

Impact of the COVID-19 pandemic on childhood vaccine uptake







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Acknowledgments and disclaimer

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- ▶ Disclaimer: Access to the data used in this study was provided by Stats NZ under conditions designed to give effect to the security and confidentiality provisions of the Data and Statistics Act 2022. The results presented in this study are the work of the author, not Stats NZ or individual data suppliers. These results are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI) which is carefully managed by Stats NZ. For more information about the IDI please visit <https://www.stats.govt.nz/integrated-data/>. The results are based in part on tax data supplied by Inland Revenue to Stats NZ under the Tax Administration Act 1994 for statistical purposes. Any discussion of data limitations or weaknesses is in the context of using the IDI for statistical purposes, and is not related to the data's ability to support Inland Revenue's core operational requirements.

Motivation

- ▶ vaccines often regarded as one of the most cost-effective health interventions
- ▶ even before the COVID-19 pandemic: gaps in uptake
- ▶ several disruptions because of the pandemic
 - ▶  health scare: fear of COVID-19 exposure
 - ▶  focus of healthcare workers to pandemic response activities
 - ▶  lock-downs and travel restrictions
 - ▶  (mis)information on vaccination practices during pandemic
 - ▶  potential change in parent's perception: increased awareness of infectious diseases
- ▶ official guidance: keep calm and keep vaccinating!
 - ▶  providers strongly encouraged to deliver infant immunisations
- ▶ what is the effect of on uptake?
- ▶ did those who missed vaccines at the start of the pandemic catch up over time?

Trends in childhood vaccine uptake

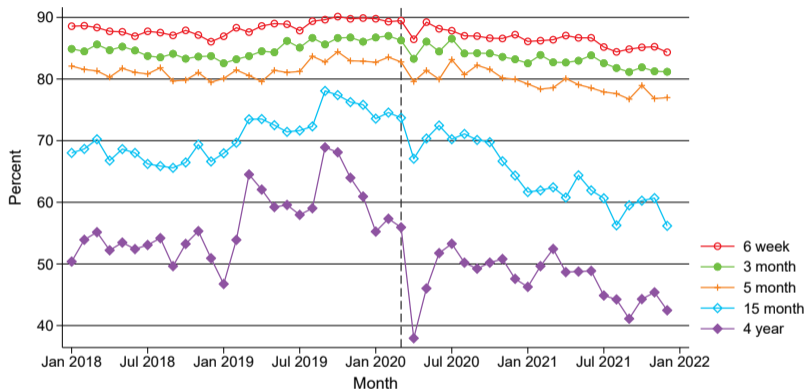
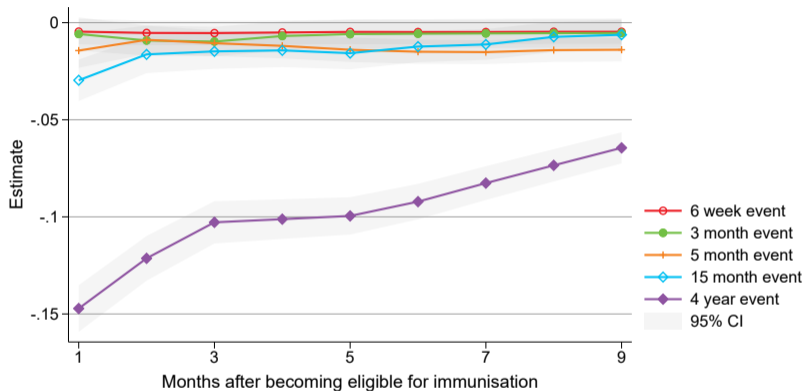


Figure: Share of fully immunised children within one month of becoming eligible for different immunisation events over time

Data and empirical strategy

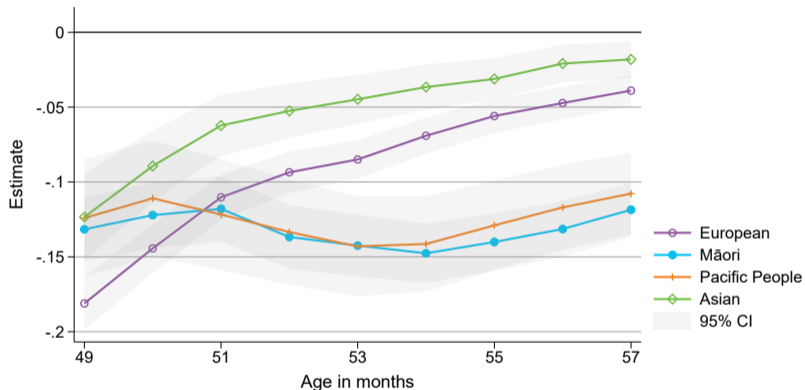
- ▶ focus on children who become eligible for immunisation at the start of the pandemic
- ▶ compare vaccine uptake of affected and unaffected children at the same age
 - ▶ affected: become eligible in March, April, or May 2020
 - ▶ unaffected: become eligible in March, April, or May 2019 (= being born **one year earlier**)
- ▶ follow these cohorts over time to analyse drops in uptake and potential catchup
- ▶ estimate equation at 9 different points in time for each immunisation event
 - ▶ e.g., for 4 year event, from age 49 months to 57 months
- ▶ idea: affected children would have behaved similarly to the earlier-born cohort in the absence of the COVID-19 pandemic
- ▶ Integrated Data Infrastructure (IDI): population-wide research database by StatsNZ
 - ▶ vaccine type and date from National Immunisation Register (NIR)
 - ▶ child and family characteristics from census and admin data

Average effects of the pandemic on vaccine uptake



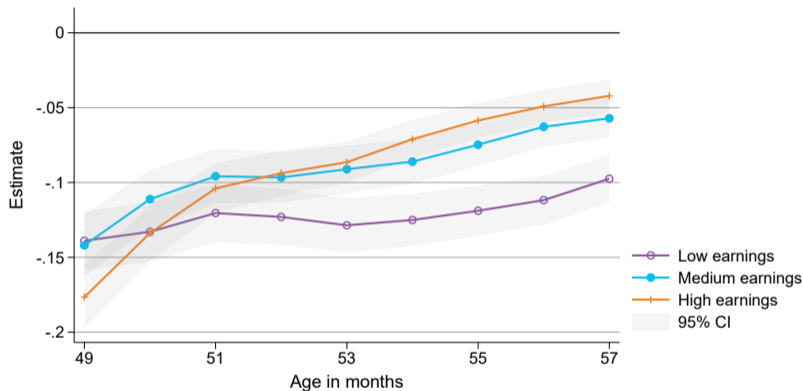
- ▶ large effects on timely vaccination at the 4 year event, some catchup over time
- ▶ small or zero effects at other events (→ [table](#))


Effects by ethnicity






- ▶ large differences in catch-up between ethnic groups at 4 year event (→ [table](#))
 - 📊 uptake among European and Asian children converges to pre-pandemic levels
 - 📊 Māori and Pacific children still 12 and 11 pp lower after 9 months
 - 📊 already had lower rates before the pandemic → widening of existing inequalities

Parents' earnings



- ▶ children whose parents have high and medium earnings tend to catch-up faster
 - ▶  vaccine uptake of children from families with low earnings still 10 pp lower (→ [table](#))
- ▶ similar patterns: parents' educational level and social welfare benefit receipt

Conditional effects

- ▶ ethnicity and socio-economic status is correlated:
 - ▶  *what is driving the differences in immunisation uptake?*
- ▶ conditional effects: analyse the relevance of a characteristic while controlling for other factors
- ▶ large differences between ethnic groups remain
- ▶ e.g., for the 4 year event at 57 months of age:
 - ▶  9 percentage point decrease in uptake among Māori and Pacific children
 - ▶  5 for European and Asian children

Conclusion

- ▶ initial phase of the pandemic
 - ▶ small or nil effects on timely immunisation at the four infancy events
 - ▶ large effect at the 4-year event
- ▶ significant differences in catch-up: widening of pre-existing inequalities
- ▶ evidence from qualitative research
 - ▶ fear of COVID-19 exposure, travel restrictions
 - ▶ parents wished not to burden the health care providers
 - ▶ uncertainty about whether routine childhood vaccinations were an 'essential service'
 - ▶ experiences of past pandemics (2009 H1N1, 2019-20 measles) and initial COVID-19 cases could explain differences by ethnicity
- ▶ ongoing research: understand decrease in immunisation uptake
 - ▶ general attitudes towards immunisation: link to parental COVID-19 vaccine uptake
 - ▶ role of outreach immunisation providers

Thank you!

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Immunisation events and cohorts

Table: Birth months of selected children

Immunisation event	Affected cohort	Unaffected cohort
4 year	March - May 2016	March - May 2015
15 month	Dec 2018 - Feb 2019	Dec 2017 - Feb 2018
5 month	Oct - Dec 2019	Oct - Dec 2018
3 month	Dec 2019 - Feb 2020	Dec 2018 - Feb 2019
6 week	Jan - March 2020	Jan - March 2019

Notes: This table shows the birth months of children in the affected and unaffected cohorts used to estimate the effects of the pandemic on vaccine uptake.

▶ back

National Immunisation Schedule

Table: Vaccines for children under 5 years on New Zealand's National Immunisation Schedule (April 2018 to September 2020)

	DTaP-IPV- HepB/Hib	PCV10	RV1	MMR	Hib-PRP	VV	DTaP-IPV
6 weeks	•	•	•				
3 months	•	•	•				
5 months	•	•					
15 months		•		•	•	•	
4 years				•			•

Notes: DTaP-IPV-HepB/Hib = Diphtheria, tetanus, acellular pertussis, inactivated polio, hepatitis B and *Haemophilus influenzae* type b vaccine, PCV10 = 10-valent pneumococcal conjugate vaccine, RV1 = Rotavirus vaccine, Hib-PRP = *Haemophilus influenzae* type b polyribosylribitol phosphate vaccine, MMR = Measles, mumps and rubella vaccine, VV = Varicella vaccine, DTaP-IPV = diphtheria, tetanus, acellular pertussis and inactivated polio vaccine.

Table: Effect of the COVID-19 pandemic on childhood vaccine uptake

	1 month after eligibility			9 months after eligibility			N
	Mean (1)	Estimate (2)	S.E. (3)	Mean (4)	Estimate (5)	S.E. (6)	
<i>Panel A: Baseline specification</i>							
6 week event	0.92	-0.00	(0.003)	0.93	-0.00	(0.003)	27504
3 month event	0.85	-0.01	(0.004)	0.89	-0.01	(0.004)	27039
5 month event	0.84	-0.01**	(0.005)	0.94	-0.01***	(0.003)	27567
15 month event	0.75	-0.03***	(0.005)	0.89	-0.01	(0.004)	26478
4 year event	0.61	-0.15***	(0.006)	0.91	-0.06***	(0.004)	26139
<i>Panel B: Additional control variables</i>							
6 week event	0.92	-0.01	(0.004)	0.93	-0.00	(0.004)	17409
3 month event	0.85	-0.01*	(0.004)	0.89	-0.01*	(0.004)	25998
5 month event	0.84	-0.02***	(0.004)	0.94	-0.02***	(0.003)	26496
15 month event	0.75	-0.03***	(0.005)	0.89	-0.01*	(0.004)	25515
4 year event	0.61	-0.15***	(0.006)	0.91	-0.07***	(0.004)	25473

Notes: This table summarises the average effects of the pandemic on vaccine uptake. Each estimate represents the results from a separate regression for different immunisation events 1 and 9 months after children become eligible. Columns 1 and 4 show the mean of the unaffected cohort, columns 2 and 5 the point estimate, columns 3 and 6 robust standard error, and column 7 the number of children in the regression. Panel A includes controls for child's calendar month of birth and sex, Panel B adds control variables for region of residence, child's ethnicity, family earnings level, parental marital status, and overseas-born parents. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table: Child characteristics and vaccine uptake at the 4 year event

	49 months			57 months			N
	Mean (1)	Estimate (2)	S.E. (3)	Mean (4)	Estimate (5)	S.E. (6)	
<i>Panel A: Ethnicity</i>							
European	0.67	-0.18*** (0.01)		0.93	-0.04*** (0.01)		11610
Māori	0.45	-0.13*** (0.01)		0.84	-0.12*** (0.01)		7818
Pacific People	0.55	-0.12*** (0.02)		0.91	-0.11*** (0.01)		2454
Asian	0.78	-0.12*** (0.01)		0.97	-0.02** (0.01)		3594
<i>Panel B: Sex</i>							
Male	0.61	-0.15*** (0.01)		0.91	-0.07*** (0.01)		13494
Female	0.61	-0.15*** (0.01)		0.90	-0.06*** (0.01)		12648
<i>Panel C: Birth order</i>							
First born	0.63	-0.15*** (0.01)		0.91	-0.05*** (0.01)		13563
Second born	0.63	-0.16*** (0.01)		0.92	-0.05*** (0.01)		7965
Third born	0.54	-0.14*** (0.02)		0.90	-0.09*** (0.01)		3012
Fourth born	0.47	-0.17*** (0.03)		0.88	-0.14*** (0.03)		945

Notes: This table summarises the heterogeneous effects of the pandemic on the 4 year immunisation event at age 49 months (mean of the unaffected cohort in column 1, point estimate in column 2, robust standard error in column 3) and 57 months (columns 4 to 6). Each estimate represents the results from a separate regression for a subgroup of the sample indicated on the left. All regressions include controls for the child's calendar month of birth and sex. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table: Parental characteristics and vaccine uptake at the 4 year immunisation event

	49 months			57 months			N
	Mean (1)	Estimate (2)	S.E. (3)	Mean (4)	Estimate (5)	S.E. (6)	
<i>Panel A: Earnings</i>							
Low earnings	0.51	-0.14***	(0.01)	0.85	-0.10***	(0.01)	9594
Medium earnings	0.63	-0.14***	(0.01)	0.93	-0.06***	(0.01)	8637
High earnings	0.71	-0.18***	(0.01)	0.96	-0.04***	(0.01)	7908
<i>Panel B: Benefit receipt</i>							
No benefit receipt	0.67	-0.16***	(0.01)	0.94	-0.04***	(0.00)	19311
Benefit receipt	0.44	-0.13***	(0.01)	0.83	-0.13***	(0.01)	6831
<i>Panel C: Education level</i>							
No degree	0.56	-0.14***	(0.01)	0.89	-0.09***	(0.01)	15147
Bachelor's degree or higher	0.70	-0.16***	(0.01)	0.95	-0.03***	(0.01)	9906
<i>Panel D: Marital status</i>							
Unmarried parents	0.53	-0.14***	(0.01)	0.87	-0.10***	(0.01)	12786
Married parents	0.69	-0.15***	(0.01)	0.94	-0.04***	(0.00)	13353

Notes: This table summarises the heterogeneous effects of the COVID-19 pandemic on the 4 year immunisation event at age 49 months (mean of the unaffected cohort in column 1, point estimate in column 2, robust standard error in column 3) and 57 months (columns 4 to 6). Each estimate represents the results from a separate regression for a subgroup of the sample indicated on the left. All regressions include controls for the child's calendar month of birth and sex. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Place of residence

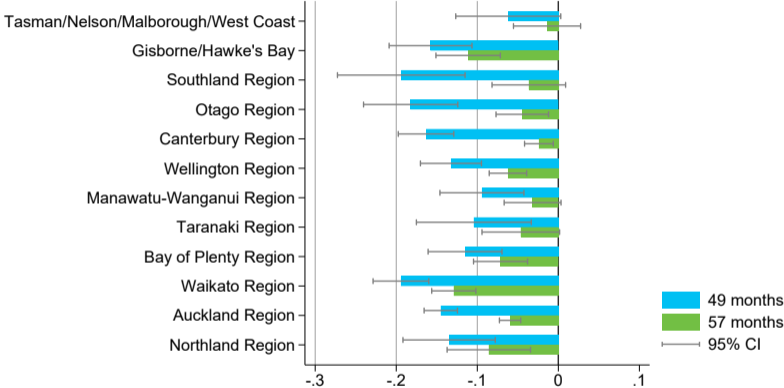


Figure: Effect of the COVID-19 pandemic on the 4 year immunisation event by region