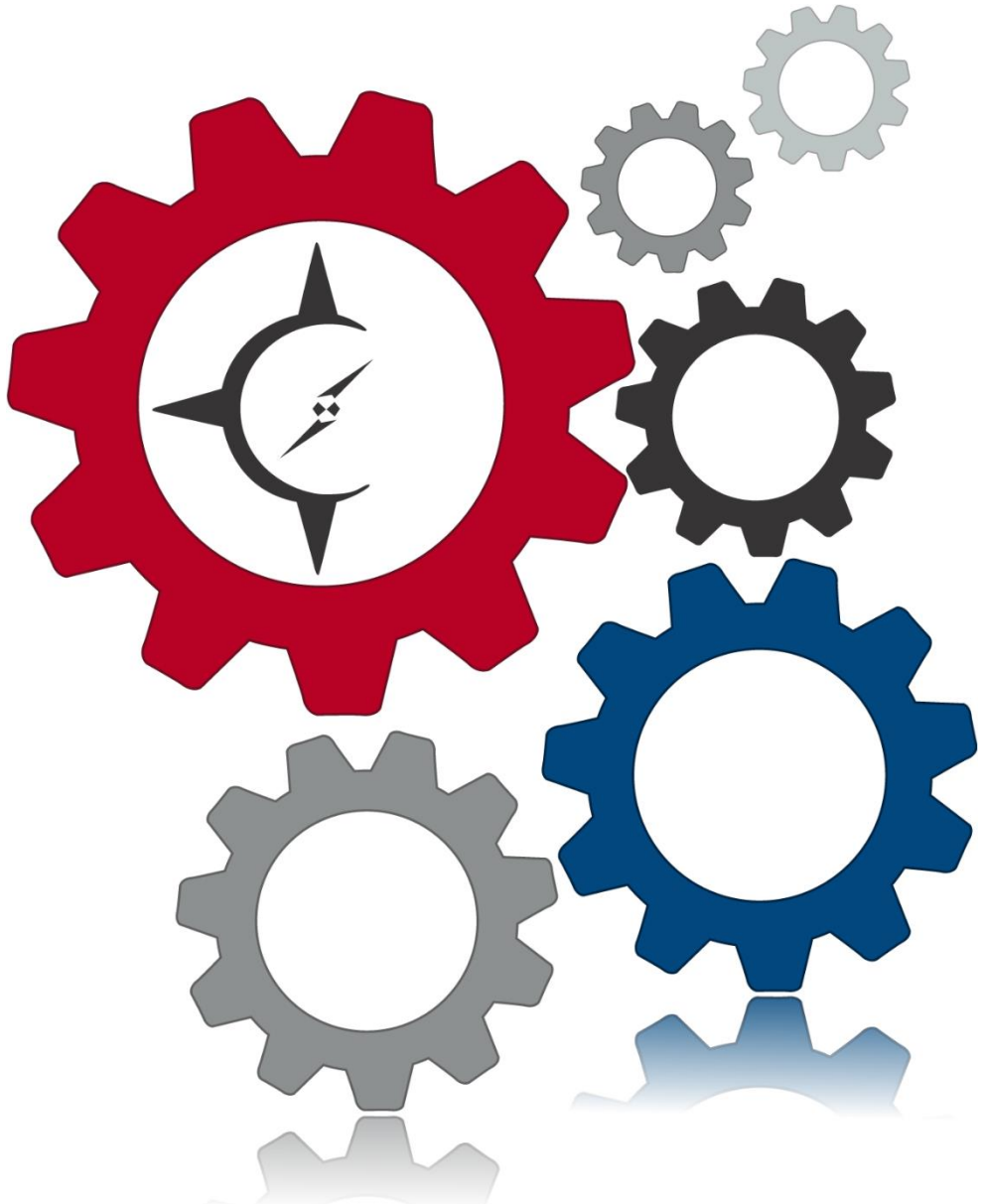


COMPASS RESEARCH CENTRE

FACULTY OF ARTS
UNIVERSITY OF AUCKLAND
Waipapa Taumata Rau

Use of Population-Level Administrative Data in Developmental Science

Barry Milne

COMPASS Colloquium

25 October 2022

National SCIENCE Challenges | A BETTER START | E Tipu e Rea

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Annual Review of Developmental Psychology

COMPASS RESEARCH CENTRE

FACULTY OF ARTS
UNIVERSITY OF AUCKLAND
Waipapa Taumata Rau

Use of Population-Level Administrative Data in Developmental Science

Barry J. Milne,[1] Stephanie D'Souza,[1]
Signe Hald Andersen,[2] and Leah S. Richmond-Rakerd[3]

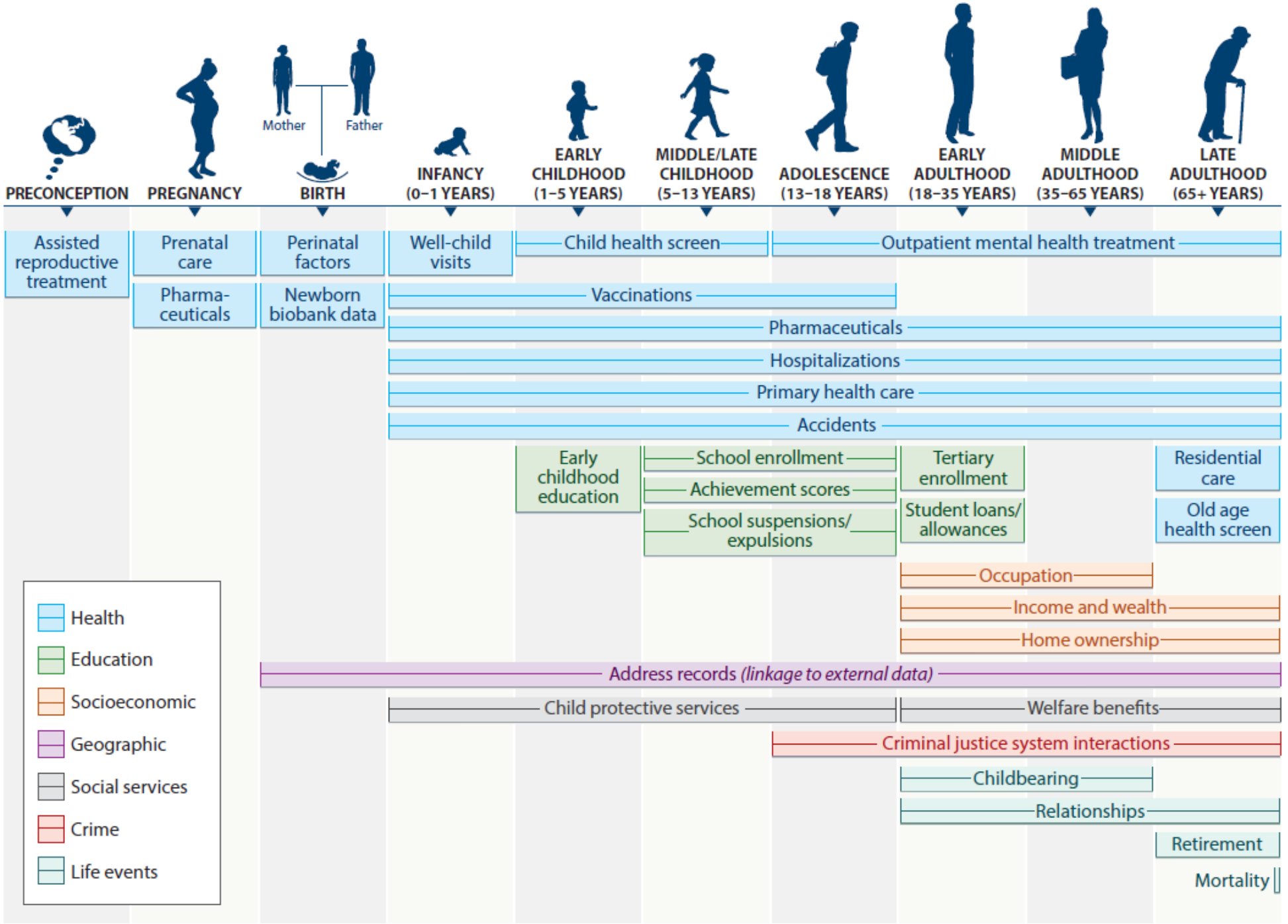
Annu. Rev. Dev. Psychol. 2022. 4:18.1–18.22

The *Annual Review of Developmental Psychology* is online at devpsych.annualreviews.org

https://doi.org/10.1146/annurev-devpsych-120920-023709

Synopsis

- Linked administrative data have a number of advantages for developmental research
- Advances in understanding human development have been facilitated in at least five areas
  - Understanding small or difficult to study populations
  - Evaluating intergenerational and family influences
  - Estimating causal effects through natural experiments
  - Identifying risk for later problems
  - Assessing the influence of neighbourhood and environmental factors
- …But there are downsides
- …And care is needed regarding ethics and governance



COMPASS RESEARCH CENTRE

FACULTY OF ARTS
UNIVERSITY OF AUCKLAND
Waipapa Taumata Rau

- Data at all stages of the life course
- Longitudinal by design
- Wide range of exposures and outcomes available - linkage across domains
- Intergenerational investigations possible
- Assessment of neighbourhood and environmental factors

Small and difficult to study populations

DOI: 10.1002/eat.22798

ORIGINAL ARTICLE

International Journal of EATING DISORDERS

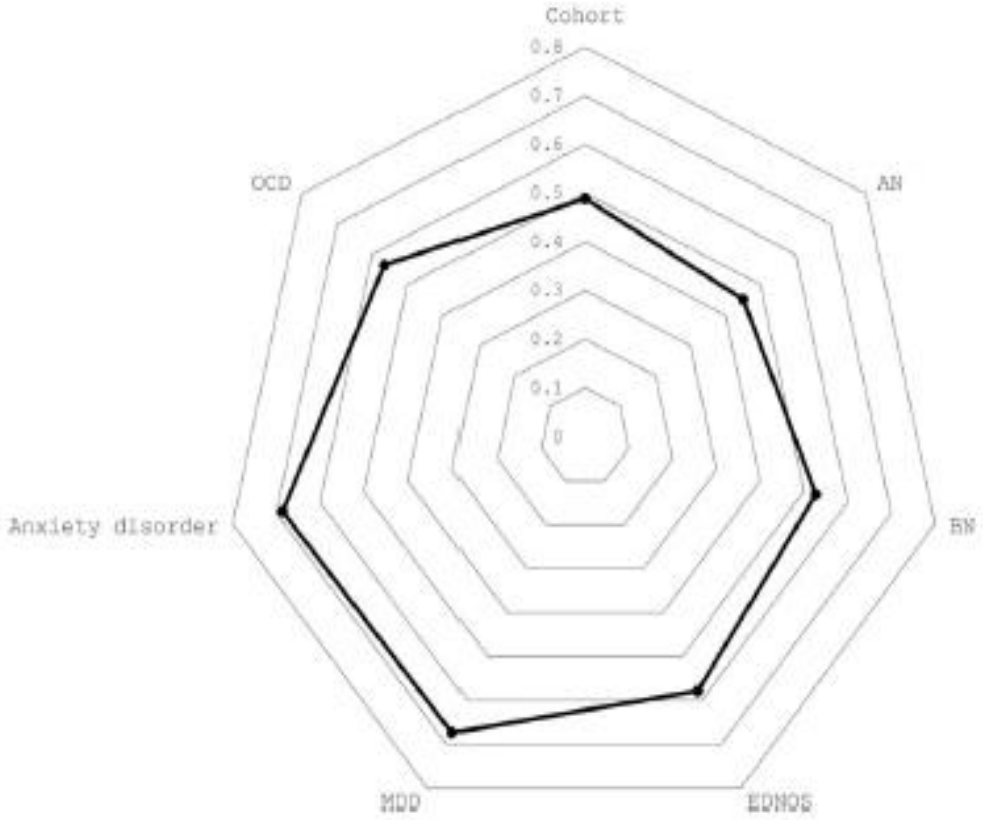
Early childhood adversities and risk of eating disorders in women: A Danish register-based cohort study

Janne Tidselbak Larsen MSc[1,2,3] | Trine Munk-Olsen PhD[1,2,3] | Cynthia M. Bulik PhD[4,5,6] | Laura M. Thornton PhD[4] | Susanne Vinkel Koch PhD[7,8] | Preben Bo Mortensen DrMedSc[1,2,3] | Liselotte Petersen PhD[1,2,3]

TABLE 1 Number of cohort members and cases exposed to early childhood adversities.

	Cohort (*N* = 495,244) *N* (%)	AN cases (*N* = 2,892) *N* (%)	BN cases (*N* = 1,027) *N* (%)	EDNOS cases (*N* = 2,150) *N* (%)
Family disruption	107,672 (21.74)	622 (21.51)	285 (27.75)	563 (26.19)
Parental somatic illness	41,776 (8.44)	205 (7.09)	69 (6.72)	181 (8.42)
Residential instability	37,613 (7.59)	213 (7.37)	86 (8.37)	191 (8.88)
Parental psychiatric illness	22,756 (4.59)	113 (3.91)	43 (4.19)	130 (6.05)
Severe parental criminality	10,384 (2.10)	42 (1.45)	19 (1.85)	58 (2.70)
Parental disability	9,016 (1.82)	40 (1.38)	7 (0.68)	50 (2.33)
Familial death	4,926 (0.99)	36 (1.24)	15 (1.46)	26 (1.21)
Parental SUD	4,540 (0.92)	24 (0.83)	12 (1.17)	26 (1.21)
Placement in OOHC	3,330 (0.67)	10 (0.35)	6 (0.58)	19 (0.88)
Any adversity	172,173 (34.77)	976 (33.75)	400 (38.95)	870 (40.47)
Any maternal adversity	39,380 (7.95)	206 (7.12)	66 (6.43)	208 (9.67)
Any paternal adversity	40,260 (8.13)	194 (6.71)	72 (7.01)	184 (8.56)
Number of adversities				
0	323,071 (65.23)	1,916 (66.25)	627 (61.05)	1,280 (59.53)
1	121,947 (24.62)	727 (25.14)	299 (29.11)	609 (28.33)
2	36,453 (7.36)	192 (6.64)	72 (7.01)	185 (8.60)
3 or more	13,773 (2.78)	57 (1.97)	29 (2.82)	76 (3.53)

Note: AN = anorexia nervosa; BN = bulimia nervosa; EDNOS = eating disorder not otherwise specified; SUD = substance use disorder; OOHC = out-of-home care.



Small and difficult to study populations

To cite: Berry MJ, Foster T, Rowe K, et al. Gestational Age, Health, and Educational Outcomes in Adolescents. *Pediatrics*. 2018;142(5):e20181016

- Most children born very preterm (23-24w) able to be resuscitated and 66% survived to age 10
  - n=549 / 613,521
- Most able to participate in and perform well at school
- Gradient of school achievement across gestational age, right up to early term (37–38w)

BACKGROUND AND OBJECTIVES: As outcomes for extremely premature infants improve, up-to-date, large-scale studies are needed to provide accurate, contemporary information for clinicians, families, and policy makers. We used nationwide New Zealand data to explore the impact of gestational age on health and educational outcomes through to adolescence.

METHODS: We performed a retrospective cohort study of all births in New Zealand appearing in 2 independent national data sets at 23 weeks' gestation or more. We report on 2 separate cohorts: cohort 1, born January 1, 2005 to December 31, 2015 (613 521 individuals), used to study survival and midterm health and educational outcomes; and cohort 2, born January 1, 1998 to December 31, 2000, and surviving to age 15 years (146 169 individuals), used to study high school educational outcomes. Outcomes described by gestational age include survival, hospitalization rates, national well-being assessment outcomes at age 4 years, rates of special education support needs in primary school, and national high school examination results.

RESULTS: Ten-year survival increased with gestational age from 66% at 23 to 24 weeks to >99% at term. All outcomes measured were strongly related to gestational age. However, most extremely preterm children did not require special educational support and were able to sit for their national high school examinations.

CONCLUSIONS: Within a publicly funded health system, high-quality survival is achievable for most infants born at periviable gestations. Outcomes show improvement with gestational ages to term. Outcomes at early-term gestation are poorer than for children born at full term.

Intergenerational and family influences

Autism Risk Across Generations

A Population-Based Study of Advancing Grandpaternal and Paternal Age

Emma M. Frans, MSc; Sven Sandin, MSc; Abraham Reichenberg, PhD; Niklas Långström, MD, PhD; Paul Lichtenstein, PhD; John J. McGrath, MD, PhD; Christina M. Hultman, PhD

JAMA Psychiatry. 2013;70(5):516-521. Published online March 20, 2013. doi:10.1001/jamapsychiatry.2013.1180

Table 1. Results From Logistic Regression Analyses on Grandpaternal Ages and Autism Risk[a]

Variable	No. (%) of Participants in Models 1-3		OR (95% CI) by Model			
	Controls	Cases	1	2	3	4
Maternal grandfather age, y						
<20	675 (2.2)	122 (2.1)	0.96 (0.79-1.18)	0.91 (0.74-1.12)	0.91 (0.73-1.12)	0.90 (0.73-1.11)
20-24	6721 (21.7)	1253 (21.1)	1.00	1.00	1.00	
25-29	9801 (31.7)	1787 (30.1)	0.98 (0.91-1.06)	1.07 (0.98-1.17)	1.07 (0.98-1.17)	1.08 (0.99-1.18)
30-34	7082 (22.9)	1334 (22.5)	1.01 (0.93-1.10)	1.18 (1.06-1.31)	1.18 (1.06-1.31)	1.19 (1.07-1.32)
35-39	3868 (12.5)	808 (13.6)	1.10 (1.00-1.22)	1.33 (1.17-1.50)	1.32 (1.16-1.50)	1.31 (1.15-1.49)
40-44	1843 (6.0)	393 (6.6)	1.12 (0.99-1.27)	1.32 (1.13-1.55)	1.31 (1.11-1.53)	1.32 (1.12-1.54)
45-49	666 (2.2)	154 (2.6)	1.22 (1.01-1.46)	1.39 (1.12-1.73)	1.37 (1.10-1.71)	1.34 (1.07-1.67)
≥50	267 (0.9)	85 (1.4)	1.67 (1.30-2.15)	1.90 (1.44-2.51)	1.87 (1.42-2.48)	1.79 (1.35-2.37)
Paternal grandfather age, y						
<20	702 (2.3)	123 (2.1)	0.96 (0.79-1.18)	0.88 (0.72-1.09)	0.88 (0.72-1.09)	0.91 (0.73-1.12)
20-24	6293 (20.4)	1139 (19.2)	1.00	1.00	1.00	
25-29	9694 (31.4)	1793 (30.2)	1.02 (0.94-1.11)	1.09 (1.00-1.19)	1.09 (0.99-1.19)	1.10 (1.00-1.20)
30-34	7046 (22.8)	1387 (23.4)	1.08 (0.99-1.17)	1.18 (1.06-1.31)	1.17 (1.05-1.30)	1.17 (1.05-1.30)
35-39	4277 (13.8)	831 (14.0)	1.05 (0.95-1.16)	1.17 (1.04-1.33)	1.17 (1.03-1.32)	1.15 (1.02-1.31)
40-44	1971 (6.4)	405 (6.8)	1.11 (0.98-1.26)	1.26 (1.08-1.47)	1.24 (1.06-1.46)	1.23 (1.05-1.44)
45-49	672 (2.2)	180 (3.0)	1.45 (1.22-1.74)	1.64 (1.34-2.02)	1.62 (1.32-1.99)	1.60 (1.30-1.97)
≥50	268 (0.9)	78 (1.3)	1.56 (1.20-2.02)	1.76 (1.32-2.35)	1.72 (1.29-2.30)	1.67 (1.25-2.24)

Intergenerational and family influences

JAMA Network Open

Original Investigation | Nutrition, Obesity, and Exercise

Associations of Prenatal and Childhood Antibiotic Exposure With Obesity at Age 4 Years

Karen S. W. Leong, MD; Jessica McLay, MSc; José G. B. Derraik, PhD; Sheree Gibb, PhD; Nichola Shackleton, PhD; Rachael W. Taylor, PhD; Marewa Glover, PhD; Rick Audas, PhD; Barry Taylor, MBChB; Barry J. Milne, PhD; Wayne S. Cutfield, MD

JAMA Network Open. 2020;3(1):e1919681. doi:10.1001/jamanetworkopen.2019.19681

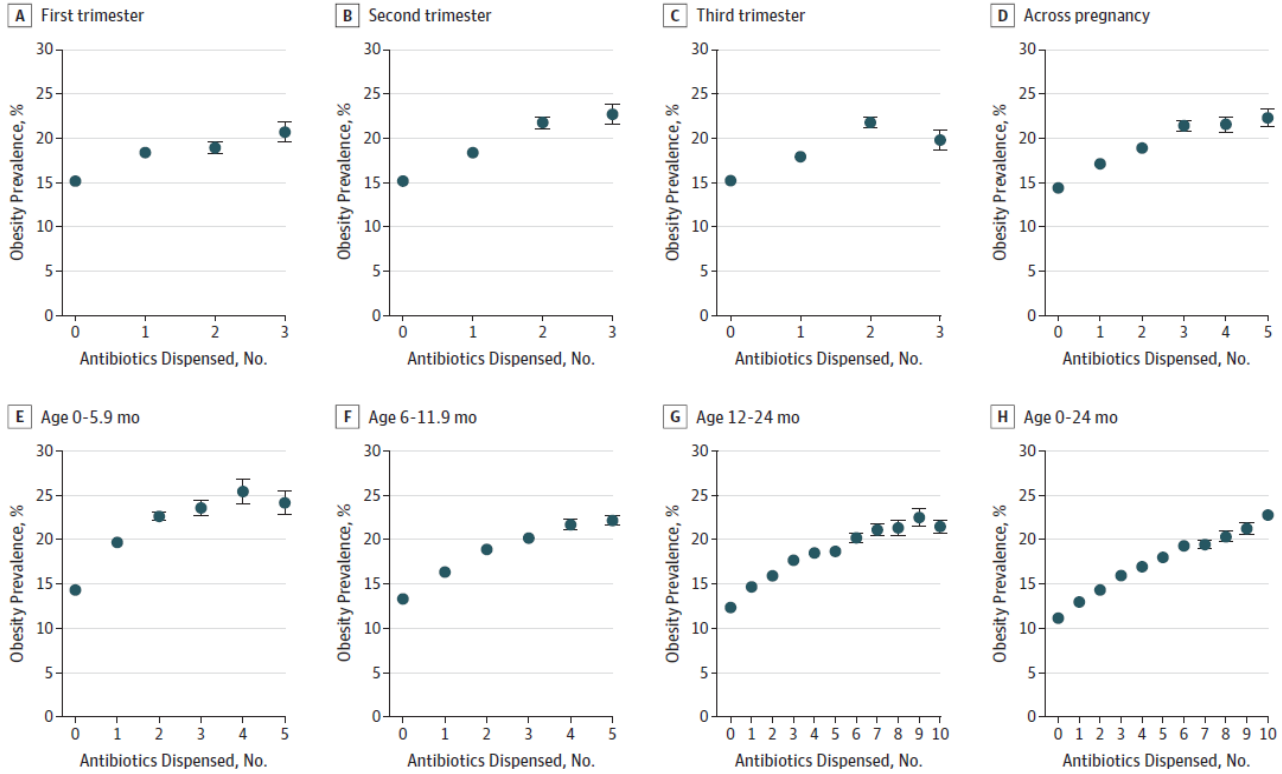


Table 4. Associations of Maternal and Child's Antibiotic Exposure With Obesity and BMI *z* Score at Age 4 Years by Siblings and Twins[a]

	Obesity, aOR (95% CI)		BMI *z* Score, Adjusted β Coefficient (95% CI)	
Antibiotic Exposure	Covariate Adjusted	Family Fixed Effects[b]	Covariate Adjusted	Family Fixed Effects
Siblings, No.	30 696	6249	30 696	30 696
Maternal exposure	1.02 (0.99 to 1.06)	0.95 (0.90 to 1.00)	0.017 (0.006 to 0.028)	−0.008 (−0.024 to 0.008)
Child's exposure	1.04 (1.03 to 1.05)	1.02 (0.99 to 1.04)	0.017 (0.013 to 0.020)	0.006 (0.000 to 0.012)
Twins, No.	4188	522	4188	4188
Child's exposure	1.05 (1.02 to 1.09)	0.91 (0.81 to 1.02)	0.018 (0.008 to 0.028)	−0.011 (−0.026 to 0.005)

Causal effects through natural experiments

COMPASS RESEARCH CENTRE
FACULTY OF ARTS
UNIVERSITY OF AUCKLAND
Waipapa Taumata Rau

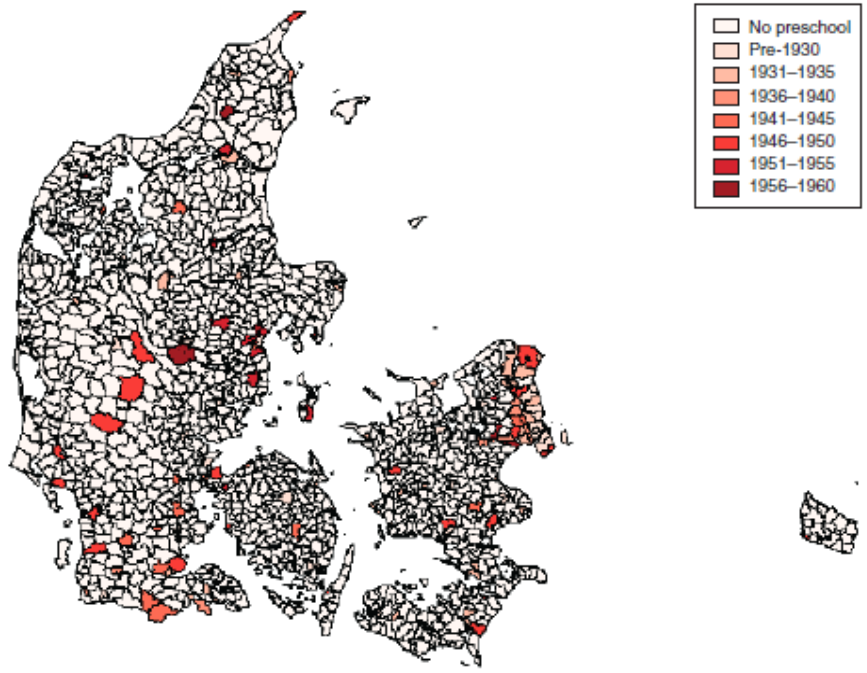
American Economic Journal: Applied Economics 2020, 12(3): 255–286
https://doi.org/10.1257/app.20180698

What is the Added Value of Preschool for Poor Children? Long-Term and Intergenerational Impacts and Interactions with an Infant Health Intervention†

By Maya Rossin-Slater and Miriam Wüst*

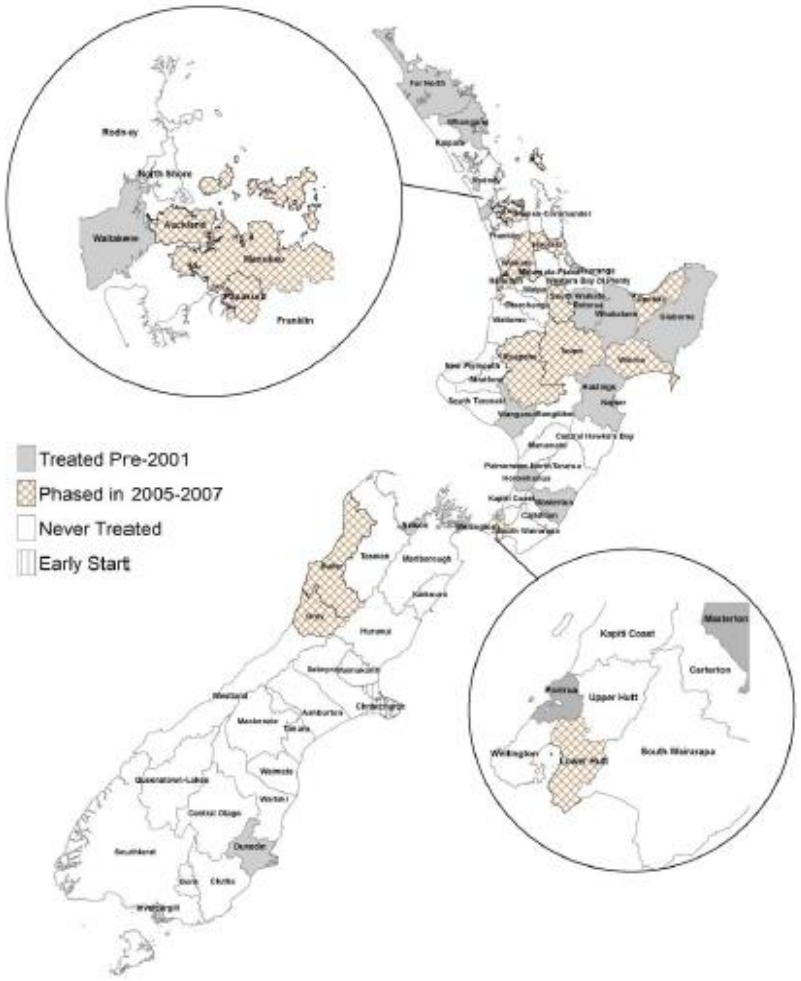
We study the impact of preschool targeted at children from low-income families over the life cycle and across generations, and examine its interaction with an infant health intervention. Using Danish administrative data with variation in the timing of program implementation over the period 1933–1960, we find lasting benefits of access to preschool on adult educational attainment, earnings, and survival beyond age 65. We also show that children of women exposed to preschool obtain more education by age 25. However, exposure to a nurse home visiting program in infancy reduces the added value of preschool, implying that the programs serve as partial substitutes.

Panel A. Map of Denmark



Causal effects through natural experiments

Figure 2: TLAs served by FS and Early Start (Christchurch)



The Impact of the Family Start Home Visiting Programme on Outcomes for Mothers and Children

A Quasi-Experimental Study

February 2016

RhemaVaithianathan[1,2]
Moira Wilson[3]
Tim Maloney[1]
Sarah Baird[4]

Table 7B: Impact of Family Start on Mortality for Benefit Population (Community FE, First Year Outcomes Only)

	Coefficient estimate (with 95% CI and p-value) on Family Start indicator
Post Neonatal Infant Mortality	-0.0035** [-0.0067, 0.0003] p=0.036
Post Neonatal SUDI	-0.0006 [-0.0022, 0.0010] p=0.466
Post Neonatal Infant Injury Death	-0.0006 [-0.0016, 0.0004] p=0.251

Identifying risk for later problems

Citation: Østergaard SD, Larsen JT, Dalsgaard S, Wilens TE, Mortensen PB, Agerbo E, et al. (2016) Predicting ADHD by Assessment of Rutter's Indicators of Adversity in Infancy. PLoS ONE 11(6): e0157352. doi:10.1371/journal.pone.0157352

FEMALES	N ADHD (%)	N total(%)	Rate (95% CI)	HR (95% CI)
Low social class				
No	4,240 (74.87)	439,782 (90.83)	1.00 (0.97–1.03)	1.00 (ref)
Yes	1,416 (25.00)	44,082 (9.10)	2.95 (2.80–3.10)	2.94 (2.77–3.12)
Severe marital discord				
No	4,425 (78.14)	435,379 (89.92)	1.05 (1.02–1.08)	1.00 (ref)
Yes	1,228 (21.68)	47,794 (9.87)	2.47 (2.34–2.62)	2.34 (2.20–2.49)
Large family size				
No	5,450 (96.24)	466,038 (96.25)	1.20 (1.17–1.23)	1.00 (ref)
Yes	203 (3.58)	17,135 (3.54)	1.22 (1.07–1.40)	1.02 (0.88–1.17)
Paternal criminality				
No	4,367 (77.11)	432,540 (89.33)	1.04 (1.01–1.07)	1.00 (ref)
Yes	1,296 (22.89)	51,654 (10.67)	2.59 (2.45–2.73)	2.50 (2.35–2.66)
Maternal mental disorder				
No	5,164 (91.19)	457,738 (94.54)	1.14 (1.11–1.17)	1.00 (ref)
Yes	499 (8.81)	26,456 (5.46)	2.72 (2.50–2.97)	2.56 (2.34–2.81)
Out-of-home care				
No	5,565 (98.27)	482,936 (99.74)	1.18 (1.15–1.22)	1.00 (ref)
Yes	98 (1.73)	1,258 (0.26)	8.58 (7.04–10.46)	7.43 (6.08–9.07)
RIA-score				
0	2,775 (49.00)	348,594 (71.99)	0.82 (0.79–0.85)	1.00 (ref)
1	1,615 (28.52)	96,140 (19.86)	1.72 (1.64–1.80)	2.10 (1.97–2.23)
2	806 (14.23)	28,395 (5.86)	2.86 (2.67–3.07)	3.50 (3.24–3.79)
3	372 (6.57)	9,024 (1.86)	4.25 (3.84–4.71)	5.25 (4.71–5.85)
4	78 (1.38)	1,829 (0.38)	4.93 (3.95–6.15)	6.14 (4.90–7.69)
5–6	17 (0.30)	212 (0.04)	9.10 (5.65–14.63)	11.37 (7.06–18.32)

Identifying risk for later problems

Injury and Mortality Among Children Identified as at High Risk of Maltreatment

Rhema Vaithianathan, PhD,[a,b] Bénédicte Rouland, PhD,[a,c] Emily Putnam-Hornstein, PhD[d,e]

PEDIATRICS Volume 141, number 2, February 2018:e20172882

TABLE 1 Distribution of Predictors of Maltreatment at Birth Among Children Born in 2010 in New Zealand

Predictor Variables (Dummies)[a]	Proportion of All Children who Are in the Top 10% Group (%)	Top 10% Children[b], No. (%)	All Children, No. (%)
Preterm birth (before 37 wk gestation)	17.5	780 (12.6)	4455 (7.2)
Female infant	9.8	2946 (47.7)	29 952 (48.5)
Maternal age <18, y	63.2	666 (10.8)	1053 (1.7)
Maternal age 18–19	35.9	981 (15.9)	2733 (4.4)
Maternal age 20–24	18.5	2037 (33.0)	11 022 (17.9)
Maternal age >35	3.6	495 (8.0)	13 617 (22.1)
Single mother	38.3	5451 (88.2)	14 229 (23.0)
Maternal history of welfare (≥3 of last 5 y)	54.7	4710 (76.3)	8604 (13.9)
Maternal history of a mental health or substance abuse (last 5 y)	42.9	2259 (36.6)	5262 (8.5)
Maternal history of childhood allegations to CPS	53.3	3321 (53.8)	6234 (10.1)
Maternal criminal justice sentence (last 5 y)	67.7	1584 (25.6)	2340 (3.8)
High parenting demand[c]	46.8	1899 (30.7)	4059 (6.6)
Siblings referred to CPS (last y)	96.5	1242 (20.1)	1287 (2.1)
Siblings referred to CPS (last 5 y)	81.7	3900 (63.1)	4773 (7.7)
Total No. children	10	6177	61 746

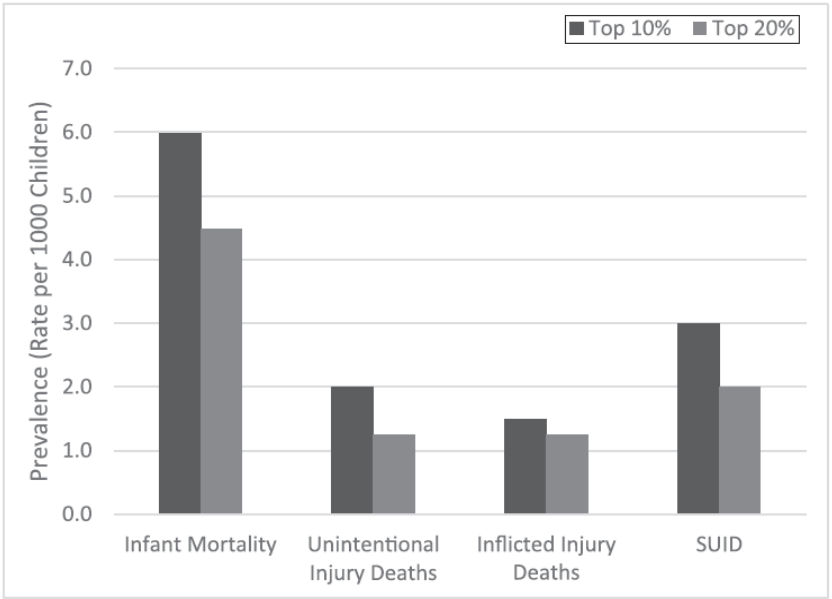


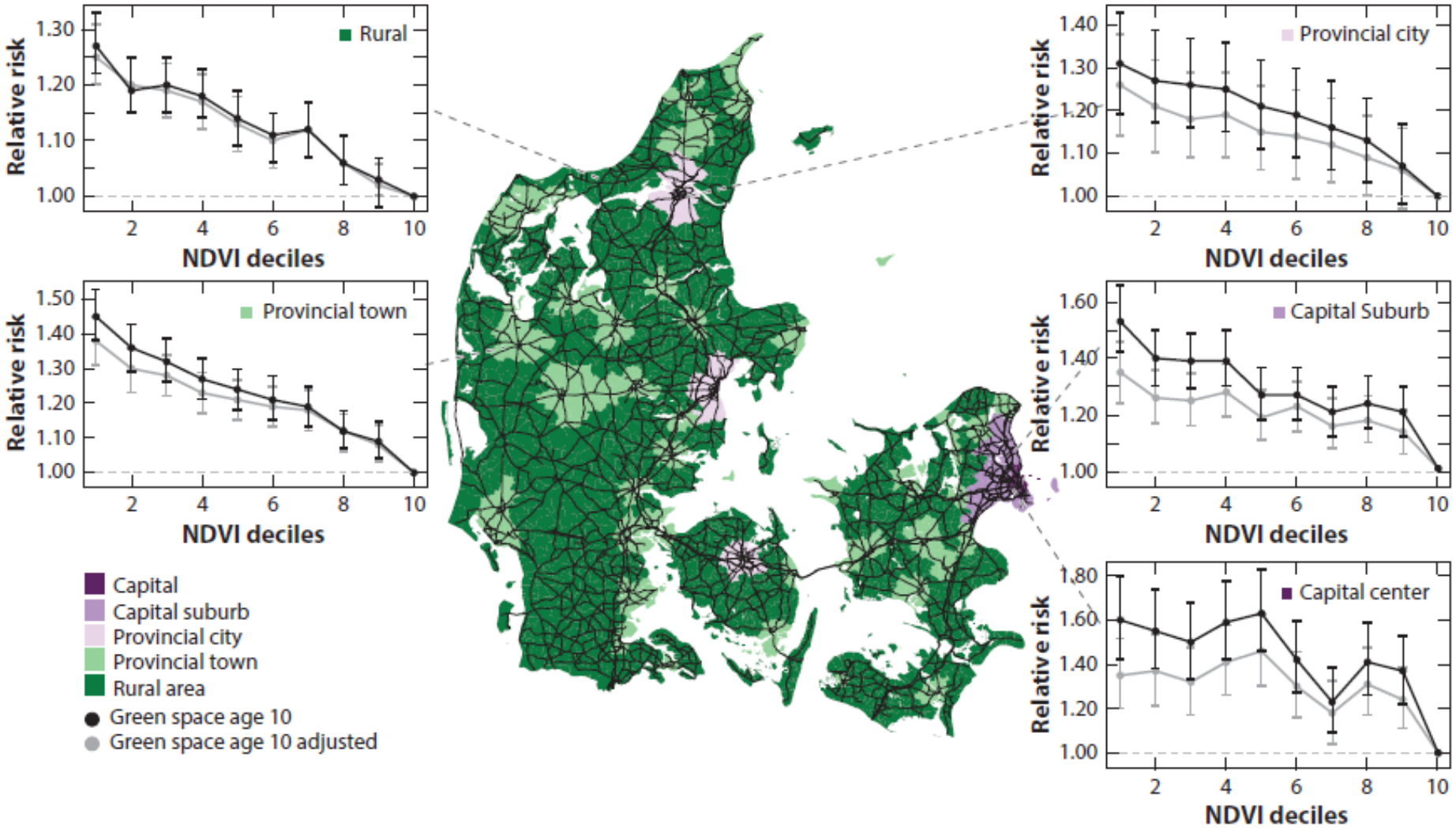
FIGURE 1
Postneonatal (death of an infant aged 29 days to 1 year) mortality outcomes among children born in 2011 in New Zealand and at very high risk (top 10%) and high risk (top 20%) of maltreatment. We applied Statistics New Zealand confidentiality rules to counts, which included the random rounding of all counts to base 3. Data come from the Integrated Child Dataset, a one-off integrated record of all live births between mid-2004 and the end of 2011 in New Zealand, with health, welfare benefits, child protection system, and justice registers. The data set was put together by the MSD in 2014.

Neighbourhood and environmental factors

Residential green space in childhood is associated with lower risk of psychiatric disorders from adolescence into adulthood

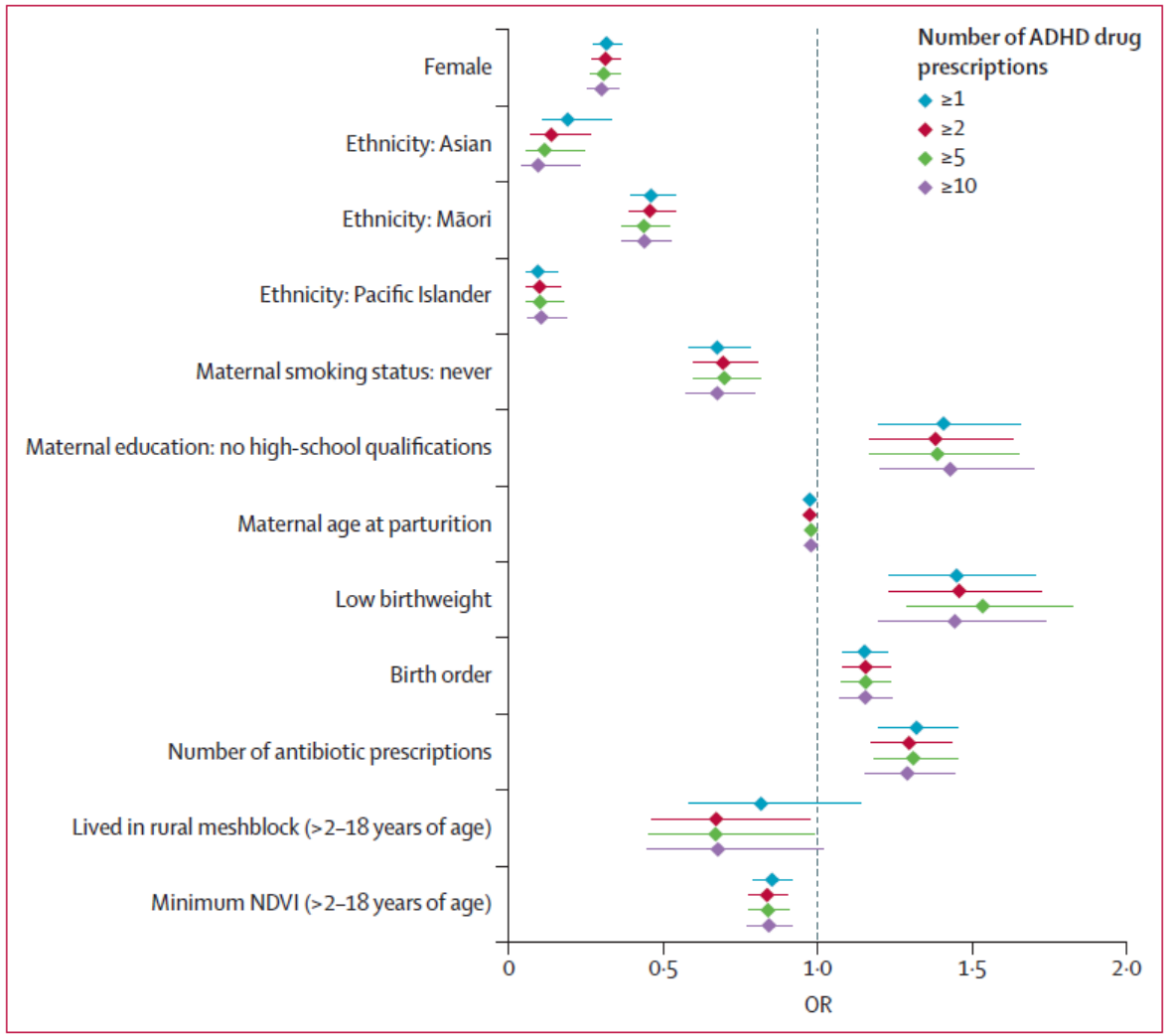
Kristine Engemann[a,b,c,1], Carsten Bøcker Pedersen[c,d,e], Lars Arge[f], Constantinos Tsirogiannis[f], Preben Bo Mortensen[c,d,e], and Jens-Christian Svenning[a,b]

5188–5193 | PNAS | March 12, 2019 | vol. 116 | no. 11



Neighbourhood and environmental factors

COMPASS RESEARCH CENTRE
FACULTY OF ARTS
UNIVERSITY OF AUCKLAND
Waipapa Taumata Rau



Association between exposure to the natural environment, rurality, and attention-deficit hyperactivity disorder in children in New Zealand: a linkage study

Geoffrey H Donovan, Yvonne L Michael, Demetrios Gatziolis, Andrea 't Mannetje, Jeroen Douwes

Lancet Planet Health 2019;
3: e226–34

Limitations

- Mostly service use
  - Often biases in those who seek/receive services
  - May not be good for prevalence; interpret with care
  - Important phenotypes not captured (e.g. loneliness, home environment)
- What State deems important to measure will reflect dominant culture and what data are valued by governments
  - Intergenerational data captures nuclear structures best (others less well)

Ethics and governance

- Data used without informed consent, so strong governance is needed - more work needed in New Zealand
  - Rights of children? How to consider their voice?
- Social license is an ongoing process
  - Requires transparency and trust – again, more work needed in New Zealand
- Big data divide – those who feature most in the data least able to control how it is used, or to be users themselves
  - A case for reconsidering access rules?
- Group harms – stigmatization or stereotyping
  - Particularly problematic in predictive risk modelling, esp if there are biases

Ethics and governance

- Indigenous data sovereignty – the right to govern the collection and use of data from/about indigenous people.
- Co-governance models?
  - Ngā Tikanga Paihere – 10 principles to follow, assessed for IDI projects
  - Best implemented in Manitoba
    - Projects in which indigenous populations are over-represented require approvals from the First Nations Health and Social Secretariat, and the Manitoba Metis Community Research and Ethics Protocol, AS WELL AS institutional ethical approval.

Final thoughts…

- Administrative data research has made major contributions to understanding human development
- Almost exclusively in Western societies
- Even within Western societies, access to data and research questions asked of it determined by a privileged few. In my view…
  - Broadening access (e.g. communities) would
    - Promote more informed debate about the value and merits of the data
    - Provide ongoing feedback about social license
      - Improved governance would help this too
    - Allow a wider range of questions to be asked of the data

Literature

COMPASS RESEARCH CENTRE

FACULTY OF ARTS
UNIVERSITY OF AUCKLAND
Waipapa Taumata Rau

Berry, M. J., Foster, T., Rowe, K., Robertson, O., Robson, B., & Pierse, N. (2018). Gestational Age, Health, and Educational Outcomes in Adolescents. Pediatrics, 142(5), e20181016. https://doi.org/10.1542/peds.2018-1016

Donovan, G. H., Michael, Y. L., Gatziolis, D., Mannetje, A. 't, & Douwes, J. (2019). Association between exposure to the natural environment, rurality, and attention-deficit hyperactivity disorder in children in New Zealand: A linkage study. The Lancet Planetary Health, 3(5), e226–e234. https://doi.org/10.1016/S2542-5196(19)30070-1

Engemann, K., Pedersen, C. B., Arge, L., Tsirogiannis, C., Mortensen, P. B., & Svenning, J.-C. (2019). Residential green space in childhood is associated with lower risk of psychiatric disorders from adolescence into adulthood. Proceedings of the National Academy of Sciences of the United States of America, 116(11), 5188–5193. https://doi.org/10.1073/pnas.1807504116

Frans, E. M., Sandin, S., Reichenberg, A., Långström, N., Lichtenstein, P., McGrath, J. J., & Hultman, C. M. (2013). Autism risk across generations: A population-based study of advancing grandpaternal and paternal age. JAMA Psychiatry, 70(5), 516–521. https://doi.org/10.1001/jamapsychiatry.2013.1180

Larsen, J. T., Munk-Olsen, T., Bulik, C. M., Thornton, L. M., Koch, S. V., Mortensen, P. B., & Petersen, L. (2017). Early childhood adversities and risk of eating disorders in women: A Danish register-based cohort study. The International Journal of Eating Disorders, 50(12), 1404–1412. https://doi.org/10.1002/eat.22798

Leong, K. S. W., McLay, J., Derraik, J. G. B., Gibb, S., Shackleton, N., Taylor, R. W., Glover, M., Audas, R., Taylor, B., Milne, B. J., & Cutfield, W. S. (2020). Associations of Prenatal and Childhood Antibiotic Exposure With Obesity at Age 4 Years. JAMA Network Open, 3(1), e1919681. https://doi.org/10.1001/jamanetworkopen.2019.19681

Milne, B. J., D'Souza, S., Andersen, S. H., & Richmond-Rakerd, L. S. (2022). Use of population-level administrative data in developmental science. Annual Review of Developmental Psychology, 4. https://doi.org/10.1146/annurev-devpsych-120920-023709

Østergaard, S. D., Larsen, J. T., Dalsgaard, S., Wilens, T. E., Mortensen, P. B., Agerbo, E., Mors, O., & Petersen, L. (2016). Predicting ADHD by Assessment of Rutter's Indicators of Adversity in Infancy. PloS One, 11(6), e0157352. https://doi.org/10.1371/journal.pone.0157352

Rossin-Slater, M., & Wüst, M. (2020). What Is the Added Value of Preschool for Poor Children? Long-Term and Intergenerational Impacts and Interactions with an Infant Health Intervention. American Economic Journal: Applied Economics, 12(3), 255–286. https://doi.org/10.1257/app.20180698

Vaithianathan, R., Rouland, B., & Putnam-Hornstein, E. (2018). Injury and mortality among children identified as at high risk of maltreatment. Pediatrics (Evanston), 141(2), e20172882. https://doi.org/10.1542/peds.2017-2882

Vaithianathan, R., Wilson, M., Maloney, T., & Baird, S. (2016). Impact of the Family Start Home Visiting Programme on Outcomes for Mothers and Children: A Quasi-Experimental Study - Ministry of Social Development. MSD. https://www.msd.govt.nz/about-msd-and-our-work/publications-resources/evaluation/family-start-outcomes-study/