A better start national science challenge: supporting the future wellbeing of our tamariki E tipu, e rea, mō ngā rā o tō ao: grow tender shoot for the days destined for you

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A better start national science challenge: supporting the future wellbeing of our tamariki E tipu, e rea, mō ngā rā o tō ao: grow tender shoot for the days destined for you

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ABSTRACT

The majority of children and young people in Aotearoa New Zealand (NZ) experience good health and wellbeing, but there are key areas where they compare unfavourably to those in other rich countries. However, current measures of wellbeing are critically limited in their suitability to reflect the dynamic, culture-bound, and subjective nature of the concept of 'wellbeing'. In particular, there is a lack of measurement in primary school-aged children and in ways that incorporate Māori perspectives on wellbeing. A Better Start National Science Challenge work in the areas of Big Data, Healthy Weight, Resilient Teens, and Successful learning demonstrates how research is increasing our understanding of, and our ability to enhance, wellbeing for NZ children. As we look ahead to the future, opportunities to support the wellbeing of NZ young people will be shaped by how we embrace and mitigate against potential harms of new technologies, and our ability to respond to new challenges that arise due to climate change. In order to avoid increasing inequity in who experiences wellbeing in NZ, wellbeing must be monitored in ways that are culturally acceptable, universal, and recognise what makes children flourish.

Understanding wellbeing

Wellbeing in Aotearoa New Zealand

Our understanding of children's wellbeing during the early years is critical for building strong foundations to ensure lifelong positive education, health and wellbeing outcomes.

Key measures of infant, child and youth health have improved in Aotearoa/New Zealand (henceforth NZ) over the last century (e.g. infant mortality was 40–50 deaths per 1000 births in the 1930s to 3.5 per 1000 births in 2022) (United Nations DoEaSA, Population Division 2022), and immunisation rates are now greater than 80% at 2 years of age (Ministry of Health 2022). As of June 2021, 92% of young people (aged 15–24 years) described their health as good or excellent, and 86% of NZ children (aged <17 years) lived in households experiencing good material wellbeing (New Zealand Government 2022). In 2021, 97% of children had participated in early learning prior to starting school, with 84% having accessed early childhood education services for more than 10 hours per week in 2020 as 4-year-olds (Ministry of Education 2021).

While the majority of children and young people are doing well, disparities persist in which population groups face challenges to their optimal learning, wellbeing and development. Too many experience poverty, violence inside and outside of their homes, overcrowding, and rising inequities in access to healthcare and education (New Zealand Government 2019; OECD 2019). Despite recent reductions in prevalence, nearly one in three NZ children begin school with a BMI in the overweight or obese range (Daniels et al. 2022). The proportion of children and youth with a diagnosed mental health problem has more than doubled in the last decade (Ministry of Health 2021a), with accompanying rises in antidepressant prescriptions (Bowden et al. 2019). It is not clear whether this increase in recognition and intervention reflects rises in baseline mental health problems or more effective healthcare delivery, but nearly one in four high school students reported significant depressive symptoms in 2019, compared to just 13% in 2012 (Fleming et al. 2020). Literacy in NZ has recently been described as 'perilous' following a 2020 UNICEF report indicating that over a third of our youth reach age 15 without basic proficiency in reading and mathematics (UNICEF Innocenti 2020; Hood and Hughson 2022). Without intervention these early life obstacles can be expected to set NZ's children on a trajectory whereby barriers to wellbeing are amplified across the lifecourse (Dornan and Woodhead 2015). At the same time as these concerns are raised domestically, changing patterns of both infectious and non-communicable disease alongside global events are affecting children worldwide. In recognition of these circumstances, international organisations are calling for investment in child wellbeing, but understanding how NZ's children and youth compare to those from other countries is not straightforward.

This review will outline how wellbeing is defined and measured, then reflect on issues with these approaches both internationally and in the NZ context. We will then outline recent research outcomes led by researchers within the Better Start National Science Challenge (E Tipu Rea) in areas integral to child wellbeing. Key findings from the Big Data, Healthy Weight, Successful Learning, and Resilient Teens theme research within the Better Start National Science Challenge will be discussed. Next, we will reflect on some of the biggest challenges that face today's children, youth, and those yet to be born: the ever-changing landscape of the digital world and other technologies, and climate change. Finally, we discuss how measurement of wellbeing may be improved to better support and enhance the wellbeing of children and young people in Aotearoa New Zealand, including consideration of the effects of colonisation and te Tiriti on Māori health outcomes. These dimensions are critical to understanding health and wellbeing for Māori and ensuring that they too may grow strong in the face of endemic racism, privilege, and the legacy of colonisation.

What is wellbeing?

In a broad sense, 'wellbeing' is used to refer to the aspects of an individual's life that are important for their happiness, quality of life, and welfare (Ministry of Social Development 2008). In reality, the concept is complex, culture bound, and no single definition predominates the literature (Aked et al. 2009; Morrow and Mayall 2009; Tomyn and Cummins 2011; Dodge et al. 2021). In practical terms, child wellbeing can be described as a multifactorial representation of physical, psychological, and social health and often includes elements of how children are faring in the context of their family and school in recognition of these two settings as pivotal to children's experiences (Morrow and Mayall 2009; Statham and Chase 2010). Another way to approach the concept is to consider 'flourishing', describing aspects such as a sense of purpose, autonomy, and connection to others, and recognising that children can thrive in difficult environments while those experiencing good material wellbeing may not (Whitaker et al. 2022). It should be noted that non-indigenous models of wellbeing tend to prioritise the individual at the expense of examining whānau, societal and cultural values and perspectives on wellbeing, which are important for Māori (Cram 2019).

The concept of wellbeing from a Pasifika perspective also differs to a westernised position, whereby the role of 'family and community' play an important role in shaping peoples' understanding of what wellbeing is and how to improve it (Firestone et al. 2018). In these groups, there is a strong focus on family and extended family for enabling children's health and wellbeing.

A recent project supported through the New Zealand Council for Education Research (Alansari et al. 2022) examined the socio-psychological conditions for educational success from the perspectives of Māori and Pasifika ākonga (students), kaiako (teachers), and whānau across NZ. It highlighted the importance of learning experiences that are strengths based, culturally relevant and contextually unique for Māori and Pasifika ākonga.

Measuring wellbeing

Despite difficulties in defining wellbeing, it has been measured and reported prolifically. As an important source of international comparative data, UNICEF's recent Innocenti report ranks NZ 35 out of 38 rich countries, with bottom and near-bottom rankings for mental well-being and physical health, respectively (UNICEF Innocenti 2020). Though this report undeniably identifies failures in specific outcomes for NZ children, it also illustrates a key limitation in measuring wellbeing. The international comparison necessitates measures that are common across countries, which severely limits wellbeing measures to childhood overweight and obesity as the only measure of child health, and teenage suicide as the only measure of mental wellbeing (Morrow and Mayall 2009). There is a growing consensus that a complete picture of a child's wellbeing requires a combination of objective and subjective measures, including children's perspectives of what wellbeing means to them across different demographic groups (Statham and Chase 2010), yet comparison over time and place necessitates measures that are routinely collected and universally applicable (UNICEF Innocenti 2020). There are critical gaps in our knowledge about wellbeing in NZ, particularly for younger children (New Zealand Government 2019). The result is the repurposing of broad-scoping measures with a weak theoretical basis for representing wellbeing (Statham and Chase 2010).

Meaningful measurement of wellbeing is important for many reasons; to evaluate interventions or policy changes, fulfil reporting obligations, and ensure compliance with international agreements (OECD; Ministry of Social Development 2008), and in particular, to identify and plan priorities for public investment (Forgeard et al. 2011). A result is that Government-initiated or derived measures almost inevitably highlight those who are being left behind, rather than those who are doing well. Though an important part of strategies to address inequities, many child wellbeing measures have been criticised for taking a 'becoming' approach, whereby the primary concern with child wellbeing pertains to the future costs of health, incarcerations, and other social problems rather than a desire for children to be living good lives in the present (Morrow and Mayall 2009).

How do we measure child wellbeing in NZ?

In NZ, valuable snapshots of the nation's wellbeing can be gained from longitudinal research (AUT Pacific Health Research Centre n.d.; Fergusson 1998; Growing up in New Zealand 2020; OECD n.d.), but these only describe changes within a cohort over a defined time period. Repeated cross-sectional data are available from some health checks, and at a household level from Stats NZ surveys and census. Some of these data can be integrated using the Stats NZ Integrated Data Infrastructure (IDI), a resource that is rare even in affluent countries. The IDI includes 60+ deidentified datasets spanning social welfare, housing, income, population, justice, education, and health, which can be linked using unique identifiers (Stats NZ Tatauranga Aotearoa 2020a). Particularly relevant to child wellbeing are the maternity and birth datasets, B4 School Check, immunisations, and prescriptions (Statistics New Zealand 2017). Other routine health assessments and GP visits are not available through the IDI. Although information about education and training enrolment is recorded, no data about achievement in training courses, or in school before the age of 15 years, are available (Stats NZ Tatauranga Aotearoa 2020a). Though census and household surveys can be linked to health data, the integration of these datasets poses methodological difficulties due to differences in coverage, timeframe, and the type of data gathered. Other limitations of data within the IDI are discussed briefly in relation to the Challenge's work below. Concerns have also been raised about data governance in relation to the IDI (Independent Māori Statutory Board 2019), with calls for data sovereignty, which includes greater control over data gathering, ownership, guardianship and expression. Globally, indigenous data is patchy, inconsistent or non-existent, raising concerns about indigenous invisibility and to what extent data are able to reveal the situation of indigenous people (Taylor and Kukutai 2015).

High school students across NZ have been surveyed on measures of wellbeing in the Youth2000 survey series (Faculty of Medical and Health Sciences University of Auckland n.d.), but no similar surveys exist for younger children. Children's understanding of what constitutes wellbeing often deviates from their caregivers', for example when considering the importance of autonomy, and the role of climate change in perceptions of future wellbeing. The United Nations Convention on the Rights of the Child emphasises the importance of considering children's views in matters that affect them; thus the importance of self-reported data from children should not be understated (Fattore et al. 2007; Dex and Hollingworth 2012). Until recently, NZ's children's voices were largely absent from

wellbeing measurement. The current NZ government has made child wellbeing a key priority with the Child and Youth Wellbeing Strategy (New Zealand Government 2019), which was preceded by consultation with the wider community and included older adolescents and young adults (Office of the Children's Commissioner and Oranga Tamariki 2029). The Strategy outlines six key outcomes for children and youth: that children and youth should be 'loved, safe and nurtured', 'have what they need', 'happy and healthy', 'learning and developing', 'accepted, respected and connected', and 'involved and empowered'. Though the strategy identifies areas where wellbeing knowledge is missing, it is not clear how these gaps will be filled (New Zealand Government 2019). There are opportunities to approach children to collect information about their wellbeing in school settings and at dental and other health appointments. However, measures capturing only those who are regularly engaging with health and social services will need to take into account equity issues in access to services (Taranaki District Health Board 2018).

Community consultation has indicated that currently used measures of wellbeing do not capture the lived experience of many Māori whānau (Jellyman and Allport 2016). Māori are often invisible in what are assumed to be universal measures of wellbeing (Cram 2014), which are steeped in individual and western concepts. Frameworks for measuring Māori wellbeing include individual, collective and te ao Māori relevant measures (Durie 2006a).

Te Tiriti guarantees Māori rights to taonga, including health, and to equitable outcomes. Using a Tiriti framework, data that enable equal explanatory power for Māori and measure equity, or inequity, are essential for monitoring Crown performance (Pomare et al. 1995; Hauora: Māori Standards of Health IV. A study of the years 2000–2005 2007). As argued above, it is also key that measures reflect Māori realities. In the following sections, we outline some of the considerations for Māori, followed by a section on Pasifika. Pasifika peoples, while covering many nations, are included as a key population within the work of the Challenge.

Māori and wellbeing measures

Māori ways of measuring wellbeing need to encompass Māori realities and worldviews and may differ across contexts (Durie 2006a). This requires exploration of diverse levels and measures; for example, iwi-level indicators may only be partly informed by individual measures and are not necessarily applicable across contexts. There have been calls for a set of Māori child wellbeing indicators in line with international recommendations due to criticisms that, among other things, previous attempts to describe Māori wellbeing– and indeed child wellbeing generally–have been deficit-focused (Cram 2019).

Strengths based research perspectives to conceptualising Māori wellbeing focus on examining conditions that lead to successful outcomes for Māori. The wellbeing of tamariki Māori is intimately connected to whānau (Cram 2019), whakapapa[1] (Williams et al. 2019), whenua (Durie 1999), wairua (Fleming 2018), and individual factors (Cram 2019) of being and belonging from within both historical and contemporary worldviews (Rameka 2018) of what it means to be Māori. Tamariki are reliant upon their whānau (caregiving system) to achieve their wellbeing. This necessitates a whānau ora approach to measurement (Taskforce on Whānau-Centred Initiatives 2010) that holds in mind individual needs (Kōkiri 2015) and the collective and holistic flourishing of tamariki

(Durie 2013; Williams et al. 2019; Tupaea 2020). Te Kupenga is a post-censual survey of Māori wellbeing conducted twice since 2013 (Stats NZ Tatauranga Aotearoa 2020b) that has been praised for valuing Māori input in design and governance in a way that most routinely-collected government data do not (Cram 2019). However, it does not survey those under 15 years of age directly, although it provides valuable information about the wellbeing of Māori whānau (Stats NZ Tatauranga Aotearoa 2020b).

Understanding more about how to assess the wellbeing of tamariki Māori is important for measuring how we as a nation are doing, how we as whānau are doing and how we as individuals are doing (Durie 2006b). Cram (Cram 2019) argues that good-quality and strength-based data about tamariki Māori wellbeing is important. She suggests a mauri framework with three components of tamariki Māori thriving related to the ihi, wehi and wana of the individual child. The mauri framework suggests key data sources that are already collected for monitoring the ihi, wehi and wana of tamariki Māori. What is missing is the data source to consider the flourishing of pēpi Māori from a Te Ao Māori framework. It is important to remember that Māori infants are likely to live within an embrace of multiple relationships (Penehira and Doherty 2013; Stevenson et al. 2016) and that whānau resilience is crucial for wellbeing (Waiti and Kingi 2014; Fleming 2018); however this needs to occur within macro level changes to societal conditions (Moewaka Barnes et al. 2013).

Pasifika perspectives of wellbeing

For Pasifika children, viewpoints based on lived experiences and knowledge of their world have largely been omitted from general Pasifika models of health (e.g. Fonofale, Fānau ola) (Tu'itahi 2013), and there is limited research on how Pasifika children conceptualise their wellbeing. Dunlop-Bennett et al. in 2019 (Dunlop-Bennett et al. 2019) is the first NZ-based research to highlight viewpoints of what is important to the wellbeing of Samoan children (aged 8 years old), that includes: connecting to loved ones; feeling secure and not having to worry; being valued, feeling included and a sense of belonging; and being a good person. These ideals align very closely to the Samoan cultural values, and contextualise how family and community behave and operate (Dunlop-Bennett et al. 2019).

From a community viewpoint, the Fonofale model of health (Pulotu-Endemann 2001) is often used to guide the stance on Pasifika wellbeing. Qualitative research from Firestone and others (2018) explored Pasifika peoples' hopes and dreams for their health and wellbeing. Findings highlighted the importance of taking a strengths-based approach to improve health and wellbeing. This requires a family-centric approach, particularly to prepare the younger generation for the future, and for families to take responsibility for their own health (as compared to the community taking that responsibility). From the perspective of Pacific adults, 'family and community' was considered the most important wellbeing dimension for Pasifika peoples in NZ, though dimensions such as physical, spiritual and mental wellbeing were also important (Firestone et al. 2020). These works indicate that the Pasifika concept of wellbeing is dynamic over time, which means that some models of health may not necessarily be receptive to how people view wellbeing today. However, what is clear is that Pasifika wellbeing is strongly collective and must be family focused.

A Better Start National Science Challenge–contributions to wellbeing for NZ children

A Better Start researchers aim to give children the best possible start in life through a holistic and evidence-based approach to addressing key challenges. By bringing together researchers from multiple disciplines with a variety of methodological approaches, the Challenge recognises that children's wellbeing is inextricably connected to their health, learning, and resilience. This section outlines recent research from A Better Start themes, including a combination of published and preliminary, unpublished data.

Big data theme

The big data team has used national administrative data to explore early life exposures and their effects on later outcomes and childhood wellbeing. These data are available for research in anonymised form through the Integrated Data Infrastructure (IDI). How demographic data are collected is highly variable between datasets within the IDI, as is the detail, quality, and who is represented (Teng et al. 2021). For example, in the Programme for the Integration of Mental Health Data sets, NZ European individuals are overrepresented in comparison to population baselines, while Pasifika, Asian, and to a lesser extent Māori, are underrepresented, reflecting differential engagement with the services from which the data are derived. Other datasets show different patterns with regards to ethnicity (Bowden et al. 2020c). The large scale of the IDI data provides a large number of sibling and twin comparisons to understand associations without environmental and social confounding factors, which lead to misinterpretation in the findings of many childhood association studies (Milne 2022). For example, IDI data was used to demonstrate that exposure to antibiotic therapy both in utero and early childhood had a dose-dependent association with increased obesity risk at age 4 years. However, there was no such association when examining siblings and twins, suggesting that the apparent associations may have been due to unmeasured familial confounding (Leong et al. 2020). These findings were consistent across ethnicity. Similarly, sibling analyses, as well as whole-cohort analyses, found no evidence that caesarean birth impacts later NCEA level 2 attainment (Slykerman et al. 2021).

The team has also demonstrated the value of the IDI for using multiple data sources to identify young people engaging with health services for mental health problems in the context of a fragmented and inequitable mental health system (Bowden et al. 2020a). They have described recent increased dispensing in young people (aged <25 years) of both anti-depressant medications (Bowden et al. 2019) and drugs used for the treatment of attention-deficit/hyperactivity disorder (ADHD) (7), which is in line with global trends. They have further identified differences in dispensing between different demographic groups, with lower dispensing rates among those living in the most deprived areas, and differential dispensing rates between ethnic groups (Bowden et al. 2019; D'Souza et al. 2020). Prescribing rates were highest among those of NZ European/ Other ethnicity, followed by Māori, with lower rates among Asian and Pacific ethnic groups (9).

Autism, or Takiwātanga, meaning 'in one's own time and space', describes a spectrum of conditions that are increasingly of interest to NZ researchers. However, there is little

information about its incidence and the concomitant challenges to wellbeing experienced by autistic individuals in NZ. The big data team has developed a method for estimating prevalence of autism using multiple administrative health data sources in the IDI (Bowden et al. 2020c). Low relative rates of autism were identified among Māori and Pasifka young people, which more likely reflects services that do not meet the needs of these groups, than a lower 'true' prevalence of autism (Bowden et al. 2020b). Applications of this method have quantified high rates of co-occurring intellectual disability (31%) and mental health conditions (70%) among autistic young people. Autistic children also experience a disproportionate medication burden (Bowden et al. 2020b) including high rates of melatonin use (McLay et al. 2021) and significantly elevated levels of poly-pharmacy compared to the general population (Bowden et al. 2020b; McLay et al. 2021). Using linked health and non-health data, the team has identified that autistic students are three times more likely to be suspended from school than their non-autistic peers. However, this work provides justification for substantial education-based funding support, which the team found was associated with a significant reduction in suspension rates (Bowden et al. 2022). It is also encouraging that autistic young people are significantly less likely to interact with the criminal justice system (Bowden et al. 2021).

Healthy weight theme

Most children in NZ have a healthy weight but a large proportion have an unhealthier high weight–a concern for the future. Obesity prevalence has increased over the last few decades in almost every demographic group worldwide (Ramachandran and Snehalatha 2010; OECD 2017). Though the NZ Health Survey suggests that weight issues continue to rise in NZ children (Ministry of Health 2021a), a collaboration between the Big Data and Healthy Weight themes has demonstrated the opposite trend in four-year-olds attending the B4 School Check (Shackleton et al. 2018; Daniels et al. 2022). The B4 School Check was established in 2010 as a free, comprehensive health and development check for four-year-olds. The data includes results of hearing, vision, growth, dental, and behaviour and developmental screening. The check had almost universal attendance in recent years, however, examination of which children do not attend indicates a reinforcement of existing disparities (Gibb et al. 2019). There needs to be an increased effort at all levels to ensure all children and whānau benefit from early identification of developmental issues.

Data from the check demonstrated a small but steady decrease in children with BMI ≥85th percentile from 35% in 2010/2011 and 32.8% in 2015/2016 (Shackleton et al. 2018), with a slightly larger fall in prevalence to 29.4% in 2018/2019 (Daniels et al. 2022). This decrease was apparent across all ethnicities, the socioeconomic spectrum and all regions across New Zealand, which makes NZ the only country thus far to report such a trend that is not accompanied by increasing inequities (Maessen et al. 2021; Daniels et al. 2022). It is heartening to see that NZ is uniquely showing a sustained trend in reduction of preschool obesity given that we have one of the highest childhood obesity rates in the world. For there to have been such a pervasive effect across New Zealand it is likely that nation-wide policies or practices have created this healthy outcome. Furthermore, it is probable that these policies may have had other health goals and a reduction in childhood obesity was not expected or planned. Exploration

of which society-wide changes to policies, laws, and behaviours have preceded this change is underway. Possible candidates include the introduction of paid parental leave, which has demonstrated effects on child overweight prevalence in California (Lichtman-Sadot and Bell N 2017); improvements to Early Childhood Education affordability and quality; reduced unemployment, and perhaps most important, reductions in maternal smoking during pregnancy.

NZ's comprehensive anti-smoking campaign led to dramatic falls in smoking prevalence, including during pregnancy, across the 90s and 2000s (Laugesen and Swinburn 2000). Reductions in tobacco sales further indicate that those who do smoke are smoking fewer cigarettes (Cancer Control Council of New Zealand n.d.). In 2010, 14.4% of women smoked at 2 weeks postpartum, compared to 8.4% in 2019, but smoking during pregnancy is particularly common in demographic groups more affected by obesity (Ministry of Health 2021b). While the reduction in smoking prevalence during pregnancy is encouraging, understanding the complex factors and stressors that lead to continued smoking need to be better understood and addressed. Implementation of interventions that are engaging for Māori women and their whānau in particular are needed on a wider scale (Glover and Kira 2011). Smoking in pregnancy has been linked to obesity and adverse cardiometabolic sequelae for the offspring in NZ and international studies (Carter et al. 2011; Maessen et al. 2019). Using the IDI to link maternity and birth records to the B4 School check, we were able to demonstrate that children whose mother reported smoking at their first antenatal visit were more likely to be born small for gestational age or preterm (unpublished data), both independent risk factors for overweight and obesity in adulthood (Mathai et al. 2013; Hong and Chung 2018). Further, smoking in pregnancy was associated with birthweight and with overweight and obesity at the B4 School Check, with greater effects for heavier smokers (unpublished data). Modelling is underway to estimate the proportion of decline in overweight/obesity prevalence that may be attributed to changes in smoking patterns.

Successful learning theme

Literacy is crucial for full participation in many facets of life; from education, employment and career progression; to travelling, socialising, and parenting; as well as engagement in political, healthcare and economic structures that have a pervasive influence on wellbeing and daily life (Bravo et al. 2002; Otto 2006). In particular, literacy is important for children's successful engagement at all levels in a school setting (Walker et al. 1994; Fergusson and Lynsky 2006).

A child's opportunities to develop early foundational skills for literacy acquisition are influenced by their home environment and the cultural and linguistic exposure it provides (McNaughton 2020; Gillon et al. 2022). The Pacific Island Families Study in Auckland demonstrated that children from mothers who aligned strongly with both their Pasifika and New Zealand culture outperformed other children at 6 years of age in vocabulary (Kim et al. 2019).

Children's emergent literacy skills at school entry predict literacy development across their school career, suggesting that early initiation of literacy support is important to promote success throughout life (McNaughton 2020; Gillon et al. 2022). Investigations undertaken within the Successful Learning theme highlighted that The B4 School

Check would benefit from more direct measures of children's emergent literacy skills (Schluter et al. 2020).

The Better Start Literacy Approach (BSLA) aimed to develop children's foundational literacy skills. The research team adopted a He Awa Whiria or braided rivers approach (Martel et al. 2021) to integrate western, non-western, Kaupapa Māori and Pacific science to inform their work. They developed online early literacy assessments that are strengths-based, culturally appropriate, and designed for teachers to monitor children's emergent literacy development in their first two years at school (Gillon et al. 2022; Scott et al. 2022).

Controlled intervention trials in seven schools from lower socioeconomic communities in Christchurch demonstrated that BSLA could benefit learners at all levels and across ethnicities when compared to usual literacy instruction. Improvement was assessed across a variety of indicators of early literacy skills such as letter-sound knowledge, phonological awareness, and vocabulary (Gillon et al. 2019). Greater effects on literacy were observed for a subset of these children identified to have weak oral language at school entry who were exposed to the approach earlier compared to later in the school year (Gillon et al. 2020). Children identified to need extra support after class level teaching of the BSLA across Auckland and Christchurch were selected for targeted small groups with increased teaching intensity. They had accelerated reading and spelling skills compared to similar children without additional support (Gillon et al. 2022).

Following the success of these research trials, BSLA is now being implemented nationally through the Ministry of Education's Early Literacy Initiative. Junior school teachers and literacy specialists in over 650 schools are currently funded to receive quality professional learning and development to effectively implement BSLA. Results of implementation in over 13,000 children who have received at least 10 weeks of BSLA teaching demonstrate accelerated improvement in these children's early literacy learning, including a strong response to this teaching approach from Māori and Pasifika learners (Gillon, email communication October 2022). The BSLA shows immense potential for reducing the literacy equity gap among tamariki in NZ.

Resilient teen theme

Mental health is an integral part of most wellbeing definitions. While the majority of young people in NZ report being happy with their lives, young people bear the major burden of mental health disorders, with a third of these disorders emerging before age 14 and the majority before age 25 (Solmi et al. 2022). Mental health disorders are the leading cause of illness and disability in this age group, with depression, anxiety, and behavioural disorders predominating (WHO). In addition, a large proportion of young people may experience subthreshold mental health problems, stress and distress that also have tremendous impact on their wellbeing and functioning (Pascoe et al. 2020).

Internationally, many young people with mental health problems do not seek help (Salaheddin and Mason 2016), and even those referred with clear need for mental health services may not be able to access them (Cosgrave et al. 2008). Discrepancy between the number of youth reporting mental distress and those accessing services suggest a similar pattern in NZ. A fifth of high school students reported difficulty getting help with emotional problems, and both the experience of psychological distress and access to mental health services was not equitable, disproportionately affecting female students

and those aged over 15 years or living in more socioeconomically deprived neighbour-hoods (Fleming et al. 2020). Thus, development of mental health support that is effective, accessible, and acceptable to youth is an important area of research.

Today's teens are digital natives and, the Better Start Resilient Teen theme has been meeting teens where they are–on their digital devices–to deliver mental health support in innovative ways. Though technology-based mental health interventions for young people have been trialled before, maintaining sustained engagement has remained a chal-lenge (Lattie et al. 2019). The 21-Day Stress Detox by the resilient theme members used a 'chatbot', which is programmed to send, recognise, and respond to messages through Facebook Messenger. The chatbot delivered daily content teaching and reinforcing strat-egies for dealing with stress and anxiety. On average, participants had improved scores on the WHO-5 wellbeing index (M: −7.38; 95% CI: −11.14, −3.61; $p < .001$) and the abbreviated Perceived Stress Scale (PSS-10) (M: 1.77: 95% CI: 0.59, 2.94; $p < .004$) at post- compared to pre-intervention. The chatbot experience was acceptable to most par-ticipants, and over 40% completed more than 2/3 of the sessions, demonstrating the feasibility of a chatbot intervention for stress and anxiety in NZ youth. Qualitative feed-back indicated the need for more individualised experiences, which may improve engage-ment in future iterations (Williams et al. 2021).

In early 2020, there were disruptions to our way of life on an unprecedented scale as the COVID-19 pandemic took hold. As NZ went into a country-wide lockdown, the Resi-lient Teen theme acted quickly to adapt existing chatbot technology for mental health support in response to the rising anxiety experienced by NZ's youth. In the two weeks following its launch, the Aroha chatbot had 393 registrations and 238 logged-in users, 127 of whom were in the target age range (13-24 years). The chatbot content was dynamic to respond to the user and responsive to feedback throughout the trial, and demonstrated feasibility of the modality to deliver event-specific, responsive mental health support in times of high need (Ludin et al. 2022).

Tune In is another app co-created with young people, including rangatahi Māori, to support behaviour change through goal setting (Penno et al. 2022). The app aims to reduce suicidal ideation and enhance wellbeing for users by allowing them to set person-ally relevant goals. It has been trialled in 79 12–18-year-olds identified as potentially needing support for their wellbeing or emotional/behavioural functioning. Strategies chosen by young people and then used to achieve goals mostly related to sleep/bed time and wake time, physical activity, time spent on enjoyable and/or creative activities, or jotting down their worries. Though analysis is still underway, raw data suggests improvements in WHO-5 and reduced depression scores for the 43 users who completed the follow-up survey. Despite the demonstrated potential of social-media-based mental health interventions, retainment of users and engagement from those who could most benefit continue to be areas of weakness for this approach. A study is in progress to examine how Tune In could be more culturally responsive for Māori, who are often underrepresented in mental health studies in NZ.

Child wellbeing in the future

As the world changes both physically and socially, the children of today face a unique set of opportunities and challenges that will shape their lives and those of future generations.

While reported to have higher standards of living and greater connectivity and innovation than any other generation in human history, our children are inheriting pervasive inequity, unprecedented ecological degradation, and predatory commercial practices that threaten a sense of certainty about what their future will hold (Clark et al. 2020). Based on the Challenge's research, the following section summarises some key considerations for child health and wellbeing in the next 10 years.

Technology

Humans have never had such easy access to information and means to communicate with each other. The way we communicate, learn, and access healthcare and other services is constantly evolving, with immense effects on everyday life.

Internet connectivity has been critical in minimising disruption to students' learning during the Covid-19 pandemic, but globally, only one in three school-aged children have access to internet in their home (United Nations Children's Fund and International Telecommunication Union 2020). In NZ, 85% of households with children had an internet connection in 2013. This proportion varied considerably by region and income at the time of the census and has likely increased in the following years in line with other households (Stats NZ 2020; 20/20 Trust n.d.). As well as the internet providing vast opportunities for self-directed learning and remote participation in learning activities, young people see the internet as an important platform for engaging in politics, reading news, and connecting with family (UNCIEF Office of Research - Innocenti and London School of Economics and Political Science 2019). The role of communication technologies have had particular value during the Covid-19 pandemic (Gabbiadini et al. 2020), and may have helped to mitigate the effects on children of social isolation due to lockdowns throughout the pandemic (López-Bueno et al. 2021).

As the internet breaks down barriers to accessing education, it also introduces new challenges. The ability to make critical judgements about the reliability of information is now essential from a young age, yet fewer than 1 in 10 students participating in the Programme for International Student Assessment (PISA) can differentiate between fact and opinion based on the content, context, and implicit cues of a text (OECD 2020). The late 90s bogeyman of the stranger in a chat room has grown into fears of financial scams, addiction to online gambling and gaming, and even radicalisation by terrorist organisations or political extremists. A 2021 US-wide survey found that boys aged 8–18 years spent an average of 2 hours and 20 minutes gaming per day, with 40% playing games on a console, computer or portable player every day (Rideout et al. 2022). This is a relatively new area of research into a rapidly evolving space, but adolescents frequently encounter extremist messages while online and many do not recognise them as such (Nienierza et al. 2021). While these fears are real, measurable negative outcomes may be rare and appear to be mitigable with a robust approach to digital citizenship (Morris 2016).

There are simultaneous streams of research into the negative impacts of social media on child physical and mental health, but also their potential to improve these outcomes. The documented harms of screen use for children and adolescents generally include increased risk of myopia (Foreman et al. 2021; Zhang et al. 2022) and other eye

disease (Ganne et al. 2021; Mineshita et al. 2021), harm to hearing from earbud use–particularly when ill-fitting and/or sustained at high volumes–(World Health Organization 2015), spinal pain related to posture (Joergensen et al. 2021), direct and indirect effects on sleep (Li et al. 2020; Zhang et al. 2022), and increased risk of an unhealthy weight (Li et al. 2020; Zhang et al. 2022).

Despite the popularity of social media platforms among young people, they are seen by some youth themselves as sources of depression, anxiety, and bullying, with many considering themselves to be 'addicted' to the platforms (O'Reilly et al. 2018). A scoping review suggests that nearly a quarter of high school students experience cyberbullying, increasing their likelihood of depression (Hamm et al. 2015). Children's rights to privacy are also threatened by social media, both through lack of understanding of potential consequences of information and image sharing, and because they lack control over what personal information others, especially their parents, may share about them online without consent (Keith and Steinberg 2017; Tatlow-Golden and Garde 2020). The full potential of social media sites as marketing tools is likely yet to be seen, but already digital advertising is being used to promote unhealthy food to children, often escaping regulatory controls on conventional advertising methods (Kelly et al. 2015; Tatlow-Golden and Garde 2020). As tech companies increasingly aim to create immersive experiences for their users, concerns are being raised about the potential to more effectively engage potential consumers, including children, in advertisement of harmful products such as alcohol (Huckle and Casswell 2022).

However, there are positive aspects to social media, with a systematic review finding beneficial effects on social relationships (Sharma et al. 2020). This may be particularly important for young people who are LGBT+, have disabilities, or are in a minority group, as they can use social media to find community, support, and advice from people with shared identities (Glazzard and Stones 2020). From the perspective of young people, being on social media removes barriers to socialising due to illness, physical distance, or a lack of confidence in face-to-face social interactions.

In a more direct way, social media is a potentially powerful tool to information share and provide support for variety of specific health conditions through discussion forums, or through health promotion–which can be aimed at children or youth themselves rather than caregivers (Hamm et al. 2014). Further, social media can be used to inform young people in need of mental health support, leading to increased help-seeking behaviour (Evans-Lacko et al. 2022). As demonstrated by the resilient teen theme (Lattie et al. 2019; Williams et al. 2021), mental health interventions on social media platforms are becoming a rich area of research with potentially wide reach and impact.

Other digital technologies can be used to enhance children's ability to manage their own chronic conditions, and to provide support beyond what can be achieved in hospital appointments (Blower et al. 2020; Mills et al. 2022). However, to be successful, these must be carefully designed in consultation with the intended users to address children's concerns about stigma, privacy, accessibility, and reliability of apps and online support (Blower et al. 2020).

Another area where huge strides are being made towards improved quality of life is healthcare. As technology advances, so too does the potential to diagnose, manage, and treat illness earlier, more effectively, and more accurately. For the most part, successful technologies are augmenting rather than replacing traditional care, including face-to-

face visits to healthcare professionals. Beyond the potential of simple digital technologies, machine learning, robotics, 3D printing, virtual reality, and data analytics are examples of technologies being explored or already used in multiple areas of medicine to improve care (Paul 2019; Mills et al. 2022). Despite all the possibilities that technology offers, it comes with certain weaknesses and ethical concerns, including Māori data sovereignty. that must be considered, and where possible, mitigated. If we rely on technology too much, we could be left helpless when it fails or is deliberately interrupted, such as when Waikato DHB was targeted in a ransomware attack, resulting in serious disruption to care provision.

As with any progress, disparities in access to new technologies have the potential to increase the equity gap rather than closing it. As an internet connection and digital literacy become the norm, those without these assets may be left behind. If home learning becomes regularly implemented on a wide scale in response to future pandemics, access to services such as an appropriate place to learn and the social and health services usually delivered in a school setting could be disrupted.

Climate change

Climate change and the destructive impact of human activity on the environment that underpins it are undoubtably the biggest threat to global health for the coming decades. Today's children are growing up on a planet in crisis on a scale that no previous generations have faced. Though children who are already disadvantaged are most at risk from consequences to education, nutrition, wellbeing, and physical and mental health (Currie and Deschênes 2016; Hellden et al. 2021; Leffers 2022), it is unlikely that any of today's children or those yet to be born will entirely escape these wide-reaching effects (Currie and Deschênes 2016; Leffers 2022). Without significant intervention, climate change and environmental degradation will magnify health and wellbeing inequity both globally and locally (Hellden et al. 2021; Vergunst and Berry 2021).

The effects of the climate crisis on children's mental health are underexplored (Vergunst and Berry 2021), but some mental health experts predict increased rates of anxiety, depression, and PTSD as catastrophic events become more commonplace due to the effects of climate change (Hrabok et al. 2020). Coming to terms with how climate change may affect their future has been reported to trigger feelings of anxiety, helplessness, and hopelessness as children begin to think about global issues in late childhood and early adolescence (Ojala 2012). This increasingly recognised chronic and existential type of anxiety has been dubbed 'climate anxiety' (Wu et al. 2020). Although there are no comparable statistics available for NZ, 84% of respondents in an international survey of 10,000 16–24-year-olds were at least 'moderately worried' about climate change, and more than 45% reported that this worry affected their daily functioning (Hickman et al. 2021).

Despite their increased physical and physiological vulnerability across the life course (The Climate Crisis is a Child Rights Crisis: Introducing the Children's Climate Risk Index 2021) and considerable concerns about effects of climate change (National Environmental Justice Advisory Council 2018), children and young people were, until relatively recently, largely neglected in discussions about the science, politics, and consequences of climate change (Gibbons 2014; Council 2018). In contrast, young people are at the forefront of movements calling for governments to address what has been called a

child rights crisis and an intergenerational injustice (Currie and Deschênes 2016; Council 2018; The Climate Crisis is a Child Rights Crisis: Introducing the Children's Climate Risk Index 2021; Leffers 2022). The most recognisable activist in the climate movement, Greta Thunberg, was 15 when she first challenged the Swedish government and began the School Strike 4 Climate movement. In New Zealand, Generation Zero was born in 2010 out of young people's frustration at the world's political leaders and their failure to commit to meaningful action against climate change (Generation Zero n.d.). Climate change highlights concerns for Māori about loss of whenua and extractive and damaging relationships with whenua due to colonisation.

Strategies to mitigate and adapt in the face of a changing planet may have direct positive effects on the health, education, and wellbeing of our communities as well as the wider environment (Leffers 2022). Such strategies have already influenced worldwide behaviours through social movements and legal, taxation, and policy changes. In NZ, for example, red meat consumption per capita has more than halved since 2000 (OECD 2022). A 2019 report indicated that a third of all New Zealanders are consciously limiting the amount of meat in their diet for both their own health and for the environment, (Food Frontier and Life Health Foods 2019), in line with recommendations for reducing cardiovascular and cancer risk (World Cancer Research Fund 2018; Heart Foundation 2020). Other initiatives consistent with recommendations for mitigating climate change such as renewable energy, insulation, and heating grants for homes, are likely to have positive effects on children's environments (C40 Cities 2019; Climate Action Tracker 2021). More than 20% of vehicles imported to in early 2022 were reduced-emission vehicles (electric or hybrid), compared to only 6.5% just two years earlier (Stats NZ 2022), alongside government actions to promote safe and accessible active transport (Te Manatū Waka Ministry of Transport 2020). However, in order for these benefits to outweigh the potential disastrous consequences of continued global heating, NZ will need to address short-term policies that are incompatible with climate change action (Climate Action Tracker 2021). NZ is one of 17 countries to have legally binding commitments to net zero carbon emissions by 2050 (Energy & Climate Intelligence Unit 2022), but following the release of the an updated carbon emissions plan in Dec 2021 was still rated as making 'highly insufficient' progress towards these goals (Climate Action Tracker 2021). The full effects of climate change and global environmental degradation and depletion on younger generations have only recently begun to be understood, and measuring what impact they have already had is still a challenge. NZ children and youth therefore face both unprecedented opportunity and threats to their wellbeing and it is thus imperative that we all work towards supporting them with resources to improve their resilience and adaptability.

The future of wellbeing measurement

In order for measurement to be meaningful and useful, it should be comprehensive, representative, national, or international. Any adoption of international measures, however, will need to be done with careful consideration of appropriate interpretation and use in a NZ context. Previously, comprehensive wellbeing measurement has largely fallen to researchers, leaving significant gaps in our knowledge about the physical and emotional wellbeing of NZ children and youth, particularly for primary school-aged

children. For example, although we know about BMI trends for four-year-olds from B4 School Check data, there are no comparable national data to understand whether the improvements in the prevalence of weight issues in this age group translate to lower risk across childhood and into adulthood.

For both ease of collection and cost-effectiveness, measures could be added to expand knowledge gained from surveys that are already established, or school settings could be used to capture as many children as possible. For example, the Children's Worlds survey measured self-reported subjective wellbeing of 8-, 10, and 12-year-olds from 35 countries with the support of participating schools (Rees et al. 2020). The data have been used to describe adolescents' flourishing alongside more prosaic measures of wellbeing (Whitaker et al. 2022). The National Child Measurement Programme in England, connected to the health service, is an example of national-level data capture; children in all state schools have their height and weight measured at school entry and again at age 10–11 years (NHS Digital 2021). This could be accompanied by measures of flourishing that are not limited to physical and mental health and include other things such as eudaimonic wellbeing and child-perceived learning success. Care must be taken to reduce school and child burden, and also to collect information in a sensitive and non-stigmatising way, particularly if body measurements are taken.

Children are entitled to have their views considered in governmental decisions that affect them (United Nations 1989; Loveridge 2010), but young people are understandably concerned about how their data are used and protected (Audrey et al. 2016; Thabrew et al. 2022). Robust processes must be in place to ensure that child data are collected with a clear justification and benefit to the population, with a focus on strengths-based reporting without stigmatising any population groups (Health Research Council New Zealand 2007; Loveridge 2010). Further, children should be given the opportunity to understand what the justification is: a balance should be struck between complete, comprehensive data, and child autonomy to opt out of the process altogether (Health Research Council New Zealand 2007; Loveridge 2010). This should involve partnerships with Māori and an understanding of wellbeing through the lens of all New Zealanders as Treaty partners. Involvement from less advantaged communities and newer migrants, whose experiences of wellbeing may differ from other population groups would also be valuable.

Indigenous models of wellbeing are not only important for use within the communities they are created by and for but have value for informing wellbeing models that may be applied more widely. Māori models of data sovereignty, too, can inform best practices for data that describe non-Māori children as well as Māori children (Te Mana Raraunga 2018). Despite increasing numbers of participants identifying as Māori, population longitudinal studies have fallen short. However, For older children, it may be possible that now the Growing Up In New Zealand Study has an experienced Kaupapa Māori epidemiologist, a more useful data set for Māori will emerge.

We have outlined the considerable difficulties with defining wellbeing as a 'one-size-fits-all' concept, with current predominant definitions of wellbeing doing a poor job of incorporating the views of children, Māori, and Pasifika. However, measuring wellbeing in ways that are meaningful but also applicable across different contexts is likely to be the bigger challenge going forward. The ability to monitor improvements or declines in wellbeing for New Zealand children, and how this might differ among different demographic

groups, will clearly continue to be important as NZ children face the challenges outlined above. Identifying problems is only beneficial if they can be addressed, so continuing innovation alongside robust systems and services that are effective in addressing inequity should not be neglected in favour of monitoring in isolation. Currently, a lack of universal screening after the age of 4 alongside fragmented mental health services leave only insufficient global measures to understand how NZ children are faring in important areas of wellbeing. A Better Start research findings have begun to address some of these issues, and research will continue to play a role in informing wellbeing measures, effective interventions, and outcomes.

Note

1. The layer of relationships over time.

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