263>

Child Functioning and Parents' QoL



Wolke, D., Baumann, N., Busch, B., & Bartmann, P. (2017). Very Preterm Birth and Parents' Quality of Life 27 Years Later. *Pediatrics*, e20171263. <https://doi.org/10.1542/peds.2017-1263>



Summary: Parents' Quality of Life



Resilience

Quality of life of parents of preterm born children no different from parents of term born children



Children's mental health and peer relationships predicted parents' quality of life more than a decade later

If their kids are **happy** and have **friends** in childhood – parents are more satisfied in adulthood



Although preterm born children more often experienced disability, it did not reduce quality of life of parents

Conclusions

NEONATALLY

- Create a more family centred neonatal unit
- Try for gentle safe treatment



AFTER DISCHARGE

- Preterms are more sensitive to adverse environment (more vulnerable)
- Support optimal parenting
- Focus on social integration and social skills – prevent bullying
- Parent and Teacher Training on Needs of Preterm children (Preschool, early school age)

Social
Neuro-
protection



Chairs of the TEG

Professor Dieter Wolke,
UK/Germany



Dr Aleid van
Wassenaer-Leemhuis,
The Netherlands



european standards of
care for newborn health



Invest more in social Neuroprotection

Comprehensive Review

Annual Review of Developmental Psychology

The Life Course Consequences of Very Preterm Birth

Dieter Wolke,^{1,2} Samantha Johnson,³
and Marina Mendonça¹

2019, Vol 1, 69-92 DOI: 10.1146/annurev-devpsych-121318-084804



Questions?

