Child-centred pandemic decisions: how the Precautionary Principle can generate better risk assessment in an era of uncertainty

Amanda Kvalsvig (amanda.kvalsvig@otago.ac.nz)
University of Otago Wellington https://orcid.org/0000-0002-4184-001X

Jin Russell
University of Auckland

Carmen Timu-Parata
University of Otago Wellington and New Zealand Breastfeeding Alliance

Michael G. Baker
University of Otago Wellington

Research Article

Keywords: Covid-19, children, human rights, Indigenous, New Zealand, pandemic, Precautionary Principle

Posted Date: December 8th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-1149981/v1

Abstract

Key messages

Risk assessment for children has been a polarising issue during the Covid-19 pandemic. Governments around the world are preparing to ‘open up’ before risks to children are fully quantified, with unknown implications for their long-term health.

Applying the Precautionary Principle to child health requires decision makers to 1) take preventive action until risks are better understood; 2) ensure that the burden of proof rests with proponents of risk; 3) explore alternatives to the risk; and 4) use participatory approaches to decision-making.

Policies relating to children must be centred on the rights and wellbeing of children. We provide a framework for comprehensive Health Impact Assessments to ensure that direct and indirect impacts upon children are taken into account in major policy decisions.

Elimination strategies offer an integrated approach to the protection of children’s wellbeing, the wellbeing of the population as a whole, and health equity. Where countries are transitioning away from elimination, a tight suppression approach is preferable to loose suppression or mitigation.

Main Text

In common with many other jurisdictions, Aotearoa New Zealand’s pandemic response has not given adequate consideration to the best interests of children. Governments around the world are preparing to ‘open up’ before risks to children are fully quantified, with unknown implications for their long-term health. A precautionary approach is needed, says a group of New Zealand health experts.

Introduction

Risk assessment for children (ie, those aged under 18 years) has been a contentious and polarising issue during the pandemic. Aotearoa New Zealand has generally avoided engaging with these controversies because its elimination strategy significantly reduced impacts on children from both Covid-19 infection and the control measures used to contain it. Currently the country is experiencing its first Delta-variant outbreak at a time when its children are still largely unvaccinated and immunologically naïve to SARS-CoV-2.

Our analysis uses a structured approach to consider the proper place of children in pandemic decisions. The Precautionary Principle is often invoked without definition or explanation of its implications. To address this gap, we identify four key elements of the Precautionary Principle and explore their relevance to children in the pandemic, guiding strategic and operational decisions in the presence of high uncertainty. We provide a framework for comprehensive Health Impact Assessments to ensure that direct and indirect impacts upon children are taken into account in major policy decisions. We use the example

of Aotearoa New Zealand as a country at the brink of key decisions about its pandemic strategy and its child population.

Children and the SARS-CoV-2 pandemic

The initial perception that children experienced minimal illness from Covid-19 infection has evolved into a more complex picture that includes evidence of significant harms to children. These harms may be direct (arising from being a case) or indirect (arising from community transmission with impacts on non-Covid healthcare and health equity). Added to these harms from the virus itself are the impacts of the pandemic response (ie, control measures); again, these harms may be direct (educational disruption from school closures) or indirect (increased prevalence of child poverty when employment is insecure).

The wellbeing of children should be central to pandemic policy decisions. In Aotearoa New Zealand, similarly to other Indigenous cultures, Māori health perspectives support individual wellbeing but there are also beliefs around collective wellbeing that are linked to Māori self-determination.[1] Tamariki Māori (Māori children) must not be seen alone in matters of health and wellbeing, but always centred in the context of their whānau/family. They are seen as gifts from the atua (spiritual beings) and from the tipuna (ancestors), requiring societies to provide nurturing environments to support them to achieve their potential.[2]

This collective model of wellbeing aligns closely with a population health approach,[3] providing the basis for an integrated assessment of the linked effects of the pandemic on children, families, and communities.[4] Decisions need to be centred on child wellbeing to protect children from direct and indirect harms of the pandemic and the response. Jurisdictions should avoid using children as a means to an end such as population immunity to Covid-19 whether via vaccine or disease.[5]

The Precautionary Principle as a decision framework for children and the pandemic

The Precautionary Principle is a decision framework intended for situations of high uncertainty where decisions have significant impacts. Our analysis of children's place in the pandemic is structured around four key elements of the Precautionary Principle:[6]

1. Take preventive action until risks are better understood;

2. Ensure that the burden of proof rests with the proponents of risk;
3. Explore alternatives to the risk; and
4. Use participatory approaches to decision-making.

We consider the implications of each principle for Covid-19 pandemic decisions.

Principle 1: Take preventive action while novel risks are being characterised and quantified

By definition an elimination strategy prevents more transmission, illness, disease complications, and death from Covid-19 than other pandemic strategies, simply because it prevents more cases. But because having no community transmission allows for fewer pandemic restrictions, elimination has also prevented many of the adverse consequences of lockdowns and overwhelmed health systems experienced by jurisdictions attempting mitigation or suppression.[7 8] An elimination strategy provides time to learn from the experience of other jurisdictions, implementing policies that have been shown to be successful elsewhere while avoiding policy failures. Two examples where Aotearoa has learned from international experience include evidence about vaccination safety and efficacy in children, and observing the stark health inequities experienced by children in marginalised populations.

Principle 2: Ensure the burden of proof rests with the proponents of risk

Proponents of Covid-19 endemicity ('living with the virus') have a responsibility to be transparent regarding the ongoing health and social costs of this strategy at a population level. Endemicity is often confused with mild disease and normal life, but many common endemic diseases (eg, malaria) cause high morbidity and mortality in children. Poliomyelitis, another disease that was endemic in most of the world until recently, is asymptomatic in around 70% of infections and only rarely causes paralysis. But tolerating endemicity is not an accepted strategy for polio because the high transmissibility of this infection (R_0 around 10^9) results in large numbers of cases, leading to a high and unacceptable health burden in unvaccinated populations.

The same phenomenon can be seen in Covid-19 outbreaks; when community transmission is high the absolute numbers of paediatric hospitalisations and of serious complications such as multisystem inflammatory syndrome of childhood (MIS-C)[10] are likewise high and can overwhelm health service capacity.

Similarly, the prevalence and duration of ongoing post-acute symptoms (eg, Long Covid) in children is yet to be clearly established but emerging findings are concerning.[11 12] Life-altering post-acute effects have been observed in most childhood infectious diseases and in both of the previous coronavirus pandemics.[13] Decision-makers advocating against the use of Covid-19 vaccines or other preventive measures for children need to demonstrate evidence for beliefs that the SARS-CoV-2 virus will be more benign compared with these other infections.

Principle 3: Explore alternatives to the risk

The three main strategies for a pandemic of moderate-to-high transmissibility and severity are elimination, mitigation, and suppression.[8 14] These approaches are described in Table 1, while the impacts of these Covid-19 strategies on children are compared in Table 2.

Table 1. The three main Covid-19 pandemic strategies: elimination, mitigation, and suppression.

Pandemic control strategies

Pandemic options that are enacted at the country level are defined by their aims.[8 14] Elimination aims to stop community transmission of the SARS-CoV-2 virus for prolonged periods within a specified country or region. Mitigation is a form of control that accepts transmission at a predetermined, manageable level, e.g. to avoid overwhelming the health system in an influenza pandemic. Suppression aims to keep transmission at a low level to minimise adverse health effects, as for HIV/AIDS. Elimination strategies have been widely used in the Asia-Pacific region for control of Covid-19.[15]

How is Covid-19 elimination experienced 'on the ground'?

Elimination differs from mitigation or suppression in ways that go beyond differences in case numbers. Elimination starts from and returns to a baseline in which children experience relatively few restrictions in their daily lives, although stringent restrictions at the borders are necessary. Mitigation and suppression approaches allow more freedom to travel but accept a continuous and fluctuating level of new cases, hospitalisations, and deaths.

Mitigation and suppression approaches require ongoing application of controls such as school closures and cancellation of routine healthcare to prevent health systems from becoming overwhelmed during peak transmission periods. Elimination requires a high stringency of outbreak control applied at an early phase of the epidemic curve, but once elimination is regained, controls are lifted. Paradoxically, jurisdictions pursuing Covid-19 elimination have spent less time under lockdown than jurisdictions aiming for mitigation or suppression (Figure 1).

Table 2
Comparison of impacts of the pandemic and the response on children under different pandemic strategy options.

Impacts on children	Jurisdictions with a mitigation or suppression* strategy	Jurisdictions with an elimination strategy
Direct impacts of Covid-19 disease	• Although severe acute infections in children are fortunately rare, substantial numbers of children experience complications in places where community transmission is high. • Severe illness may require hospitalisation and intensive care admission for mechanical ventilation • Children from population groups that are historically and currently disadvantaged, and children experiencing socioeconomic disadvantage or comorbidities including obesity are at increased risk of severe illness. Incidence, hospitalisations, and mortality are strongly patterned by ethnicity and deprivation (see 'Inequities' below) • Rarely, severe complications include multisystem inflammatory syndrome (MIS-C)[10] • Post-acute impacts include persisting symptoms such as fatigue and cognitive difficulties (e.g. Long Covid)[11] with pathological inflammatory changes at the tissue level observed in vital organs such as the brain.[12] The duration of persisting symptoms, incidence, and long-term impacts are not yet fully established but population impact may be substantial given the large number of children infected • According to CDC reports, Covid-19-associated paediatric hospitalisations over six month period from October 2020 to April 2021 were 2.5 to 3.0 times higher than influenza-associated hospitalisation rates across three consecutive seasons (2017 – 2018; 2018-2019; and 2019 – 2020)[16]	• Paediatric cases are rare • In NZ, since the onset of the pandemic there have been 1612 Covid-19 cases in the 0-19 years age group (including cases identified in the community and in the border quarantine system). To date there have been no fatal paediatric cases of Covid-19 in NZ.

* Note that with a suppression approach, particularly if applied rigorously (ie 'tight suppression') the direct and indirect effects of disease will be less, but the direct and indirect effects of the response may be increased

Impacts on children	Jurisdictions with a mitigation or suppression* strategy	Jurisdictions with an elimination strategy
	• CDC data for the US estimate that there have been around 5.5 million confirmed cases in children; 791 children have died of Covid-19 to date.	
Indirect impacts of Covid-19 disease	• Children may experience bereavement, loss of a primary caregiver and/or secondary caregiver, isolation from caregivers, and quarantine • Infected children may experience guilt (particularly if they are identified as a source case) and/or stigma, and anxiety for loved ones • In jurisdictions with high levels of community transmission, overwhelm of healthcare systems due to acute Covid-19 cases may result in disruption to routine paediatric healthcare delivery • Covid-19 infection in pregnant people is associated with increased risk of preterm birth, compounding existing health and ethnicity-based inequities in birth outcomes • Globally, it is estimated that over a million children have lost a primary caregiver to Covid-19. Losing a caregiver is an Adverse Childhood Experience (ACE) associated with multiple poor outcomes for children including severe mental distress, lower educational attainment, and experiencing physical and sexual violence.[17]	• Adult cases are rare, minimising the impacts on children of illness or death in the family. • The cumulative total of confirmed Covid-19 cases in NZ is currently 1287 per million population; since the onset of the pandemic there have been a total of 6594 cases and 28 deaths. (By comparison, the US and UK have each experienced >130 000 confirmed cases per million population).

* Note that with a suppression approach, particularly if applied rigorously (ie 'tight suppression') the direct and indirect effects of disease will be less, but the direct and indirect effects of the response may be increased

Impacts on children	Jurisdictions with a mitigation or suppression* strategy	Jurisdictions with an elimination strategy
Direct impacts of the pandemic response	• The Covid-19 pandemic has been described as "the largest disruption to education in history", affecting around 94% of the world's children.[18] • Prolonged school closures result in educational harms and compound existing educational inequities • Prolonged school closures also lead to social isolation, separation from peers and supportive adults, counselling, child protection safety nets, school-based meals, and health services delivered at school including immunisation and sexual health programmes • Paediatric Covid-19 vaccines have excellent safety and efficacy profiles to date. The most serious adverse effect of vaccination appears to be myocarditis which is rare and self-limiting, with better outcomes compared with myocarditis due to Covid-19 disease. • Imposing or lifting public health and social control measures has impacts on transmission of non-Covid infections. Impacts may include reduction of infections eg, seasonal influenza; but as jurisdictions transition to a greater dependence on Covid-19 vaccines and loosen physical distancing measures, the return and changing epidemiology of other infections may have large and unpredictable effects on population child health. • Childhood immunisation programmes (ie, for non-Covid infections) can be adversely affected if infrastructure and staff are redirected to Covid vaccination.	• Schools remain open for extended periods when community transmission is low or eliminated, minimising educational, health, developmental, and social harms from prolonged school closures. • Elimination results in shorter time spent in lockdown than in jurisdictions using suppression or aiming for herd immunity. Children are able to socialise with older members of their wider family and community, supporting child wellbeing and interconnectedness. • Vaccines: Effective prevention of community transmission will require most children to be vaccinated. Aotearoa NZ has commenced vaccination of the 12-15 year age group. The FDA has approved vaccination in the 5-11 year age group and the results of vaccine trials in children aged 6 months to 4 years are awaited; • NZ's high stringency lockdowns eliminated transmission of a large number of respiratory and other infections during the winter of 2020.[19] As NZ transitions to a greater dependence on Covid-19 vaccines and loosens physical distancing measures, the return and changing epidemiology of other infections may have large and unpredictable effects on population child health. Loosening of border restrictions during 2021 resulted in a rapid resurgence of RSV infection. • Childhood immunisation programmes (ie, for non-Covid infections) can be adversely affected if infrastructure and staff are redirected to Covid vaccination.

* Note that with a suppression approach, particularly if applied rigorously (ie 'tight suppression') the direct and indirect effects of disease will be less, but the direct and indirect effects of the response may be increased

Impacts on children	Jurisdictions with a mitigation or suppression* strategy	Jurisdictions with an elimination strategy
Indirect impacts of the pandemic response	• Prolonged lockdowns have been associated with high levels of economic hardship, causing additional impacts on wellbeing.[7]	• Shorter lockdowns have a lower adverse impact on employment and other family-level determinants of child wellbeing.[7] • Children may however be negatively impacted through geographic separation from family members overseas due to border restrictions.
Health equity	• The Covid-19 pandemic has widened pre-existing inequities over multiple domains. • In countries with high levels of transmission, severity of disease is higher in children from low-income households and children with underlying chronic conditions.[20] Covid-19 hospitalisations are also strongly patterned by ethnicity, with particularly high incidence rates in Indigenous populations.[21]	• In jurisdictions like Aotearoa where widespread Covid-19 infections are likely to widen pre-existing health inequities, elimination is pro-equity in its aims. However, the Alert Level 4 lockdown of 2020 caused substantial hardship for low-income families. This additional hardship was predictable and could have been mitigated through effective policy.[22] • Inequities in the pandemic response signal the need for policy design that is explicitly pro-equity.[23] In Aotearoa for example, Te Tiriti o Waitangi/ The Treaty of Waitangi must be upheld in all aspects of the pandemic response.[24–26]
* Note that with a suppression approach, particularly if applied rigorously (ie 'tight suppression') the direct and indirect effects of disease will be less, but the direct and indirect effects of the response may be increased		

Principle 4: Use participatory decision-making

The SARS-CoV-2 pandemic exacerbates existing structural inequalities and as noted in Table 2, these inequalities have had profound impacts on child wellbeing during the pandemic.

These findings are in keeping with known inequities in infectious disease incidence in Aotearoa[27] and the catastrophic impacts of previous pandemics and epidemics for Māori. Uncontrolled community transmission in Aotearoa would very likely result in disproportionate hospitalisations of Māori and Pacific children, children from high deprivation backgrounds, and children with disabilities and comorbidities.[26 28] Waves of Covid-19-positive child hospitalisations require strict infection control procedures and can exceed intensive care capacity, placing stress on already stretched health care workforce. Vaccine availability and uptake is also inequitable, further intensifying impacts on disadvantaged populations.

Those that carry the most risk of adverse impacts must have a say in policy decisions. Such decisions need a national conversation and transparent policy processes, ensuring that decisions reflect the views of children and their advocates. In particular it is critical to ensure that commercial determinants of health

(eg, pressure from tourism or hospitality industries) are not the deciding factors in Covid-19 policy relating to children.

Discussion

Decisions about children in the pandemic are currently being made in an environment of rapid change and high uncertainty. In many jurisdictions including Aotearoa NZ, governments' pandemic strategy decisions have not included mechanisms for considering the needs and rights of children.[29]

The United Nations Convention on the Rights of the Child (UNCROC) guarantees rights for children and young people up to the age of 18 years. The Convention has been ratified by all UN member states except the US, and was ratified by New Zealand in 1993. Of particular relevance is Part 1, Article 6: "States Parties shall ensure to the maximum extent possible the survival and development of the child".[30]

UNCROC needs to be seen alongside the Sustainable Development Goals[31] and, in colonised jurisdictions such as Aotearoa New Zealand, the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP).[32] Together these international frameworks maintain a focus on health equity and on Indigenous contexts and measurements of wellbeing. From a Te Ao Māori (Māori world) perspective, they provide a platform to uplift Te Tiriti o Waitangi (the Treaty of Waitangi), the founding document of New Zealand's constitution, protecting children's wellbeing during the Covid-19 pandemic.[26] However, it is not enough to assess Māori child health simply in the context of the health services that are currently provided. The bigger issue is to ensure that tamariki Māori (children) are not disadvantaged by society generally, so that 'being Māori' is not synonymous with being sick.[33] This wider perspective expresses a transformative goal for the health inequities experienced by disadvantaged groups around the world.

The Precautionary Principle recommends preventive action and exploring alternatives to risk while the evidence is unclear. This principle also requires participatory decision-making and self-determination in pandemic risk management. Prevention of Covid-19 transmission is equity-promoting in its intent, but pandemic control measures require careful design and implementation to avoid perpetuating existing health inequities. That means consistently upholding the rights and values of Indigenous Peoples, children, and other populations at risk of adverse outcomes.

Covid-19 elimination protects child wellbeing in multiple ways and allows time for the development and adoption of innovative approaches to improve pandemic outcomes. Where elimination is too challenging to implement, a high degree of suppression would be the second choice. As with other infectious diseases of public health importance, Covid-19 control requires a multi-layered approach that includes vaccination, public health and social measures, and outbreak control. These measures have co-benefits as well as risks. For example, optimising air quality in schools holds promise for preventing transmission of Covid-19 and many other childhood respiratory infections, while improving children's learning and concentration. Such measures have potential to be a lasting and positive legacy of the pandemic.

Over time as knowledge accumulates, the Precautionary Principle can give way to a more conventional evidence-informed approach. Vital evidence to guide strategy will include robust prevalence and duration data on post-acute complications in children and young adults, information on the safety and efficacy of new vaccines in these age groups, and the development of effective infection control measures in schools to support safe in-person learning.

Conclusion

The precautionary approach analysis presented here indicates that elimination continues to be the optimal strategy for Covid-19 because it offers an integrated approach to the protection of children's wellbeing, the wellbeing of the population as a whole, and health equity. Elimination minimises both direct and indirect impacts upon children, and removes the requirement for children and adults to take on unquantified risks from this novel and incompletely-understood infectious disease.

Where countries transition away from elimination they must apply the precautionary principle for the health of children. In these circumstances, a tight suppression approach would be preferable to a mitigation strategy that allowed widespread infection of children with poorly quantified and potentially serious health impacts. However, a suppression strategy can also generate negative impacts on children through ongoing imposition of control measures, so those impacts need to be carefully managed.

Children's wellbeing is a special consideration because children are growing and developing: governments planning to allow a large proportion of their child population to be infected with a new pathogen need to consider the impacts that this decision may have on population health for decades to come. This paper provides a framework for a comprehensive Health Impact Assessment to ensure that direct and indirect impacts upon children are taken into account in major pandemic policy decisions. Such decisions must include the voices of children and their advocates.

The impacts identified in this analysis indicate the importance of minimising Covid-19 infection in the child population, bringing public health policy into line with the standard approach for other vaccine-preventable diseases of childhood. This precautionary approach should be the benchmark against which Covid-19 risks and policies are assessed.

Declarations

Conflicts of interests

There are no conflicts of interest.

Contributorship statement

AK has a dual background in clinical paediatrics and infectious diseases epidemiology, JR is a paediatrician and child health researcher, CTP (Ngāti Kahungunu) is a nurse and public health researcher, and MB is a public health physician with extensive expertise in infectious diseases research, including pandemic strategy and epidemiology.

AK initiated the idea of applying the precautionary principle to child wellbeing in the pandemic, and produced the initial draft. All other authors contributed content and critique to subsequent drafts. CTP also contributed content and concepts relating to Te Ao Māori (the Māori world), as a Māori researcher with child health expertise.

Sources of information for this analysis included published literature, publicly available Covid-19 data (available at https://covid.cdc.gov/covid-data-tracker/#datatracker-home, https://www.health.govt.nz/our-work/diseases-and-conditions/covid-19-novel-coronavirus/covid-19-data-and-statistics, and https://ourworldindata.org/grapher/covid-stringency-index), as well as the authors' experience of contributing to Aotearoa New Zealand's pandemic response.

References

1. Durie M. Whaiora: Maōri health development: Oxford University Press 1998.
2. Jenkins K, Harte HM. Traditional Maori Parenting: An Historical Review of Literature of Traditional Maori Child Rearing Practices in Pre-European Times: Te Kahui Mana Ririki 2011.
3. Saadatian-Elahi M, Horstick O, Breiman RF, et al. Beyond efficacy: The full public health impact of vaccines. *Vaccine* 2016;34(9):1139–47. doi: https://doi.org/10.1016/j.vaccine.2016.01.021
4. Power T, Wilson D, Best O, et al. COVID-19 and Indigenous Peoples: an imperative for action. *J Clin Nurs* 2020;15:15. doi: https://dx.doi.org/10.1111/jocn.15320
5. Alwan NA. We must call out childism in covid-19 policies. *BMJ* 2021;375:n2641. doi: 10.1136/bmj.n2641
6. Kriebel D, Tickner J, Epstein P, et al. The precautionary principle in environmental science. *Environ Health Perspect* 2001;109(9):871–76. doi: 10.1289/ehp.01109871
7. Oliu-Barton M, Pradelski BSR, Aghion P, et al. SARS-CoV-2 elimination, not mitigation, creates best outcomes for health, the economy, and civil liberties. *Lancet* 2021 doi: 10.1016/S0140-6736(21)00978-8
8. Baker MG, Wilson N, Blakely T. Elimination could be the optimal response strategy for covid-19 and other emerging pandemic diseases. *BMJ* 2020;371:m4907. doi: 10.1136/bmj.m4907
9. Thompson KM, Duintjer Tebbens RJ. Lessons From the Polio Endgame: Overcoming the Failure to Vaccinate and the Role of Subpopulations in Maintaining Transmission. *J Infect Dis* 2017;216(suppl_1):S176-S82. doi: 10.1093/infdis/jix108

10. Kabeerdoss J, Pilania RK, Karkhele R, et al. Severe COVID-19, multisystem inflammatory syndrome in children, and Kawasaki disease: immunological mechanisms, clinical manifestations and management. *Rheumatol Int* 2021;41(1):19–32. doi: 10.1007/s00296-020-04749-4
11. Roessler M, Tesch F, Batram M, et al. Post COVID-19 in children, adolescents, and adults: results of a matched cohort study including more than 150,000 individuals with COVID-19. *medRxiv* 2021:2021.10.21.21265133. doi: 10.1101/2021.10.21.21265133
12. Wenzel J, Lampe J, Müller-Fielitz H, et al. The SARS-CoV-2 main protease Mpro causes microvascular brain pathology by cleaving NEMO in brain endothelial cells. *Nature Neuroscience* 2021 doi: 10.1038/s41593-021-00926-1
13. Sullivan O. Long-term sequelae following previous coronavirus epidemics. *Clin Med* 2021;21(1):e68. doi: 10.7861/clinmed.2020-0204
14. Kvalsvig A, Baker MG. How Aotearoa New Zealand rapidly revised its Covid-19 response strategy: lessons for the next pandemic plan. *Journal of the Royal Society of New Zealand* 2021 doi: 10.1080/03036758.2021.1891943
15. Summers J, Cheng H-Y, Lin H-H, et al. Potential lessons from the Taiwan and New Zealand health responses to the COVID-19 pandemic. *The Lancet Regional Health – Western Pacific* 2020;4 doi: 10.1016/j.lanwpc.2020.100044
16. Havers FP, Whitaker M, Self JL, et al. Hospitalization of Adolescents Aged 12–17 Years with Laboratory-Confirmed COVID-19—COVID-NET, 14 States, March 1, 2020–April 24, 2021. *Morb Mortal Wkly Rep* 2021;70(23):851.
17. Hillis SD, Blenkinsop A, Villaveces A, et al. COVID-19-Associated Orphanhood and Caregiver Death in the United States. *Pediatrics* 2021 doi: 10.1542/peds.2021-053760 [published Online First: 2021/10/09]
18. United Nations. Policy brief: Education during COVID-19 and beyond: United Nations, 2020.
19. Huang QS, Wood T, Jelley L, et al. Impact of the COVID-19 nonpharmaceutical interventions on influenza and other respiratory viral infections in New Zealand. *Nat Commun* 2021;12(1):1001. doi: 10.1038/s41467-021-21157-9
20. Bailey LC, Razzaghi H, Burrows EK, et al. Assessment of 135 794 Pediatric Patients Tested for Severe Acute Respiratory Syndrome Coronavirus 2 Across the United States. *JAMA Pediatrics* 2021;175(2):176–84. doi: 10.1001/jamapediatrics.2020.5052
21. Karaca-Mandic P, Georgiou A, Sen S. Assessment of COVID-19 Hospitalizations by Race/Ethnicity in 12 States. *JAMA Internal Medicine* 2021;181(1):131–34. doi: 10.1001/jamainternmed.2020.3857
22. McAllister J, Neuwelt-Kearns C, Bain L, et al. The first year of Covid-19: Initial outcomes of our collective care for low-income children in Aotearoa New Zealand. Auckland, New Zealand: Child Poverty Action Group, 2021.
23. McLeod M, Gurney J, Harris R, et al. COVID-19: we must not forget about Indigenous health and equity. *Australian and New Zealand Journal of Public Health* 2020;44(4):253–56. doi: https://doi.org/10.1111/1753-6405.13015

24. Kvalsvig A, Wilson N, Davies C, et al. Expansion of a national Covid-19 alert level system to improve population health and uphold the values of Indigenous peoples. *The Lancet Regional Health – Western Pacific* 2021;12 doi: 10.1016/j.lanwpc.2021.100206
25. McMeeking S, Savage C. Maori responses to Covid-19. *Policy Quarterly* 2020;16(3)
26. RACP Indigenous Child Health Working Group. Indigenous child health in Australia and Aotearoa New Zealand: Royal Australasian College of Physicians (RACP), 2020.
27. Baker MG, Telfar Barnard L, Kvalsvig A, et al. Increasing incidence of serious infectious diseases and inequalities in New Zealand: a national epidemiological study. *Lancet* 2012;379(9821):1112–9. doi: https://doi.org/10.1016/S0140-6736(11)61780-7 [published Online First: 2012/02/23]
28. Tsankov BK, Allaire JM, Irvine MA, et al. Severe COVID-19 Infection and Pediatric Comorbidities: A Systematic Review and Meta-Analysis. *Int J Infect Dis* 2021;103:246–56. doi: 10.1016/j.ijid.2020.11.163
29. The Children's Convention Monitoring Group. Getting it right: Children's rights in the Covid-19 response. New Zealand: The Children's Convention Monitoring Group, 2021.
30. United Nations General Assembly. Convention on the Rights of the Child. *United Nations, Treaty Series* 1989;1577(3):1–23.
31. Marmot M, Bell R. The Sustainable Development Goals and Health Equity. *Epidemiology* 2018;29(1):5–7. doi: 10.1097/ede.0000000000000773
32. United Nations General Assembly. United Nations Declaration on the Rights of Indigenous Peoples. Washington: United Nations, 2007.
33. Waldon J. Tamariki Māori: A Māori View of Children's Rights: Action for Children and Youth Aotearoa 2010.

Figures

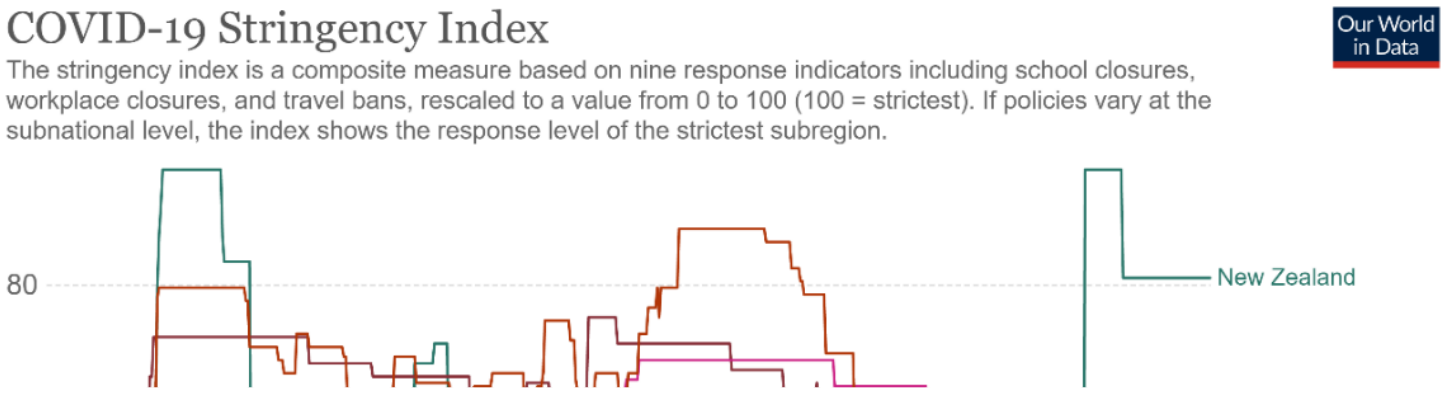

Figure 1

Stringency index illustrating sustained high stringency of jurisdictions pursuing mitigation or suppression (UK, US, and Sweden) compared with New Zealand's elimination strategy, using intermittent application of high-stringency control measures to extinguish outbreaks. The first of the NZ peaks represents a national-level lockdown; the second and third were regional only; and the fourth commenced as a national lockdown but is now regional only. (Graph generated using the Oxford COVID-19 Research Tracker; https://ourworldindata.org/grapher/covid-stringency-index).