Do pre-school socio-demographic and health developmental indicators predict the future utilization of early primary school-based literacy interventions: a national population study

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Predicting children's need for literacy intervention

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- Literacy and health literacy is critical to a person's health and wellbeing and realising his or her full potential
- Support of literacy is essential, and those with reading and learning disabilities identified early for intervention
- Language exposure and rate of expressive language development vary significantly by socioeconomic position (even by age 3-years)
- Critical to detect literacy deficits early so that timely remediation can be efficaciously applied

- But, can we detect these children?

kids WHO READ succeed

Predicting children's literacy success and needs

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PACIFIC ISLANDS FAMILIES STUDY

Growing Up in New Zealand

Predicting children's need for literacy intervention

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- Mandated by Government, in 2011 prototype, extended 2013
  - IDI data integrated using deterministic and probabilistic linking, conducted by SNZ; it contains over 166 billion facts, consumes 1.22 terabytes of space
- Exploiting national datasets – social, environmental, cultural determinants of health and education
- Allows empirical evidence-based findings – assist decision-makers early for intervention
- Multi-disciplinary team with requisite content and technological expertise...

- But, can we detect these children?

Predicting children's need for literacy intervention

- B4 School Check (B4SC); national screening programme of 4-year-olds
  - focuses on identifying any social, behavioural or development issues which could potentially interfere with children's learning and success at school and to support children's healthy development
- Key explanatory variables:
  - hearing; vision; BMI; Parents' Evaluation of Developmental Status (PEDS) - *concern of cognition, communication, motor skills, readiness for school*; Strengths and Difficulties Questionnaire (SDQ) – *emotional symptoms, conduct problems, hyperactivity, peer relationship problems, prosocial behaviours*
- B4SC uptake high, with 92% of the nation's 4-year-old children participating in 2015/2016 checks
- Demographics: sex; ethnicity; rurality; NZDep2013

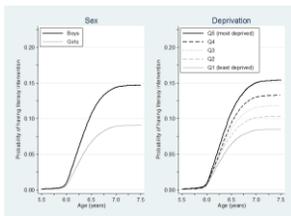## Predicting children's need for literacy intervention

- Literacy was assessed via:
  - 'Reading recovery', which is an intensive reading program targeting children aged 6 years, typically having completed their first year of primary schooling; and
  - 'Specialist teaching', whereby specialist resource teachers' work with students who are struggling to meet national literacy standards for their age

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Results

- N=255,093 children aged 4 years had B4SC between: 1 July 2010 & 30 June 2015
- By 31 December 2015, 20,652 (8.1%) children had received at least one literacy intervention
  - median age to children's first intervention was 6.3 years (Q$_1$=6.1, Q$_3$=6.5 years)

Results

- All variables significant (p<0.001)

	n	Adjusted HR (95% CI)
Sex		
Female	124,032	1 (reference)
Male	**131,061**	**1.65 (1.60, 1.70)**
Ethnicity		
European	182,700	1 (reference)
Māori	70,254	1.20 (1.16, 1.24)
Pacific	34,785	1.11 (1.07, 1.16)
Asian	27,948	0.51 (0.47, 0.54)
Other	7,542	0.80 (0.73, 0.89)
Domicile area		
Urban	203,157	1 (reference)
Rural	50,013	1.26 (1.21, 1.31)
Deprivation		
Q1 (least dep.)	44,988	1 (reference)
Q2	**43,713**	**1.20 (1.14, 1.27)**
Q3	**43,929**	**1.36 (1.29, 1.43)**
Q4	**45,636**	**1.53 (1.45, 1.60)**
Q5 (most dep.)	**57,454**	**1.69 (1.61, 1.78)**

	n	Adjusted HR (95% CI)
SDQ–parent/caregiver		
No action	196,815	1 (reference)
Advice given	35,499	0.92 (0.86, 0.97)
Referred	6,048	1.08 (0.99, 1.18)
Referred – declined	1,779	1.06 (0.87, 1.28)
Under care	2,583	0.78 (0.64, 0.94)
Declined test	3,882	0.94 (0.81, 1.09)
Not done (missing)	8,484	0.81 (0.25, 2.63)
SDQ–teacher		
No action	113,013	1 (reference)
Advice given	8,667	1.12 (1.03, 1.23)
Referred	3,378	1.07 (0.95, 1.19)
Referred – declined	621	0.93 (0.70, 1.22)
Declined test	66,657	1.03 (0.99, 1.07)
Not done (missing)	8,700	0.72 (0.43, 1.20)
Not applicable	52,737	0.91 (0.87, 0.95)

	n	Adjusted HR (95% CI)
Hearing		
Pass	200,769	1 (reference)
Pass after rescreen	17,934	1.24 (1.18, 1.30)
Fail – referral	13,893	1.13 (1.06, 1.20)
Under care	8,751	1.12 (1.04, 1.21)
Declined test	8,091	1.41 (1.19, 1.68)
Not done (missing)	5,646	0.62 (0.27, 1.43)
Vision		
Pass	204,945	1 (reference)
Pass after rescreen	**11,568**	**1.35 (1.27, 1.43)**
Fail – referral	**16,572**	**1.42 (1.35, 1.50)**
Under care	8,274	1.09 (1.01, 1.19)
Declined test	8,085	0.98 (0.82, 1.16)
Not done (missing)	5,652	1.73 (0.75, 3.99)
BMI		
Normal/underweight	158,487	1 (reference)
Overweight	44,172	1.01 (0.97, 1.05)
Obese	30,837	1.08 (1.03, 1.13)
Morbidly obese	8,016	1.11 (1.03, 1.19)
Not done (missing)	13,608	1.11 (0.99, 1.24)
PEDS		
No action	183,039	1 (reference)
Advice given	41,496	1.04 (0.99, 1.10)
Referred	**11,385**	**1.40 (1.31, 1.49)**
Referred – declined	1,251	1.21 (0.97, 1.52)
Under care	6,618	1.25 (1.12, 1.40)
Declined test	2,826	0.92 (0.76, 1.10)
Not done (missing)	6,578	1.62 (0.53, 5.09)

Predicting children's need for literacy intervention

- But, can we detect these children?
- Multivariable models (c-statistic):
  - Harrell's c-statistic gives the probability a randomly selected participant who experienced an event (e.g. the literacy intervention) had a higher risk score than a participant who had not experienced the event
  - A value of 0.5 indicates that the model is no better than chance at making a prediction and a value of 1.0 indicates perfect prediction
  - Model *reasonable* when c-statistic>0.7 and *strong* when c-statistic>0.8
  - With demographics only: 0.611 (95% CI: 0.605, 0.616)
  - With demographics + B4SC variables: 0.622 (95% CI: 0.617, 0.628)
- Significant improvement in model (p<0.001), but falls short of having universal utility

Predicting children's need for literacy intervention – where next?

- Results encouraging:
  - Introduce more variables from earlier MoH records, and other databases
  - Instead of whole population approach – investigate particular subgroups (e.g. geographical or ethnic)

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Ethnicity		
European	182,700	1 (reference)
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Other	7,542	0.80 (0.73, 0.89)

On all available benchmarks, Pacific children achieve, on average lower early literacy and numeracy than all other students

Pacific composed of many (20+) ethnicities – manifest in differing cultures, languages, immigrant generations, acculturation strength

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