

Protective factors of children and families at highest risk of adverse childhood experiences:

An analysis of children and families in the Growing up in New Zealand data who “beat the odds”

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Disclaimer

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Contents

Policy summary	3
Executive summary	4
Introduction	6
Adverse childhood experiences	6
Resilience and protective factors framework.....	6
Predictive risk models and protective factors.....	7
Purpose of the study	7
Methods	9
Predictive risk model.....	9
Protective factors for children at risk	9
Results	12
Results of protective factor analysis	12
Discussion	14
Limitations	21
Policy implications and future work	23
References	24

Table of figures

Figure 1: Univariate and multivariate results (participants with partner data)	4
Figure 2: Univariate and multivariate results (all participants)	19
Figure 3: Univariate and multivariate results (participants with partner data)	19

Table of tables

Table 1: Summary of potential protective factors associated with “beating the odds” by having fewer than expected adverse childhood experiences.....	4
Table 2: Summary of potential protective factors associated with “beating the odds” by having fewer than expected adverse childhood experiences....	10
Table 3: Distribution of predictors of adverse childhood outcomes (ACEs) in the <i>Growing Up in New Zealand</i> study	15
Table 4: Significant univariate associations between antenatal and 9-month mother <i>Growing Up in New Zealand</i> (GUiNZ) Study Instruments.....	16
Table 5: Significant univariate associations between antenatal and 9-month mother and partner <i>Growing Up in New Zealand Survey</i> (GUiNZ) study instruments	17

Appendices

Appendix 1: Variables and categorisations used for predictive modelling.....	27
Appendix 2: Variables and categorisations used for protective factor exploration analyses	28

Policy summary

With increasing access to integrated administrative data, it is easy to identify infants who are likely to suffer childhood adversities. However, many infants who appear “at risk” end up thriving, experiencing few of the adversities that beset other children with similar risk factors. Understanding what helps children “beat the odds” is important for policy-makers and frontline services that want to help families at risk.

The present report analyses the Growing Up in New Zealand (GUiNZ) birth cohort to identify protective factors for at-risk children who “beat the odds”. For the purpose of illustration, we build a predictive risk model using variables that are observed prenatally or at-birth in the GUiNZ data. These are mainly economic and demographic factors, and are chosen because they are typically available in administrative data. We use a predictive risk model to identify children who are at the highest risk of being exposed to Adversities of Childhood Experiences (ACEs) by 54 months. Children are classified as “beating the odds” if they are in the highest 20% risk group based on the predictive risk model, but by age 54 months have not experienced a single ACE.

Using univariate and multivariate approaches, 749 factors that are collected in the GUiNZ data are tested for their protective association with “beating the odds”. These factors are classified by the researchers in five categories: (i) strength of the parent-child relationship; (ii) strength of the mother-partner relationship, (iii) parental health and wellness; (iv) community and neighbourhood characteristics, and (v) family finances. Taking advantage of the breadth of these investigated categories, we identified several factors that appear to be protective in children at high risk of ACEs.

We found at least one univariate significantly correlated factor to “beating the odds” in each investigated domain. Based on survival of significant univariate factors in backward and forward multivariate testing, mother-partner factors, parental health and wellness, and family finances are all found to be important. Surprisingly, based on standardised effect size, parental relationship factors are found to have the strongest associations with “beating the odds”. The two largest standardised effects included a parent’s report that they are more inclined to “like each other’s ideas”, and a report from the partner of decreasing worry over who does the household chores.

Our findings suggest that programmes that focus solely on mother-child interactions, without attending to the mother-partner relationship, might be missing an important opportunity for reducing adversities in childhood. Further research, including research on the impact of programmes to improve the quality of the mother-partner relationship on childhood adversities, is needed to test this hypothesis. An additional area of future work could identify mutable factors in the context of policy and interventions.

Executive summary

The Adverse Childhood Experiences (ACEs) Study (Felitti *et al*, 1998) and subsequent research have shown that people exposed to a range of negative childhood experiences have poor health as adults (Kalmakis & Chandler, 2015; Kerker *et al*, 2015). ACEs include exposure to maltreatment, witnessing violence, living with household members with mental illness, who abuse substances, have a history of incarceration, or have experienced parental divorce. Predictive risk models are now being proposed as useful approaches to screen children at risk of adverse outcomes. However, one of the criticisms of the use of predictive risk models is that they are overly focused on risk factors and ignore protective factors. Moreover, simply identifying children at risk is not sufficiently useful for frontline social workers and other support services. In particular, if families at risk are identified, frontline workers want to know what other factors they should assess to determine whether there are countervailing protective factors; and also to consider what sorts of strengths might mitigate against these risks.

The present study explores whether:

- there exists a simple predictive risk model that can use basic characteristics available in administrative records at birth to screen families for risk of exposure to ACEs
- amongst those families who are at highest risk of ACEs based on administrative data, what parent-child, mother-partner, community and neighbourhood, family finance, and parental mental wellness factors can be found to be protective.

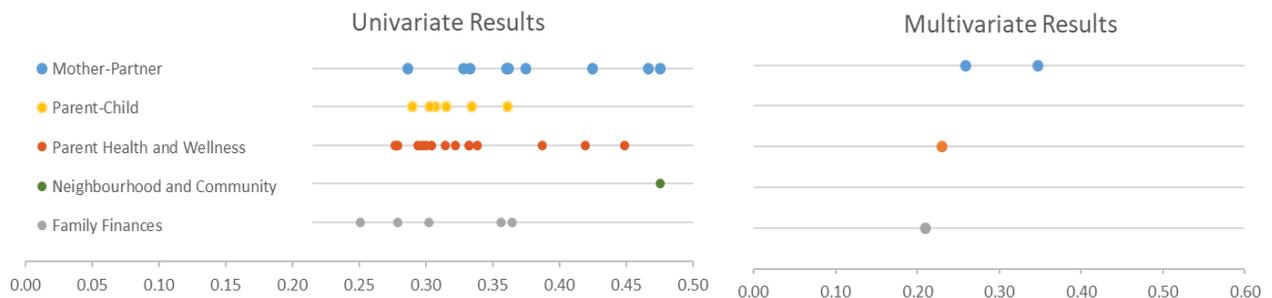
The research was conducted in two phases. The first stage was to build a predictive risk model using factors observed at birth that are able to predict ACEs. For the GUINZ sample overall, 47.2% had no record of an ACE by the 54 month wave. In contrast, for those identified as high risk by the predictive risk model, 19.2% had no record of any ACEs and 51.9% had two or more ACEs. The 19.2% sub-sample who recorded no ACEs were classified as children who “beat the odds”, because although their risk was high, they had no ACEs.

In the second stage of the analysis, 749 factors collected by the GUINZ survey from the various partner and mother surveys fielded up to the 54-month wave were tested for their protective association with “beating the odds”. They were classified by the researchers into five domains: (i) strength of the parent-child relationship; (ii) strength of the mother-partner relationship; (iii) parental health and wellness; (iv) community and neighbourhood characteristics; and (v) family finances.

The modelling strategy was to first undertake a univariate logistic regression which estimated the odds-ratio that the single factor was associated with the child “beating the odds”. A total of 35 factors were found to be statistically significant at the 1.0% significance level (that is, they had a p-value less than or equal to 0.01). A standardised effect size was reported – so that each effect could be compared.

Figure 1 shows the count of factors correlated with “beating the odds” in each domain. While there are factors in each domain associated with “beating the odds”, the mother-partner factors seem to have higher overall fully standardised effect sizes. The mother-partner variables also had the highest percentage of factors significantly associated with “beating the odds” (**Table 1**).

Figure 1: Results for GUiNZ participants with partner data in the highest 20% risk category (N=675)



*Univariate results show the fully standardised effect sizes for all 35 variables with p-value <0.01. The multivariate results show the factors that remain statistically significant in either the backward or forward selection methods.

Table 1: Summary of potential protective factors associated with “beating the odds” by having fewer than expected adverse childhood experiences: Subset of Growing up in New Zealand (GUiNZ) participants with mother and partner data GUiNZ, New Zealand 2009-2015

Domain	Investigated factors	Percent of factors investigated significant at 0.01			
		0.05 [^]	0.01 [^]	0.001 [^]	
Mother-Partner	67	17	9	5	13.4%
Parent Health And Wellness	105	23	14	5	13.3%
Parent-Child	134	19	6	0	4.5%
Family Finances	172	19	5	1	2.9%
Community and Neighbourhood	271	9	1	0	0.4%

*Results in this report focus on the 0.01 significance level.

[^]Factors associated with “beating the odds” at each level of significance.

Our results suggest that programmes that focus solely on mother-child interactions, without attending to the mother-partner relationship and parent health and wellness might be missing an important opportunity for reducing adversities of childhood. Further research, including on the impact of programmes to improve the quality of the mother-partner relationship on childhood adversities, is needed to test this hypothesis.

Introduction

Adverse childhood experiences

The Adverse Childhood Experiences (ACEs) Study (Felitti *et al.*, 1998) and subsequent research have shown that people exposed to a range of negative childhood experiences have poor health as adults (Kalmakis & Chandler, 2015; Kerker *et al.*, 2015). ACEs include exposure to maltreatment, witnessing violence, living with household members with mental illness, who abuse substances, have a history of incarceration, or have experienced parental divorce. One of the pathways between ACEs and health is hypothesised to be harmful biological responses to stress (Voellmin *et al.*, 2015). These physiological effects include a range of changes in the nervous system that have behavioural implications, compromising the child's memory and causing cognitive and attention problems (Danese & McEwen, 2012; Thompson & Haskins, 2014).

The GUiNZ study is a longitudinal birth cohort of over 6,000 children and their parents (Morton *et al.*, 2010, 2012, 2014). Parents were enrolled and interviewed during pregnancy and at several time points including at 9, 24, and 54 months after birth. Collection waves utilised numerous standardised questionnaires and included data on demographics, health histories and behaviours, community and neighbourhood characteristics, and social and cognitive measures. With the wealth of data available at the individual, home, and community level, we were able to map ACEs to the GUiNZ data, as detailed in an earlier report "Adverse childhood experience and school readiness outcomes" (Walsh *et al.*, 2019). The present report extends on this analysis to create a predictive model of ACEs to identify children who "beat the odds", that is, are at risk of multiple ACEs but end up experiencing none. In many ways, the GUiNZ data is ideal for this investigation. The data provides a range of factors that were observable at birth, and is also a longitudinal study which follows the children and parents over time collecting data on a wide range of factors across numerous categories.

Resilience and protective factors framework

Interest in studying 'resilience' in children can be traced back to Norman Garmezy (1974) who identified children at high risk for psychopathology but who instead developed and maintained healthy adaptive behaviours. Resilience is defined in this literature as children who develop 'positive adaptation despite experiences of significant adversity or trauma' (Luthar, 2006). Garmezy and subsequent studies identified key qualities that encourage resilient youth, which included children's pro-social behaviour and their ability to express and regulate a range of emotions (Murphy & Moriarty, 1976). A large study of infants in Hawaii identified affectionate parenting, outside of home support systems and

child's sociability as significant protective factors (Werner & Smith, 1992; Werner, 2004).

As research evolved, three groupings of protective factors associated with resilience were identified. These are factors unique to children, their families and the wider social and community context (Garmezy, 1987; Rutter, 1987; Werner & Smith, 1992; Masten, 2001).

Family factors studied include the quality of attachment between mother and child and father and child. Meisels & Shonkoff (2000) review the literature on resilience and early family dynamics, highlighting the fundamental role of maternal attachment in successful human development. A balanced attitude to discipline and parental oversight has also been identified as a protective factor in a child's upbringing. Outside of the home environment, a child's involvement in quality childcare can have a protective effect, especially for economically disadvantaged children (Meisels & Shonkoff, 2000; Phillips & Shonkoff, 2000). Sociability and relationships with friends are also protective for at-risk children (Benard, 2004; Conger, Cui, Bryant & Elder Jr, 2000). Participating in community social groups and a sense of belonging to a community were also found to be protective factors (Sampson, Raudenbush & Earls, 1997; Wilson, 2003). For example, fathers of at-risk youth who participated in community activities were found to be associated with a lower criminal involvement of these youth in later life (Mahoney & Magnusson, 2001).

Predictive risk models and protective factors

Predictive risk models (PRM) are now being proposed as useful approaches to screening children at risk of adverse outcomes. Cuccaro-Alamin *et al.* (2017) provide a comprehensive literature review of the state of knowledge and utility of PRM tools in screening. Vaithianathan, Rouland & Putnam-Hornstein (2018) show that these PRM models trained to predict child welfare involvement at birth, are effective at identifying children at considerably increased risk of maltreatment related death and injury. However, one of the criticisms of the use of predictive risk models is that they are overly focused on risk factors and ignore protective factors. Moreover, simply identifying children at risk is not sufficiently useful for frontline social workers and other support services. In particular, if families at risk are identified, frontline workers want to know what are the protective or strength factors that they should be identifying.

Purpose of the study

The present study attempts to answer whether:

1. there exists a simple predictive risk model that can use basic characteristics available in administrative records at birth, to screen families for risk of exposure to ACEs

2. amongst those families who are at highest risk of ACEs based on administrative data, what parent-child, mother-partner, community and neighbourhood, family finance, and parental mental wellness factors are found to be protective?

Methods

Predictive risk model

To construct our study sample, we started with 5,562 births in the GUINZ data with parent/s who answered both the antenatal survey and the 54 month wave. For the predictive risk models, respondents who did not respond to the items that were used as predictors were excluded, leaving 5,473 in the study group.

The predictors (ie explanatory variables) were taken exclusively from the antenatal examinations for both the mother and partner to ensure that they were available at the time of birth. Variables from the antenatal data collection are listed in Appendix 1. Characteristics that were used in the predictive variables include: age, income, education, health behaviours, ethnicity, employment status, relationship status, beneficiary status, and household and car ownership, among others. These were selected because of their use in previous studies predicting adverse outcomes for children, such as maltreatment (Cuccaro-Alamin *et al.*, 2017; Vaithianathan, Rouland & Putnam-Horstein, 2018). Correlates to these measures are found in the administrative databases available from Statistics New Zealand as a part of the Integrated Data Infrastructure. Where partner information was not available because the partner did not participate in the study or the mother did not have a current partner, a missing variable was created for each category of partner information. For example, 'partner smokes', 'partner does not smoke' and 'partner missing smoking information' would be included in the regression models.

The outcome (dependent variable) was the count of ACEs over the course of the child's first 54 months. Details of how exposure to ACEs was coded and counted are included in the first report (Walsh *et al.*, 2018).

We used three general modelling strategies: Poisson-regression on the count of ACEs; logistic regression models and random forest models with the dependent variable dichotomised based on the count (for example at ≥ 2 ACEs, or ≥ 3 ACEs). The Poisson-regression model and logistic-regression models were estimated using Stata Version 14.2. The random forest models were estimated using R-studio.

Protective factors for children at risk

The next step was to identify potentially protective factors from all waves of the GUINZ study. By design, we cast a wide net for possible protective factors – with factors from both the mother's and her partner's survey. The factors that were explored are summarised in **Appendix 2**.

To identify the children who were at heightened risk of ACEs, we applied the Poisson-regression to predict the average number of ACEs for each child in the sample. We ranked the children according to the predicted number of ACEs, and

flagged the 20% of children with the highest predicted ACEs as “*high risk children*”.¹ Because we want to correlate these factors with the likelihood that the child “beats the odds” by experiencing no ACEs, we restricted the sample to those 1,094 who were classified in the top 20% of risk by the predictive risk model. A number of these children (38.3%) had missing partner surveys – either due to the mother reporting that she was partnered but the partner not completing the survey, or (less frequently), when the mother did not report having a partner. For the 675 children where mother and partner surveys were present, we were able to test a total of 749 factors. For the sample as a whole, we conducted analyses separately by dropping factors that appear in the partner survey. When evaluating only factors from surveys answered by the mother we tested 337 factors. Missing data in the protective analyses were recoded as the mean of the responses for that variable across all GUINZ participants.

All potential protective factors were collected in the antenatal and 9-month examinations. Researchers categorised the factors into one of five domains: Mother-Child, Mother-Partner, Mother Health and Wellness, Family Finances, and Community and Neighbourhood Attributes. The total variables in each domain are summarised in **Table 2** below.

Table 2: Summary of potential protective factors associated with “beating the odds” by having fewer than expected adverse childhood experiences: Subset of Growing up in New Zealand (GUINZ) participants with mother and partner data GUINZ, New Zealand 2009-2015

Domain	Mother antenatal and 9-month survey variables n=337	Mother and partner antenatal and mother and partner 9-month survey variables n=749
Mother-Partner	33 (9.8%)	67 (8.9%)
Mother-Child	55 (16.3%)	134 (17.9%)
Parent Health and Wellness	42 (12.5%)	105 (14.0%)
Community and Neighbourhood	114 (33.8%)	271 (36.2%)
Family Finances	93 (27.6%)	172 (23.0%)

We excluded from the protective factor analysis medical comorbidity outcomes (except for mental health factors), factors related to survey administration, and those used as predictor variables in the predictive risk model. We undertook the analysis in two stages. In the first, a logistic model with the outcome being “beating the odds”, estimated for each protective factor. The factors that were significant at the 1.0% threshold were collected and included in a forward and backward stepwise logistic regression at the 1.0% thresholds.

¹ Note that for the 1,094 GUINZ children classified at highest risk of ACEs in the total ACEs Poisson model, 87% (N=952) and 83% (N=904) were also classified in the highest 20% of risk scores in the logistic regression models looking at ≥ 3 and ≥ 2 ACEs (data not shown).

To enable comparison across different protective factors, we also calculated the fully standardised effect sizes. This allows comparison across variables that have different units of measure as it shows the impact of a standard deviation change in the protective factor on the standard deviation of the probability that the child will “beat the odds”. Therefore, factors can be ranked according to the impact size. As appropriate, additional analysis of variance and chi-square tests of independence were conducted.

Results

We created several predictive risk models that use data often available in administrative data at birth to stratify children at high risk of ACEs. The Area under Receiver-Operator Characteristic Curve (AUC) for each of the models that we investigated ranged from 0.76-0.78. The Poisson model had a Pseudo R-squared of 0.11. Given the fact that each of the models had similar predictive power, and that the Poisson-regression model did not need to dichotomise the outcome, we used it to stratify the sample and to undertake the “beating the odds” analysis. **Appendix 1** shows the variables included in the final Poisson predictive model. Of those who were identified as high risk, 19.2% did not in fact have an ACE (compared with 47.2% for the GUiNZ sample as a whole). The mean ACEs for the entire cohort of children was 0.87 with 23.1% having two or more. In the group of children at highest risk the mean ACEs were 1.72 with 51.9% having two or more.

Table 2 provides an overall description of the high risk children compared to all GUiNZ children. As expected, children at the highest risk of ACEs tend to have lower family income and live disproportionately in the poorer communities. Slightly over three-fifths (60.2%) of children at highest risk live in the most deprived neighbourhoods (Dep 9-10) compared with 25.1% of the overall sample. Similarly, over half of the mothers in the high risk sample are aged under 25 years of age (54%) compared with 21.6% of mothers in the general GUiNZ sample. Also, while 57.8% of the mothers in GUiNZ reported New Zealand European ethnicity, 19.7% of the mothers with children at highest risk of experiencing ACEs reported New Zealand European ethnicity.

Results of protective factor analysis

In **Table 3** and **Table 4** we present the standardised effects from the univariate estimation. The tables only include those factors that were significantly associated with the child “beating the odds”. Table 4 is similar to **Table 3**, but is restricted to the 675 children where the mother and her partner’s surveys are completed. **Table 4** therefore presents an expanded list of factors since some factors also come from the partner survey.

Full sample (Table 3): A total of 11 factors were found to be significant. The standardised beta shows the estimated impact of a standard deviation change in the protective factor on the (standardised) log-odds of having zero ACEs (ie “beating the odds”). These are somewhat difficult to interpret, so we shall only be using these as an ordinal scale to compare amongst different protective factors. Results of the forward and backward selection methods on these 11 variables showed four factors that remained in either the forward or backward models. These were (i) decreasing report of how often partners argue; (ii) higher composite satisfaction with parenting role, (iii) lower report of being

angered by things outside your control, and (iv) not reporting being forced to buy cheaper food to pay for other needed things.

Restricted sample with partner information (Table 4): In the restricted sample, 35 total factors were associated with “beating the odds” including nine Mother-Partner factors. The top two factors in the Mother-Partner domain include an increasing report of liking each other’s ideas and decreasing worry about who does household chores. The final forward and backwards selection models were identical and included these two Mother-Partner factors. As shown in **Table 1** (see Executive Summary; page 3) both Mother-Partner (13.4%) and Parent Health and Wellness (13.3%) categories had the highest percentage of factors investigated that were significantly associated with “beating the odds”. In this restricted sample, at least one factor from each domain was found to be associated with “beating the odds”. The list of 14 Parent Health and Wellness, five Family Finances, and one Community and Neighbourhood factors are found in **Table 3**. **Figures 2 and 3** provide a visualisation of the standardised effect sizes across the categories of factors that are found to be significant in the univariate and multivariate results.

Discussion

Among the most robust and largest factors associated with “beating the odds” were related to the Mother-Partner domain. A higher reported interparental relationship warmth was the single factor with the largest standardised effect on “beating the odds”. In the subset of high risk GUiNZ children with mother and partner responses, “increasing report of how helpful you find your partner” and “decreasing worry about who does household chores” were significant across all models. Other factors that appear in the univariate analysis for the overall sample include increasing report of liking each other’s ideas, increasing report of how helpful you find your partner, and decreasing report of how often you argue with your partner when you disagree about something. From the partner sub-sample, a total of nine factors are significant in the univariate analysis. These include: “increasing report of seeing my partner standing next to me when I imagine life in the future”, “decreasing worry about family members getting along”, and “decreasing report of getting angry with my partner”.

Table 3: Distribution of predictors of adverse childhood outcomes in the Growing Up in New Zealand Study, New Zealand, 2009-2015

Predictor variables	High-risk (top 20% from PRM)	GUINZ total sample
Family income		
<=20K	9.6%	3.1%
>20K - <= 30K	10.5%	4.3%
>30K - <=50K	19.9%	11.0%
>50K - <=70K	13.6%	13.9%
>70K - <=100K	13.0%	20.2%
>100K - <=150K	2.5%	20.0%
>150K	1.2%	13.1%
Missing income	29.3%	13.9%
New Zealand 2006 Deprivation Index		
1-2	2.9%	16.9%
3-4	5.2%	19.5%
5-6	9.7%	17.8%
7-8	21.8%	20.3%
9-10	60.2%	25.1.%
Mother's education		
No secondary qualification	19.9%	5.7%
Secondary school NCEA 1-4	35.3%	22.3%
Diploma/trade NCEA 5-6	37.9%	30.4%
Bachelor's degree	4.7%	24.1%
Higher degree	2.0%	17.2%
Mother's age		
Under 20 years	13.1%	4.1%
20-25	40.9%	17.6%
26-30	24.2%	26.0%
31-35	14.2%	32.6%
36-40	6.1%	1.7%
Greater 40	1.2%	2.2%
Mother's ethnicity (main)		
NZ European	19.7%	57.8%
Māori	35.5%	13.0%
Pacific	38.0%	12.3%
Asian	5.0%	13.5%
Other ethnicity	1.7%	3.4%
Partner's age		
Under 20 years	4.5%	1.2%
20-25	16.3%	6.6%
26-30	14.9%	15.4%
31-35	11.4%	22.5%
36-40	7.2%	15.6%
Greater 40	4.3%	8.2%

Table 4: Selective* associations between antenatal and 9-month mother Growing Up in New Zealand (GUINZ) study instrument variables and "beating the odds" by having no ACEs when the child was in the highest 20% risk of ACEs, ordered by domain and fully standardised beta coefficients. All GUINZ participants in top 20% risk group (n=1,094); New Zealand 2009-2015

Domain	Question	Standardised Beta	Backwards	Forwards
Mother-Partner	Higher reported interparental relationship warmth composite score	0.28		
	Increasing report of how helpful you find your partner	0.26		
	Increasing report of liking each other's ideas	0.26		
	Decreasing report of how often you argue with partner when you disagree about something	0.25		0.16
Mother-Child	Decreasing worry about being the parent of the child	0.25		
	Higher composite satisfaction with parenting role	0.24	0.16	
Mother Health and Wellness	Lower report of being angered because of things that were outside of your control over past seven days	0.25	0.20	0.20
	Lower reported composite stress score over the past seven days (Perceived Stress Scale)	0.24		
	Lower reported composite stress score over the past seven days (Perceived Stress Scale)	0.22		
Family Finances	Reporting personally being forced to buy cheaper food to pay for other needed things	0.22	0.13	0.12

*Only variables with p-value <0.01 are included in this table. These variables were then added to a multivariate model and only those variables retained in the forward and backward models (p<0.01) have coefficients included in the table above

^No variables coded as being part of Community and Neighbourhood domain were found correlated at the <=0.01 level

Table 5: Select* associations between antenatal and 9-month mother and partner Growing Up in New Zealand study (GUINZ) instrument variables and "beating the odds" having no ACEs when the child was anticipated to be in the highest 20% risk. GUINZ children in top 20% risk group with partner data (n=675), New Zealand 2009-2015

Domain	Question**	Univariate	Backwards	Forward
Mother-Partner	Decreasing worry about who does household chores (Partner)	0.48	0.35	0.35
	Increasing report of liking each other's ideas	0.47	0.26	0.30
	Report of seeing my partner standing next to me when I imagine life in the future (Partner)	0.42		
	Increasing report of how helpful you find your partner	0.37		
	Decreasing report of how often do you argue with partner when you disagree	0.36		
	Decreasing report of getting angry with partner	0.36		
	Decreasing worry about family members not getting on (Partner - Antenatal)	0.33		
	Higher reported interparental relationship warmth	0.33		
Parent-Child	Decreasing worry about family members not getting on (Partner - 9Month)	0.29		
	Decreasing report of another child's behaviour as a source of stress (Mother)	0.36		
	Increasing report of meeting your expectations for yourself as a parent of a new child (Partner)	0.33		
	Decreasing report of another child's behaviour as a source of stress (Partner)	0.32		
	Higher composite satisfaction with role as parent	0.31		
	Higher report of a source of satisfaction with taking care of your child	0.30		
	Increasing report of meeting your expectations for yourself as a parent of a new child (Mother)	0.29		
Parent Health and Wellness	Decreasing report of another child's behaviour as a source of stress (Mother)	0.36		
	Lower report of being upset because of unexpected events over past four weeks	0.45	0.23	0.23
	Lower reported composite stress score over the past seven days (Perceived Stress Scale)	0.42		
	Lower report of being angered because of things outside of your control over past four weeks	0.39		
	Lower report of feeling scared or panicky for no particular reason over past seven days	0.34		
	Lower report of feeling unable to control important things in life over the past four weeks	0.33		
	Higher self-reported health (Mother - Antenatal)	0.33		
Lower report of being nervous or stressed over past four weeks	0.32			

Domain	Question**	Univariate	Backwards	Forward
Parent Health and Wellness cont'd	Never diagnosed with having difficulties concentrating (Partner)	0.31		
	Lower report of feeling difficulties were so great to overcome over the past four weeks	0.30		
	Lower report of feeling things have been getting too much for me over past seven days	0.30		
	Higher self-reported health (Partner - 9Month)	0.30		
	Lower report of feeling anxious or worried for no particular reason over past seven days	0.29		
	Lower report of being so unhappy as to have difficulty sleeping in past seven days	0.28		
	Higher self-reported health (Mother - 9Month)	0.28		
Community and Neighbourhood	Report of not living in specific neighbourhood due to pregnancy related reason (Partner)	0.48		
Family Finances	Reported Household Sources of Financial Support: Did not include Sickness Benefit	0.36		
	Reporting a perceived increase in the general economic situation in the country from last year (Partner)	0.36		
	Reporting personally being forced to buy cheaper food to pay for other needed things	0.30		
	Reporting a perceived increase in the household financial situation compared to last year (Partner)	0.28	0.21	0.21
	Reported Household Sources of Financial Support: included NZ Superannuation or Veterans Pension	0.25		

*Only variables with p-value <0.01 from the list of evaluated variables are included in this table. These variables were then added to a multivariate model and only those variables retained in the forward and backward models (p<0.01) have coefficients included in the table above

** All variables unless indicated with (Partner) were collected through the mother of the GUiNZ participant

Figure 2: Univariate and multivariate (forward and backward selection) results for all GUiNZ participants in the highest 20% risk category (N=1,094). Univariate results show the standardised regression coefficient for all 18 variables with p-value <0.01. The multivariate results show the factors that remain statistically significant at p-value <0.01 in either the backward or forward selection methods when evaluating all 18 factors at the same time

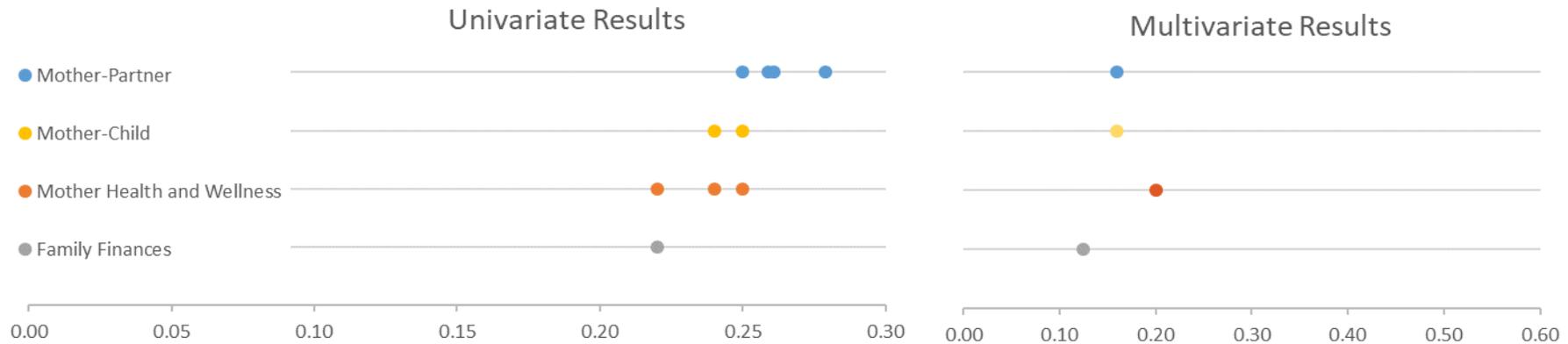
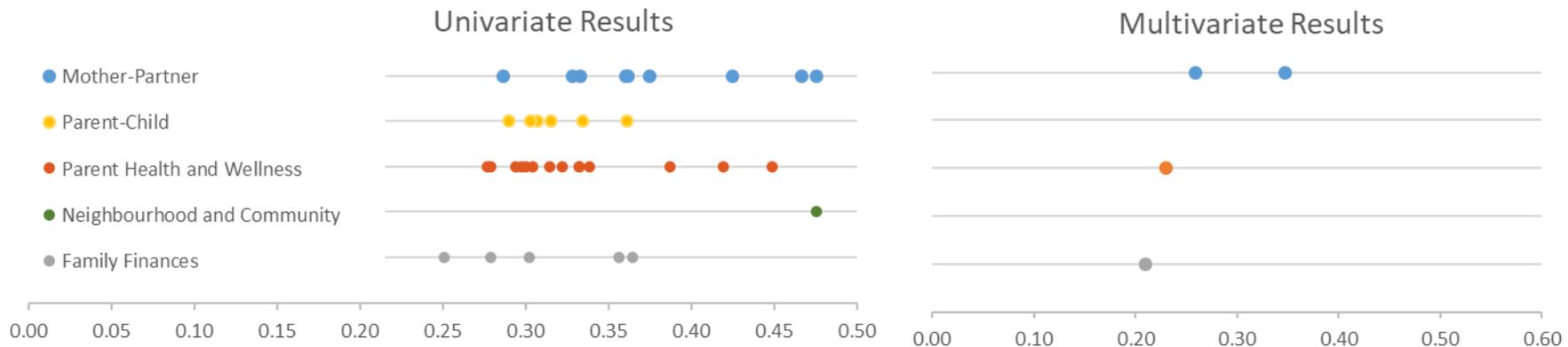


Figure 3: Univariate and Multivariate (Forward and Backward Selection) Results for all GUiNZ participants in the highest 20% risk category (N=675). Univariate results show the standardised regression coefficient for all 35 variables with p-value <0.01. The multivariate results show the factors that remain statistically significant at p-value <0.01 in either the backward or forward selection



In the univariate analysis, general satisfaction and reduction in worry were found to be protective for the Parent-Child domain. In the subgroup of participants with partner survey there were additional variables associated with “beating the odds”, but these variables were not retained in the forward or backwards models.

While there were four Parent Health and Wellness factors in the full sample and 14 factors in the partner sub-sample, in the backward and forward models only, lower reporting of being upset or angry because of unexpected events remained significant.

The Community and Neighbourhood factors are only present in the partner sub-sample and relate to the report of not living in a specific community because of pregnancy. This is significant in one of the three models.

For Family Finances, we find one robust factor amongst the full sample. In particular, report of not being forced to buy cheaper food so you could pay for other needed items, was found significant in all three models. This factor was also found in the parent subset. Four additional financial factors were associated with “beating the odds”. The most robust found in all three models was a report by the partner of an increase in the household financial situation compared to last year. One reason for this could be that these partners were earning less money or were out of work at the antenatal survey and were therefore identified by the predictive risk model as “at risk”. By the stage of the 9-month survey, their earnings and employment status might have improved.

It is plausible that our observed correlations between mother-partner factors and “beating the odds” might be focused only on those specific ACEs that are related to parental conflict (divorce or fighting between parents). We conducted a sensitivity analysis by removing the measurement of parental separation and partner intimate violence when calculating the total number of ACEs. After creating a new predictive model of risk, assigning risk scores to all GUiNZ participants and focusing on the top 20% at risk, five of the nine identified potential protective factors in the mother-partner domain were still significantly associated with “beating the odds” at the 99% (p-value ≤ 0.01) level. The other four identified measures from **Table 4** remained associated at the 95% (p-value ≤ 0.05) level. This indicates mother-partner factors are potentially protective for ACEs that are not specific to the mother-partner relationship.

Limitations

A weakness of the GUiNZ data is that it may not be population representative and is not linked to administrative data. Also, there is a required trade-off to collecting a wide range of factors in numerous categories. Namely, the depth into which each domain can be investigated. Because the GUiNZ data are not collected from a population representative sample, we need to be aware of the degree to which the sample is population representative. Unfortunately, there are no current population weights available – and because the sample frame was restricted to the Auckland and Waikato regions, there are few published statistics of the same sample frame that allows us to establish the degree of population representativeness. However, we can use information on the demographic characteristics of live births during 2009. According to Statistics New Zealand, overall population births in New Zealand in 2009 comprised of 29% Māori² which compares with 13% Māori in the GUiNZ sample. The GUiNZ data therefore has a lower Māori population than the overall New Zealand population.

In addition, many of the identified potential protective factors centred on partner involvement and satisfaction with partner help in day-to-day activities. Overall, 95% of GUiNZ children are born to mothers who are partnered. The GUiNZ sample seems to have low sole-parent status compared to a 2009 study that found one-third of families with dependent children were headed by sole-parents (Ministry of Social Development, 2010). This could be because being partnered in the GUiNZ data is not the same as their domestic-purposes benefit status, from which partnership status is inferred by other studies. We find that 70% of those who say they receive the domestic-purposes benefit also answer yes to the question of whether they have a partner – confirming that the sole-parent status derived from GUiNZ is essentially different to those studies which rely on benefit status to infer partnership status. The GUiNZ sample has 7% of respondents reporting a household income equal to or less than \$30,000. By contrast, the official New Zealand statistics based on Census 2013 records, shows that 14% of families report incomes less than or equal to \$30,000³ (Statistics New Zealand, 2013).

For this preliminary review of the potential protective factors we had no a priori hypotheses. An exhaustive investigation of interactions or specific subgroup effects was not feasible. Even with the current methods, we run the risk of finding erroneous inferences using statistical tests due to the large set of statistical inferences that were conducted simultaneously. We have slightly addressed this by lowering the standard 0.05 statistical threshold to 0.01, but these results should be seen as a first step to generate more specific hypotheses to test elsewhere. We ran protective univariate factor analyses with different p-value thresholds (0.05 and 0.001). At the 0.001 level, 11 factors were found to be correlated with “beating the odds”, and five of those factors were in the mother-partner domain. At the 0.05 level 87 factors

² Statistics New Zealand, Table VSB026AA.

³ See Table 21, <http://archive.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-income/tables.aspx>

were correlated with “beating the odds”, and 17 of those factors were in the mother-partner domain (**Table 1**; Executive Summary). In addition, the dataset allows an analysis up to age 54 months only. Protective factors might be different for older children and should be tested across different cohort and age groups. Also, our classification system of variables into five categories is simplistic and based purely on researcher intuition. Many of the topics could easily fall into multiple categories. For example, the partner reporting that he lives in a specific neighbourhood due to pregnancy reasons could be just as easily classified under family finances as the present classification under neighbourhood and community.

Policy implications and future work

In this data exploration, we found several characteristics associated with GUiNZ children who appear to “beat the odds” where we predicted they would be at highest risk of experiencing ACEs. A striking finding was the significance of the mother-partner relationship. There were nine univariate mother-partner factors associated with “beating the odds”. The increased probability of “beating the odds” for two hypothetical high-risk GUiNZ participants, one with a one-unit higher response to each of these nine factors, is 77%.⁴ Or put another way, if one high-risk GUiNZ participant had a 20% probability of “beating the odds”, another would have a 35% probability of “beating the odds” if all factors were similar except that the second GUiNZ participant had a one-unit increase in each of those nine factors. Replicating these results and testing interventions focused on the mother-partner relationship should be a priority going forward. Also of potential interest would be to see if these potential factors are predictive in all GUiNZ children and not just those identified at highest risk.

An additional area of future work with policy implications is to categorise the factors that are potentially mutable in the context of policy and interventions. For example, what mother-partner characteristics might be addressed and improved by adding to existing interventions such as home visiting programmes? Overall, positive correlations of fathers being involved with their children on child cognitive, emotional and social development have been well documented (Allen, 2002). In addition, when the co-parental relationship is not supportive, children are exposed to increased non-effective parenting strategies (Amato, 1998). Even for non-residential partners, a crucial mediating variable for child development is the partner’s relationship with the mother (Amato, 2004; Marsiglio, 2000). As family structures evolve, policies to increase effective co-parenting should be investigated by the Ministry of Social Development. For example, a recent commission tasked with recommending policy to strengthen families in Wisconsin has suggested providing in-home education programmes for new fathers on relationship building and co-parenting. This programme would be similar to home visiting programmes for new mothers (Anderson 2016). Also, these analyses could be replicated to focus on specific areas of strategic importance to the Ministry of Social Development. Perhaps these might include teen mothers or mothers already involved in specific programmes or receiving specific benefits.

⁴ Estimated by logistic regression with outcome “beating the odds” with 9 factors from the mother-partner domain from Table #4. Of the 9 variables, 3 of 9 have 7 point Likert-type scales, five of 9 have 5 point Likert-type scales and the final variable is a composite score which has 15 questions (7 point Likert-type scale each).

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Appendix 1: Variables and variable categorisations from the antenatal mother and partner interviews included in the *Adverse Childhood Experiences Predictive Model* with correlates from data available from administrative Statistics New Zealand data: *Growing Up in New Zealand Study, New Zealand 2009-2015*

Single Status: Yes, No

Mother age: Under 20, 20-25, 26-30, 31-35, 36-40, >40

Household Income Group: <=20K, >20K - <= 30K, >30K - <=50K, >50K - <=70K, >70K - <=100K, >100K - <=150K, >150K, Missing

Beneficiary: Receiving any kind of benefit, Not Receiving any kind. Benefit information missing

NZ Deprivation Index: 9-10, 7-8, 5-6, 3-4, 1-2

Household ownership: Don't know/other/missing, Freehold, Own mortgage, Family Trust, Private rental, Public rental, Free rental

Years living at current home: Missing years living at home, 0-6months, 6 months- 1 year, 1 year - 2 year, 2 year-4 years, > 4 years

Number of house moves last five years: >6, 5, 4, 3, 2, 1, 0

Motor Vehicle available: Yes, No

Relationship status: No relationship, Married, Cohabiting (living together), Couple (not living together), Dating

Household Size: 1,2,3,4,5,6,7,8,>8

Current employment (Employed base category)

Unemployed, Other employed

Mother education (No high school base category)

Secondary school, Diploma, Bachelor, Higher degree

Mother self-prioritised main ethnicity: European, Asian, Maori, Pacific, Other

Mother smoking: Yes, No

Body Mass Index group: 0-18.5, 18.5-25, 25-30, 30-35, >35 Missing

Aware pregnancy: 1-3 weeks, 4-5 weeks, 6-7 weeks, >7 weeks

Anxiety or panic attacks diagnosed by a doctor: Never, Before Pregnancy, Before and During Pregnancy, During Pregnancy, Missing

More than 20 drinks per week, before or during pregnancy: Yes, No

Partners throw, break or hit when arguing Quite often or more frequent: Yes, No

Family doctor before pregnancy: Yes, No

Seen a family doctor since becoming pregnant: Yes, No

Did you have a Lead Maternity Caregiver (LMC): Yes, No

Disability lasting 6 months or more: Yes, No

Partner smokes: Yes, No, Missing

Partner depression: Yes, No, Missing

Partner employment (Partner unemployed base category)

Partner employed, Partner student, Partner employed missing

Partner schooling (Partner no secondary school base category)

Partner secondary school: Partner diploma, Partner bachelor, Partner higher degree, Partner education missing

Appendix 2: *Growing up in New Zealand* antenatal and 9-month partner and mother survey components tested in the univariate analysis of the “beating the odds” protective analyses ordered by assigned domain and number of variables.

Variable grouping	Number of variables	Domain
Income sources	90	Family Finances
Occupation related questions	57	Family Finances
Economic perceptions	10	Family Finances
Characteristics of the household and home	9	Family Finances
Reported deprivations (eg food, shoes, medical care)	7	Family Finances
Characteristics of the neighbourhood (subjective and objective)	164	Neighbourhood Community
Larger community support	24	Neighbourhood Community
Community connectedness	21	Neighbourhood Community
Social networks	21	Neighbourhood Community
Identity and culture	20	Neighbourhood Community
Feelings about community and family adaptation	13	Neighbourhood Community
Knowledge of cultures	8	Neighbourhood Community
Sources of worry	28	Parent Health and Wellness
Individual skills and strengths	22	Parent Health and Wellness
Perceived stress scale	21	Parent Health and Wellness
Postnatal depression scale	20	Parent Health and Wellness
General health and health behaviours	8	Parent Health and Wellness
Pregnancy related health care utilisation	6	Parent Health and Wellness
Time spent with your child	47	Parent-Child
Satisfaction with parenting	23	Parent-Child
Parenting values	20	Parent-Child
Involved with tasks associated with taking care of child	13	Parent-Child
Hopes and dreams for child	12	Parent-Child
Work family life balance	10	Parent-Child
Confidence with parenting	9	Parent-Child
Co-parenting support	31	Mother-Partner
Strength of partnership	18	Mother-Partner
Warmth scale (Iowa Family Interaction Rating Scale)	18	Mother-Partner