Child Ind Res (2013) 6:213–236
DOI 10.1007/s12187-012-9171-5

Developing an Index of Well-Being for Nine-Year-Old Irish Children

Carly Cheevers · Mick O'Connell

Accepted: 2 October 2012 / Published online: 17 October 2012

Abstract This paper outlines the development of an index of child well-being using data from the first wave of the Child Cohort in the Growing up in Ireland study. This national longitudinal study explores children's lives by collecting data from 8,568 nine-year-old children, their caregivers and their teachers. Well-being indices are useful to describe children's circumstances, to monitor child outcomes, and to create and assess the efficacy of social polices involving children. Traditionally, macro-level data has been used in the construction of child well-being indices. However, micro-level data is used in this paper to provide a child-centered perspective on their well-being. This index is comprised of three domains; physical health, social & emotional functioning and educational attainment. Fourteen measures were used in the creation of these domains utilising data from children, caregivers and teachers on the child's current development. The domain content, protocol followed and confirmatory process used in creating this index are discussed. Evidence is provided supporting the inclusion of the domains and the factorial structure of the index. A child well-being index of this sort is valuable as it manages to efficiently summarize the richness of information provided by multiple informants on the multidimensional nature of child well-being into a single index. Consequently, it can be easily used and understood by the various stakeholders involved in services related to child welfare.

Keywords Indicators · Index · Well-being · Children · Development

1 Introduction

1.1 The Importance of Assessing the Well-Being of Children

Studying the well-being of children is a "significant emerging frontier" in developmental research (Pollard and Lee 2003 pp. 59). The recent proliferation in studies examining the well-being of children may in part be explained by the conversion of many

C. Cheevers (✉) · M. O'Connell
School of Psychology, University College Dublin, Belfield Dublin 4, Ireland
e-mail: carly.cheevers@ucdconnect.ie

governments to accountability-based public policy (Ben-Arieh 2008). Furthermore, stakeholders have become increasingly aware that assessing child well-being is necessary to effectively plan, and examine the efficacy of, services for children (Rutter and Stevenson 2008).

One of the most practical ways of exploring and measuring well-being is the use of social indicators. Indicators are widely used statistical markers that denote a particular phenomenon. They tend to be more common in the fields of economics and finance but the advantages to their use in the social sciences are beginning to be realized. Social indicators are unique as they provide a bridge between empirical measurement and theory (Frønes 2007), in that they give meaning to data, lend support to existing theories and inform the development of new theories. In the study of well-being, social indicators are essential as they can provide information on the condition of individuals, changes and trends across time and furthermore can be utilized to set goals aiming to improve well-being in areas of need (Ben-Arieh and Frønes 2011).

1.2 Key Developments in Child Indicator Research

The earliest discussion on social indicators pertaining to children is believed to have been stimulated by President Herbert Hoover's establishment of the Committee on Recent Social Trends in America in 1929, and the group's subsequent report, "Recent Social Trends" in the United States (US) in 1933 (Zill et al. 1983). It is argued that there has been a recent revival of the child indicators movement that can be traced back to the social indicators movement of the 1960s (Ben-Arieh 2008). The dynamic social climate of the 1960s acted as a catalyst for relevant stakeholders to seek out ways to measure and monitor the conditions of different groups in society, including families and children (Aborn 1985; Land 2000 as cited in Ben-Arieh 2008). Accordingly, since the late 1970s there has been an increasing interest in using social indicators to monitor the well-being of children (Sanson et al. 2010).

In his discussion of the history of the child indicators movement, Ben-Arieh (2008) posits that the launch of the United Nations Children's Fund's (UNICEF) annual report, "State of the World's Children" in the early 1980s and the global ratification of the United Nations' Convention on the Rights of the Child (CRC) from 1990 to the present time have also been major driving forces in bringing the measurement and use of child indicators into the spotlight.

The birth and subsequent development of the child indicators movement was enabled by a number of theoretical and methodological shifts and advancements (Ben-Arieh 2008). These theoretical shifts included: the genesis of the United Nations' CRC; the acknowledgement of childhood as a life stage; and the understanding of child development within an ecological framework.

Methodological developments which facilitated the evolution of the child indicators movement included the acknowledgement of the subjective perspective–essentially, the realization that children had an important role in studies of their childhood. Furthermore, while historically research focused on the child as part of a family, the child indicator movement now acknowledges the child as the unit of observation, a separate distinct entity to be observed. Finally, this piqued interest in children's well-being shown by stakeholders and the research community resulted in the creation of large numbers of datasets including administrative data, census,

surveys and academic research which provide rich information on children's lives.

The advancement of technology will certainly have facilitated the progression of the child indicators movement. The proliferation of personal computers and their ever increasing speed have provided researchers with access to vast numbers of datasets and the ability to conduct complex statistical analyses with one single keystroke. Without this technological and electronic growth the movement would not have managed to progress as far, as rapidly.

1.3 Composite Indices

As the amount of indicators representing various aspects of well-being proliferates, so too the effort to develop composite or summary indices of well-being emerges, with increased attention being paid to combining a number of single "simple" indicators into "constructed" composite indices. Given the multidimensional nature of well-being, composite indices are particularly advantageous and can facilitate a holistic consideration of well-being (Ben-Arieh and Goerge 2001). Using a single index can be useful in that it is easier to report, track and monitor progress, and make comparisons across groups (Moore et al. 2008; Sanson et al. 2010). Composite indices are easier for stakeholders and the public to understand, they can be utilized to understand the factors influencing child well-being and development and evaluate the impact of policies and changing social conditions (Moore et al. 2008; Sanson et al. 2010).

There are a number of challenges faced in creating composite indices: which measures to use as indicators; what domains of well-being to include; how to weight the constituent parts; the application of cut-offs; how to deal with missing or lack of data, and generally conceptualizing the entire process (Moore et al. 2007). An added complexity is that it is sometimes argued that the validity of such measures is questionable because the use of summary statistics can mask trends within their constituent parts (Moore et al. 2007, 2008). Moore et al. (2008) consider this point, but counter it with the reasoning that leading economic indices are composite measures, and that this averaging effect smoothes volatility within the data, as a result providing a more accurate portrayal of the economic situation as a whole. The same argument can apply to an index of well-being.

1.4 Macro-Level and Micro-Level Indices of Well-Being

Generally, composite indices of child well-being are created using population level data (Sanson et al. 2010). The most prominent of these originate in the US, e.g., the Kids Count Index created by the Annie E Casey Foundation (O' Hare and Bramstedt 2003) and the Foundation for Child Development's Child Well-Being Index (CWI; Land et al. 2001). While population level indices use aggregate data to describe the proportion of children in a population with a certain outcome, micro-level indices, in which the child is the unit of observation, enable one to understand children at the present time, and the developmental pathways related to functioning at an individual level (Fernandes et al. 2012; Sanson et al. 2010). Micro-level indices effectively give children a voice and offer a child-centered perspective to the concept of child well-being (Moore et al. 2008). Fernandes et al's (2012) recent review essay stated that

utilizing micro-level data advances the field of measuring child well-being, yet despite these desirable characteristics there have been a limited number of attempts to create micro-level indices of child well-being. The only efforts to do so have employed data from large scale studies in Australia and the US and the main elements of these studies are outlined in Table 1.

In calculating the composite well-being scores, the American studies using data from the NSAF and the NSCH followed the same procedure of choosing thresholds, or cut-points, for all indicators and domains to dichotomize children into groups. The studies using the NSAF chose cut-points to divide children into those experiencing *problematic* well-being or not, and the studies using the NSCH divided children into those who showed *normative* well-being or not. Conversely, Sanson et al. (2010) retained all indicator variables and domain scores in a continuous form where possible in order to exploit the valuable diversity of the data.

1.5 Measurement of Child Well-Being in Ireland

Ireland's largest endeavor to measure child well-being has been the biennial publication of State of the Nation's Children reports since 2006 (Office of the Minister for Children 2006). State of the Nation's Children reports are collaborations between government, academic institutions and other relevant stakeholders to observe and monitor the condition of children in a particular area or region (Ben-Arieh and Goerge 2001). The State of the Nation's Children reports describe how children in Ireland are faring based on a National Set of Child Well-being Indicators. These indicators include population measures of socio-demographics, children's relationships, education, health, social, emotional and behavioral outcomes, and formal and informal supports (Office of the Minister for Children and Youth Affairs 2010). The publication of the initial report in 2006 was the first undertaking in Ireland to describe and subsequently monitor the holistic well-being of Irish children. It was Ireland's preliminary step in bringing a policy focus on child well-being to light (Fitzgerald 2004).

While the Irish State of the Nation's Children report utilizes over 50 unique indicators to provide a picture of how well Irish children are doing, a number of studies have used population data to create composite indices of child well-being in Ireland (Bradshaw et al. 2007; Bradshaw and Richardson 2009; UNICEF Innocenti Research Centre 2006). The most recent study compared child well-being across 27 countries of the EU, Norway and Iceland using 43 indicators taken from administrative and survey data (Bradshaw and Richardson 2009). The domains of well-being examined were children's material situation, housing and environment, health, subjective well-being, education, children's relationships, and risk and safety.

While these reports of population level indicators and indices are crucial for describing the functioning of children in Ireland and informing their future, there has been no Irish research using indices to describe child well-being and functioning at the individual level.

1.6 The Current Paper

This paper is timely in that it creates a micro-level index of well-being of children in Ireland, using the child as the unit of observation. This index was created using data

Table 1 Information on existing micro-level indices of child well-being

Name	"Child well-being index"	"Child well-being index"	"Child well-being index"	"Outcome index"	"Child well-being index (positive)"
Authors	Moore et al. 2007	Vandivere and McPhee 2008	Moore et al. 2008	Sanson et al. 2010	Moore et al. 2012
Study	National Survey of America's Families (NSAF) (1997, 1999, 2002)	National Survey of America's Families (1997, 1999, 2002)	National Survey of Children's Health (NSCH) (2003)	Longitudinal Study of Australian Children (LSAC) (2004)	National Survey of Children's Health (2007)
N	Exact unknown. Survey sample = >30,000 per wave	Exact unknown. Survey sample = >30,000 per wave[a]	31,096 & 37,820	5,107 & 4,983	Exact unknown. Survey sample = 91,642
Age	6–11 & 12–17 years	6–11 & 12–17 years	6–11 & 12–17 years	3–19 month & 4–5 years	6–11 & 12–17 years
Domains of well-being	Health & Safety	Health & Safety	Physical Health	Health & Physical Development	Physical Health
	Social & Emotional Development	Social & Emotional Development	Psychological Health	Social & Emotional Functioning	Psychological Health
	Educational Achievement & Cognitive Attainment	Education	Social Health	Learning Competency	Social Health
			Educational Achievement & Cognitive Development		Educational Achievement & Cognitive Development
No. indicators	17	17	69	6 & 16	30 & 32

[a] Vandivere and McPhee 2008 also used data from the NSAF to create indices of well-being across 13 representative states, mirroring the indicators and domains used by Moore et al. 2007

from the Child Cohort of "Growing up in Ireland" (GUI), the National Longitudinal Study of Children in Ireland. Two cohorts of children will be followed over the course of the GUI study, the Infant Cohort who are followed from 9 months old and the Child Cohort who begin participating at 9 years old.[1] This study is the first large scale longitudinal study of children in Ireland and provides a rich data source on children and their environment using reports from parents and other caregivers, teachers, school principals and the children themselves. Additionally, information is obtained through direct measurements of the children, for example their scores on academic tests and their physical measurements. The diverse information gleaned from the study means that GUI is an ideal source for the creation of a micro-level index of child well-being. This is the first opportunity in Ireland to accurately track the progress of children across their childhood, and an index of well-being can enable users to examine the factors that influence trajectories of positive and negative child well-being and development.

1.6.1 Aims

The aim of this study is to describe the development and psychometric properties of an Index of Child Well-Being in Ireland. The measures used, and methods of calculating domain and index scores will be explained. Relationships between indicators and domains will be examined, the overall factorial structure discussed and examples of the index's utility will be illustrated.

1.7 Considerations for Developing the Micro-Level Index of Well-Being

1.7.1 Conceptualization and Measurement

The practice of creating micro-level composite indices of child well-being is still in the early stages, therefore there is no prescribed protocol to use or method to follow to measure and calculate well-being scores (Moore et al. 2008). The creation of indices is shaped by individual differences in the conceptualization of child well-being, theoretical underpinnings, the availability of data, the indicators and domains included and the calculation methods employed (Moore et al. 2008). Therefore it is necessary to clearly conceptualize and explain the measurement processes of any attempts to create composite indices.

There are a number of issues to take into consideration in conceptualizing and creating a composite index of well-being. A systematic review of the child well-being literature conducted by Pollard and Lee (2003) found that both the definition of child well-being and the tools used to measure the construct lacked consistency. This issue is further compounded by a lack of consensus on what the key indicators and domains to include in measuring child well-being are (Fernandes et al. 2012; Moore 1997; O' Hare and Bramstedt 2003; O' Hare and Gutierrez 2012; Pollard and Lee 2003). However, consistent themes are arising (Moore et al. 2008), as can be illustrated by Pollard and Lee's (2003) finding that generally five distinct domains of well-being are

[1] Although a very small proportion (1.7 %) of the sample included eight and 10-year-olds this Cohort is referred to throughout the paper as the Cohort of 9-year-olds

studied; physical, social, psychological, cognitive and economic. These appear to be the key areas contributing to a child's overall well-being and development. Pollard and Lee (2003) indicated that while definitions of well-being are not consistent in the literature, there is a clear pattern to the conceptualizations of what contributes to child well-being. Managing discrepancies in the *measurement* of well-being is the key to achieving consensus in the literature. In Pollard and Lee's (2003) review they postulate that to accurately capture well-being it is vital that the measurement tool taps the multidimensional nature of well-being. Unfortunately, while there is a multitude of measures claiming to assess child well-being, the reality is that they are tapping into more specific, unidimensional aspects of well-being rather than the construct as a whole (Pollard and Lee 2003). Their study found that 80 % of the studies they reviewed covered only one domain of well-being, 13 % covered two, almost 5 % covered three domains and just over 2 % covered four domains of well-being, namely cognitive, physical, psychological and social well-being (Pollard and Lee 2003).

The conceptualization and measurement of this Index of Child Well-Being in Ireland was informed largely by the efforts of previous studies to create micro-level indices of child well-being. Methodological elements of each study were considered and for a number of reasons it was decided to model this index on the Outcome Index created by Sanson et al. (2010). Firstly, the Outcome Index was constructing using data from Growing up in Australia which is a similar study to GUI and which also uses comparable measures. Secondly, it was preferable to exploit the information as continuous data as their study did, to avoid both the loss of fine detail that occurs when continuous data is dichotomized, and the subjective and sometimes arbitrary process of choosing cut-points to define what is and is not considered to be a state of well-being. Furthermore, a more accurate portrayal of a continuum of well-being emerges when the distribution of continuous data is used and according to Sanson et al. 2005 (pp. 22), using the data in this manner is "more statistically and mathematically principled".

1.7.2 The Choice of Domains and Measures for Inclusion

The current study aims to create a composite index of child well-being consisting of three domains of well-being: physical health, social and emotional functioning and educational attainment. These domains reflect those used by the other large scale micro-level indices, but also mirror the areas of well-being most prevalent in the research literature (Pollard and Lee 2003) and align with key domains of child development: physical, psychological, social and intellectual (Eccles and Gootman 2002).

O' Hare and Gutierrez (2012) recently reviewed the domains included in 18 comprehensive composite indices of child well-being and found that on average the indices included approximately five domains, ranging between two and seven domains. The lack of consistency in the field (Fernandes et al. 2012) is highlighted by the use of over 100 domain names in these studies, over 60 of which were unique names (O' Hare and Gutierrez 2012). The most popular domain types included were education, health and material well-being. The authors concluded that a comprehensive index of child well-being not including these three domains 'is questionable' (O' Hare and Gutierrez 2012 pp. 13) and that because over half of the studies incorporated six or seven domains in their indices this was perhaps an indication of the number of domains that should be used in such an index. However, there is one point regarding

the studies included in this review that we feel has been overlooked in reaching these conclusions; that is, the different theoretical standpoints in regards to the inclusion or exclusion of contextual/social environmental factors in the overall indices of well-being. Three of the cited studies excluded contextual measures when constructing their composite well-being indices (Moore et al. 2008; Sanson et al. 2010; Vandivere and McPhee 2008). Accordingly, these studies utilized on average just over three domains of well-being in their indices of child well-being which is important to consider, particularly in regards to the current study. However, two of the studies (Moore et al. 2008; Vandivere and McPhee 2008) did include separate indices of contextual well-being, which when merged with their indices of child well-being, were considered to represent the *overall condition* of the child.

According to Moore et al. (2012) the practice of combining measures describing how children are faring with measures pertaining to their contexts or environments confounds 'the determinants of well-being with child outcomes' (pp. 199). Moore et al. (2008) warned against including contextual measures in composite indices of well-being as it is conceptually important to differentiate between actual child well-being and the resources that may facilitate or impede well-being. Micro-level indices do not need to assume causal relations between for example household income and a child's well-being status as these relationships can be empirically tested. In the cases where social environmental factors are included in indices with child outcomes, one is implicitly modeling how a child inherits their parents' circumstance, thereby discounting the intricate mechanisms through which risk, vulnerability, resilience and protective factors function in these relationships. Following recommendations by Vandivere and McPhee (2008), Moore et al. 2008 and Brown (2006), this study will not be combining outcome measures representing child well-being with measures of the child's social environment.

1.7.3 Well-Being and Well-Becoming

The variables, or indicators, comprising each domain of well-being were chosen to place the individual child within a contextual space representing not only their "well-being", but their "well-becoming". This is in keeping with Sanson et al's (2010) guideline that there should be empirical evidence of predictive relationships between the measures of current functioning used and a child's future functioning. The variables are not only indicative of children's current functioning but they represent areas crucial for their development into healthy, able, active citizens of society. Additionally, the variables were chosen to represent positive and negative elements of well-being, as advised by Moore and Lippman (2005). Positive indicators represent a positive construct (measured on a continuum or one-dimensionally), for example emotional adjustment, whereas negative indicators portray a negative state, such as externalizing behaviours (measured one-dimensionally) (Pollard and Lee 2003). Unfortunately "well-being is often framed within a model of child deficits rather than a model of child strengths" (Pollard and Lee 2003 pp. 69), in that well-being has tended to be represented by the absence of problems, instead of the presence of flourishing and competency factors. The downside to this is that policy may place more emphasis on interventions for problems, to the detriment of research into promoting children's assets. As a result there has been a call for research into

children's strengths in order to fully understand what makes children thrive. Young people respond well to the recognition and nurturance of their strengths, and identifying these strengths can help establish what facilitates positive developmental trajectories (Moore and Lippman 2005).

1.7.4 Weighting Indicators

One of the measurement challenges involved in creating composite indices is the issue of weighting the constituent indicators and domains in terms of their contribution toward the overall construct measured. Again, due to the newness of the process of creating micro-level indices of child well-being, so far all of the applicable studies have weighted the constituent domains equally. This also appears to be the case for the composite indices of population level child well-being (Fernandes et al. 2012). At the present time equal weighting is optimal because there is no appropriate statistical and theoretical alternative mechanism of weighting (Hagerty and Land 2007). Moore and Theokas (2008) find equal weighting in this case to be acceptable because no domain dominates the entire construct, as is the nature of general well-being.

1.7.5 Type of Indicators and Informers

Moore et al. (2007) suggest that the best practice for choosing the variables to create indices of well-being is to include objective, observable and subjective indicators. This study uses all three types of indicators from multiple sources, including the main caregiver, the child's teacher and the child themselves. The child self-report indicator pertains to their health and although the children are young (9-years-old), studies have shown that children as young as five can reliably report their health and health related quality of life (see review by Riley 2004; Varni et al. 2007).

2 Method

2.1 The Growing Up in Ireland Study

The objective for Wave 1 of the Child Cohort was to interview a random sample of 8,000 nine-year-old children, their parents/guardians, carers, teachers and school principals (Growing up in Ireland Team 2010). Figures from the Irish Census in 2006 indicated there were 56,497 nine-year-olds living in Ireland at the time, thus the project aimed to survey approximately 14 % of the study population (Growing up in Ireland Team 2010). To be eligible for inclusion, children had to be born between November 1st, 1997 and October 31st, 1998 (Murray et al. 2011).

2.1.1 Sampling Frame and Sample Design

The sample was selected in two stages using the national primary education system as the sampling frame. The school acted as the primary sampling unit (psu) and the pupil was the secondary sampling unit (ssu) (Murray et al. 2011).

- Stage 1: A random sample of 1,105 schools[2] was selected on a stratified systematic basis in which schools were stratified according to county, co-educational status, disadvantaged status,[3] size (as measured by number of 9-year-olds) and religious denomination.[4] A total of 910 schools consented to participate, resulting in a school response rate of 82.3 % (Growing up in Ireland Team 2010).
- Stage 2: To select pupils, the schools were divided into two groups–those with less than 40 eligible children, and those with more than 40 eligible children. In the former group, all children were recruited into the sample and in the larger schools an upper threshold of 40 children were randomly selected by the school principal using a random number set (Murray et al. 2011). Out of 17,054 eligible students, 57 % (n=9,645) consented to participate and of those who consented, 8,655 completed the survey successfully. Data on 8,568 of these students are available in the final dataset[5] (Growing up in Ireland Team 2010).

Sample Weighting Sample weights were constructed to reflect the sample design using school and family variables to ensure the selected sample was representative of the population from which it was drawn.

2.1.2 Data Collection

Survey Administration in Schools Principals completed a school questionnaire, and teachers completed two questionnaires: one about themselves and a second on the study child. Trained interviewers administered two self-complete assessments to the children in the schools: academic tests and the Piers-Harris II self-concept scale (Piers et al. 2002). All school surveys were completed on paper (Murray et al. 2011).

Survey Administration in Homes In the home, trained interviewers administered questionnaires to primary caregivers (PCGs), secondary caregivers (SCGs) and the study child through Computer Assisted Personal Interviewing (CAPI). Additionally, all participants answered self-complete paper questionnaires of sensitive items, the child completed a "One day time use diary" and the interviewers measured the height and weight of the child and caregivers (Murray et al. 2011). A short, self-complete paper questionnaire was sent to non-resident parents and other caregivers who cared for the child for at least 8 h per week on a regular basis (Murray et al. 2011).

[2] From the national total of 3,177 primary schools (excluding 80 schools designated as only for infants and schools with no 9-year-olds enrolled)

[3] In the Republic of Ireland, schools within a catchment area of a low income community may be designated as disadvantaged

[4] State primary schools in the Republic of Ireland are 'denominated' as having a particular religious ethos by the Department of Education and Skills using one of nine religious categories

[5] This disparity in figures is a result of dropping cases when requested by the family or when the level of missingness made the data unusable

2.2 The Current Study

2.2.1 Sample

Participants included in this study were 8,568 children and their primary caregivers and teachers who participated in Wave 1 of the Child Cohort of the Growing Up in Ireland study.

Primary Caregivers The majority of primary caregivers were biological mothers (94 %, n=8,172), 2.1 % (n=185) were fathers, and the remaining were the child's grandparent, foster parent, adoptive parent or other relation. The mean age of primary caregivers was 39.28 years old (SD=5.7), 93 % (n=7,971) were Irish citizens, and 82 % (n=7,014) were living with a partner. Three in 10 had completed lower secondary school or below (30 %, n=2,585), 37 % (n=3,145) achieved upper secondary school qualifications and one third (33 %, n=2,838) had obtained a non-degree qualification or higher on leaving school. Just over half (54 %, n=4,586) were currently employed or self-employed and 28 % (n=2,408) lived in a household in receipt of social welfare payments.

Children Children were aged between eight and 10 years old, with 98 % (n=8,423) aged 9 years. Just over half (51 %, n=4,381) were male, 95 % were Irish citizens (n=8,119) and 82 % were living with two parents in the household (n=7,015).

2.2.2 Procedure

Data Collection Access to the dataset was obtained through an application to the Irish Social Science Data Archive (ISSDA). An Anonymised Microdata File (AMF), the publicly available anonymised dataset, was received on a Compact Disc (CD) and version 18 of the Statistical Package for the Social Sciences (SPSS) was utilized by the researcher to access the data.

Developing the Index of Well-Being The initial stages of developing the Index involved a number of steps to choose and prepare suitable variables for inclusion (Fig. 1 below illustrates the final items included in the index). First, a review of the research literature was conducted to ascertain individual child factors which described their current well-being status and which were also predictive of future functioning. Following consultation of the GUI questionnaires, these factors were then matched to relevant items and scales used in the study. The variables chosen were examined in terms of their missingness, the psychometric properties of the multi-item measures were assessed and all were deemed acceptable for inclusion (see Table 1 for descriptives of the variables used[6]). The relationships between the variables in each domain were then assessed for redundancy and overly high correlations. This was to ensure that weighting of domains was not imbalanced by including variables which tapped into the same underlying construct, and again all

[6] Any results reported are based on the weighted dataset

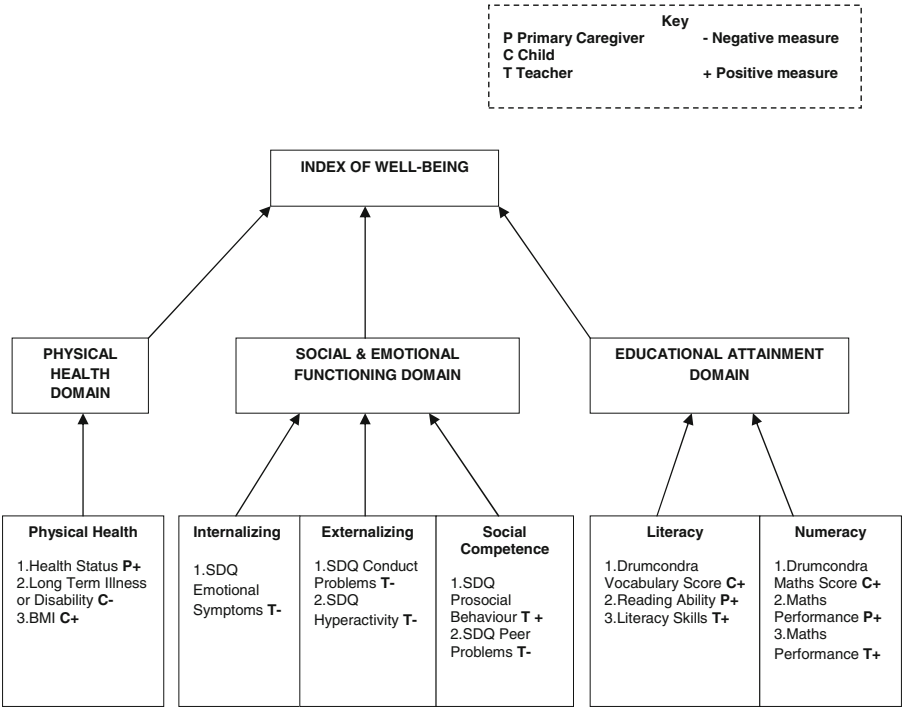

Fig. 1 The constituent measures, subdomains and domains of the Index of Well-Being

the variables were deemed acceptable. In preparing the variables for inclusion in the index, where applicable, variables were recoded so that higher scores indicated positive outcomes.

Calculating the Index of Well-Being The four steps involved in calculating the index are outlined below. These steps follow the method used by Sanson et al. (2005) and Sanson et al. (2010) in their creation of the two LSAC Outcome Indices. Their method to deal with missing data was also employed and is described in more detail below.

Step 1– Standardizing all variables

In the first step, all 14 component variables were standardized to z scores. There were a number of special cases:

- While a very small proportion of 1.7 % (n=145) of the children were not aged nine, age trends in some variables were still apparent. The following variables showed age trends and were therefore standardized by the age of the child: child health status, child's long term illness or disability, SDQ Prosocial Behavior score, and literacy skills.
- Children completed Level 2, 3 or 4 of the Drumcondra Primary Reading Vocabulary Test-Revised and Drumcondra Primary Mathematics Test-Revised depended on which class they belonged to. As a result, test scores were standardized by the test level taken.

- The standardization of BMI involved a number of steps:

  1. Firstly the continuous BMI score was standardized as z scores.
  2. To account for age and gender, cut-point data from the International Obesity Task Force (Cole et al. 2000) was used to create a categorical variable of BMI indicating whether the child was non-overweight, overweight or obese.
  3. Using this categorical variable, the original BMI standardized variable was restructured to be meaningful, so that higher scores equate to more positive outcomes compared to lower scores:

     - Overweight and obese children's scores were multiplied by −1.
     - Children who were non-overweight and who scored below 0 on the original BMI standardized score were multiplied by −1. In this way, underweight, overweight and obese children all score below 0 and the non-overweight children score above 0, keeping in line with the process for higher scores to mean positive outcomes.
     - Finally, the variable was standardized to z scores again.

Step 2– Creating subdomain scores

The second step in the calculation process was to create the five subdomain scores (the Internalizing, Externalizing, Social Competence, Literacy and Numeracy subdomains). This involved firstly calculating the mean score of the component indicators within each subdomain, and then standardizing the resultant mean scores to z scores.

Step 3– Creating domain scores

Calculating domain scores involved the same process as above, of calculating the standardized mean score of the component of each domain subdomains (or in the case of Physical Health which has no subdomains, the single indicators). These scores were standardized with a mean (M) of 100 and standard deviation (SD) of 10.

Step 4– Creating the index scores

This involved calculating the standardized mean score of the three domains of Physical Health, Social & Emotional Functioning, and Educational Attainment (only for cases in which all three domain scores were present[7]). The variable was standardized with a mean of 100 and standard deviation of 10. Additionally, the top and bottom 15 percentiles for the index and each domain were used to create variables indicating the groups of students performing best and worst in terms of their overall well-being, and more specifically their physical health, social, emotional and educational well-being. These cut-points are not intended to be clinically meaningful; rather they are based on the general statistical view that scoring less than one standard deviation below the mean of a population (which approximates to 15 % of the sample) indicates a difficulty (Sanson et al. 2005). Thus, the same logic was applied to the positive end of the scale to observe which children are thriving.

[7] Scores were available for the full sample on Physical Health and Educational Attainment, but data were missing for 3.85 % of the cases on the Social and Emotional Functioning domain

Dealing with Missing Data In the event of data missing from one or more variables within a subdomain, or from one or more subdomains within a domain, a mean score was still calculated using the available data. However, the resultant mean scores would be skewed, as the fewer scores used to create the mean score, the larger the standard deviation. Accordingly, children missing data will have scores further from their "real mean"–the mean that is technically reflective of their true scores. To correct for this, cases were grouped together according to their level of missingness, and their subdomain/domain scores were then divided by the group standard deviation.

Validation of the Index In order to assess the validity of the constructed index, the relationships between the domains were examined using Pearson correlations. Following this a forced one-factor Principal Components Analysis (PCA) was conducted as a means to examine if the three domains load adequately onto a single factor, and to what extent do these domains explain the variance in this underlying factor. Finally, continuous and categorical forms of the index and domains were used to examine the relationship of demographic factors to well-being scores.

2.2.3 Measures

Physical Health Domain

Child health status

Primary caregivers described their child's general health in the past year on a Likert type scale from 1 "Very healthy, no problems", to 4 "Almost always unwell".

Child long term illness and impact on school

Children answered two items; 1) If they had a long term illness, disability or medical condition diagnosed by a doctor and 2) If they did, whether it impacted on their participation in school. A new variable was created on a scale of 1 "Yes, has a condition and affects school", 2 "Yes, has a condition but does not affect school" and 3 "No, does not have a condition".

Body Mass Index (BMI)

The GUI dataset provides children's weight in kilograms (KG) and height in centimeters. Child BMI was calculated by dividing the child's measured weight in KG by their height in meters squared.

Social & Emotional Functioning Domain The complete social and emotional functioning domain consists of five subscales from the widely used Strengths and Difficulties Questionnaire (SDQ; Goodman 1997). The SDQ was rigorously developed on a foundation of theory using information on facets of child psychological maladjustment (using the DSM-IV; American Psychiatric Association 1994 and ICD-10; World Health Organization 1993) and factor analysis (Goodman and Scott 1999). Many studies have examined the scale's psychometric properties, deeming it to be reliable and valid (Goodman 2001; Muris et al. 2003; Smedje et al. 1999). Caregivers and teachers rated children on 25 items pertaining to their psychological adjustment on a scale of 0 "Not True", 1 "Somewhat True" and 2 "Certainly True". A study by the measure's author found that child behavior was best predicted using primary

caregiver and teacher reports, and that both reports possessed roughly equivalent predictive ability (Goodman et al. 2000). Accordingly, the mean scores of caregiver and teacher reports combined are used in this study.

Internalizing Subdomain

SDQ Emotional Symptoms Scale (α=.73)

Scores on this scale were obtained by calculating the children's mean scores on five items related to negative emotional states.

Externalizing Subdomain

SDQ Conduct Problems Scale (α=.67)

Scores on this scale were obtained by calculating the children's mean scores on five items related to disruptive, disobedient and aggressive behavior.

SDQ Hyperactivity Scale (α=.85)

Scores on this scale were obtained by calculating the children's mean scores on five items related to inattentive, overactive behavior.

Social Competence Subdomain

SDQ Prosocial Behavior Scale (α=.77)

Scores on this scale were obtained by calculating the children's mean scores on five items related to positive, considerate, sociable behavior.

SDQ Peer Problems Scale (α=.67)

Scores on this scale were obtained by calculating the children's mean scores on five items related to problems in relationships with peers.

Educational Attainment Domain

Literacy Subdomain

Drumcondra Primary Reading Test–Revised (DPRT-R)–Vocabulary

Children's scores on the Vocabulary section of the Irish national, standardized, curriculum based DPRT-R were used as a measure of their reading achievement.

Reading Ability

Primary caregivers rated how well their child's reading was relative to other children of his/her age on a scale from 1 "Poor" to 5 "Excellent".

Overall Literacy Skills (α=.91)

Teachers were to rate children on three items regarding their reading, writing, and comprehension ability relative to children in their age group on a scale from 1 "Below Average" to 3 "Above Average". An exploratory factor analysis indicated that these three items loaded onto one factor and explained 84.5 % of the variance in the factor. Accordingly, an overall teacher-rated 'literacy' scale was created using the child's mean score on these three items.

Numeracy

Drumcondra Primary Mathematics Test–Revised (DPMT-R)

Children's scores on Part A, Form A of the Irish national, standardized, curriculum based DPMT-R were used as a measure of their mathematics achievement.

Mathematics Performance (caregiver report)

Primary caregivers rated how well their children were performing in mathematics relative to other children of their age on a scale from 1 "Poor" to 5 "Excellent".

Mathematics Performance (teacher report)

Teachers were asked to rate children on their mathematics academic performance relative to others in their age group on a scale from 1 "Below Average" to 3 "Above Average".

3 Results

Table 2 displays the descriptive statistics of all of the variables included in the index of well-being.

3.1 Relationships Between Indicators

Table 3 shows Pearson Correlations between the variables included in the Index. Associations between scores on each variable ranged from negligible to large (according to Cohen 1992), with two relationships not reaching significance. These were the correlation between child BMI and scores on prosocial behavior and reading ability.

3.2 Relationships Between Domains

The associations between each domain of the index were all statistically significant ($p<.001$), and ranged from small to medium in magnitude (Cohen 1992). The relationship of the strongest magnitude ($r=.38$) was that between Social and Emotional Functioning ($N=8{,}238$) and Educational Attainment ($N=8{,}568$). The magnitude of the relationship between Social and Emotional Functioning and

Table 2 Descriptive statistics of variables included in the index of child well-being

Domain	Subdomain	Variables	N	Mean	SD	% missing
Physical health	–	Child health status	8568	2.71	0.5	0.0
		Child long term illness	8484	2.83	0.5	1.0
		Child BMI	8089	17.95	3.1	5.6
Social & emotional functioning	Internalizing	Emotional symptoms (SDQ)	8236	8.22	1.6	3.9
	Externalizing	Conduct problems (SDQ)	8229	8.90	1.2	4.0
		Hyperactivity (SDQ)	8220	7.08	2.3	4.1
	Social Competence	Peer Problems (SDQ)	8221	8.85	1.3	4.1
		Prosocial behavior (SDQ)	8225	8.58	1.4	4.0
Educational attainment	Literacy	Drumcondra vocabulary test score	8340	0.02	1.0	2.7
		Reading ability	8562	3.77	1.0	0.1
		Literacy Skills	8234	2.17	0.7	3.9
	Numeracy	Drumcondra maths test score	8417	−0.76	0.9	1.8
		Maths performance (caregiver)	8560	3.63	1.0	0.1
		Maths performance (teacher)	8218	2.16	0.7	4.1

Table 3 Pearson correlations between standardized variables used in the index of well-being

	1	2	3	4	5	6	7	8	9	10	11	12	13
Physical health domain													
1. Child health status	–												
2. Long term illness	.33***	–											
3. BMI	.06***	.06***	–										
Social/emotional domain													
Internalizing subdomain													
4. Emotional symptoms (SDQ)	.20***	.10***	.05***	–									
Externalizing subdomain													
5. Conduct problems (SDQ)	.08***	.08***	.03**	.27***	–								
6. Hyperactivity (SDQ)	.09***	.09***	03*	.25***	.56***	–							
Social competence subdomain													
7. Peer approval (SDQ)	.13***	.12***	12***	.45***	.43***	.37***	–						
8. Prosocial behavior (SDQ)	.03**	.05***	.00	.14***	.51***	.40***	.36***	–					
Cognitive domain													
Literacy subdomain													
9. Drumcondra vocabulary score	.05***	.03**	.05***	.19***	.22***	.35***	.14***	.06***	–				
10. Reading ability	.07***	.04**	.00	.12***	.14***	.33***	.07***	.10***	.50***	–			
11. Literacy skills	.06***	.05***	.07***	.21***	.24***	.47***	.19***	.14***	.62***	.53***	–		
Numeracy subdomain													
12. Drumcondra mathematics score	.06***	.03**	.07***	.23***	.21***	.36***	.19***	.05***	.62***	.32***	.51***	–	
13. Mathematics performance (caregiver)	.07***	.04***	.05***	.21***	.16***	.32***	.15***	.08***	.36***	.48***	.42***	.44***	–
14. Mathematics performance (teacher)	.05***	.05***	.10***	.24***	.21***	.40***	.20***	.10***	.48***	.36***	.70***	.53***	.50***

N ranged from 7788 to 8568

*p<.05 **p<.01 ***p<.001

Physical Health (N=8,568) was small, with a co-efficient r=.18 and the weakest correlation was between Physical Health and Educational Attainment (r=.11).

3.3 Factorial Structure of the Index

Table 4 displays the component matrix of the forced one-factor PCA. All factor loadings were acceptable and additionally, the three variables explained 48.96 % of the factor's variance.

3.4 Illustrative Examples of Using Scores on the Index of Well-Being and its Domains

Figure 2 illustrates the mean scores of males and females on all three domains of well-being. Independent samples T-tests indicated that males score statistically significantly higher than females on the Physical Health and Educational Attainment domains ($t(8566) = 2.03$, $p<.05$ and $t(8566) = 3.13$, $p<.01$, respectively). Conversely, females score higher on the Social and Emotional Functioning domain ($t(8236) = -10.41$, $p<.001$).

Figure 3 shows a steep linear gradient in the relationship between children's scores on the Index and the income quintile they belong to, ranging from the mean score of 96.2 (SD=10.0) of children in the lowest income quintile to a mean score of 103.4 (SD=8.7) of children in the highest income quintile. A One Way Analysis of Variance indicated there was a significant relationship between children's well-being scores and their family income, $F(4,7703) = 126.11$, $p<.0001$. Tukey post-hoc comparison tests indicated that scores at each income level were statistically significantly different.

3.5 Profiles of Children Performing in the Bottom and Top 15 % of the Index of Well-Being

Table 5 illustrates the demographic information of the 15 % of children scoring lowest on the Index of Well-Being compared to the total sample and the 15 % of children who scored highest on the Index. The results indicated that the group scoring in the bottom 15 % were overrepresented by children from single parent, low income, urban households, with unemployed, lower educated primary caregivers. Conversely, the group scoring in the highest 15 % was overrepresented by children with employed, highly educated primary caregivers in two parent, high income families.

Table 6 indicates the number of index domains in which children were categorized into the top or bottom 15 %. Firstly, 36.1 % of children (n=2,978) did not score in the top or bottom in any domain. Almost 64 % (n=5,235) of children did not score in the top 15 % on either the Physical Health, Social & Emotional Functioning or Educational Attainment domains. Just over 28 % (n=2,359) of the children scored

Table 4 Component matrix of forced 1 factor principal components analysis

Domain	Component matrix
Social & emotional functioning	.806
Educational attainment	.761
Physical health	.490

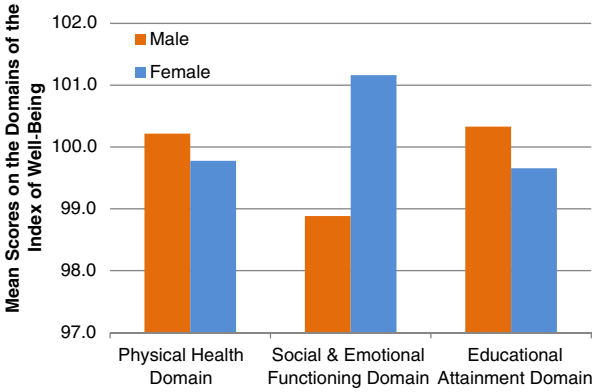

Fig. 2 Mean scores on the three domains of Index of Well-Being for males and females

in the top 15 % in one domain, 7 % scored in the top 15 % in two domains and 0.8 % (n=68) scored in the top 15 % in all three domains. In relation to the bottom 15 %, 65.6 % (n=5,408) of children did not score in the bottom 15 % of any domains. One quarter of the children (n=2,071) scored in the bottom 15 % in one domain, 7.6 % (n=643) scored in the bottom 15 % in two domains, and just over 1 % (n=116) scored in the bottom 15 % in all three domains.

There were also cases of students scoring in the bottom 15 % and top 15 % simultaneously. Just over 5 % (n=445) of children scored in the top 15 % and the bottom 15 % in one domain, while 0.9 % (n=78) scored in the top 15 % on one domain and in the bottom 15 % of two domains. Finally, 0.6 % (n=50) of children scored in the top 15 % in two domains, while scoring in the bottom 15 % on one domain.

4 Discussion

4.1 Structure of the Index

Analyses indicated that the components within each domain were statistically significantly associated with one another. While the associations between components

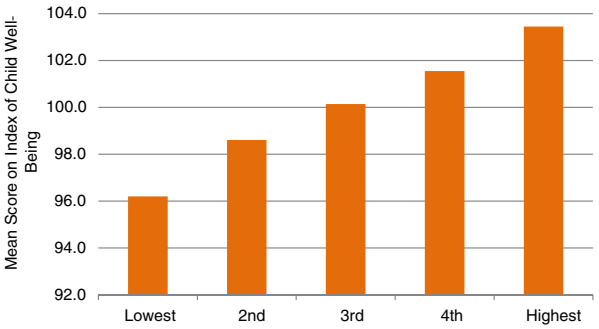

Fig. 3 Mean scores on the Index of Well-Being per income quintile

Table 5 Demographic profile of the lowest performing 15 % of children, the total sample and the highest performing 15 % of children

		Bottom 15 %		Total sample		Top 15 %	
		N	%	N	%	N	%
Child gender	Male	653	52.9	4381	51.1	615	49.8
	Female	582	47.1	4187	48.9	620	50.2
Household location	Urban area	598	48.4	3832	44.8	549	44.6
	Rural area	637	51.6	4721	55.2	681	55.4
Household type	Single Parent 1 or 2 children	229	18.5	980	11.4	91	7.4
	Single Parent 3 or more children	137	11.1	573	6.7	38	3.0
	Couple 1 or 2 children	418	33.8	3004	35.1	436	35.3
	Couple 3 or more children	451	36.5	4011	46.8	671	54.3
Primary caregiver education	None or primary	178	14.4	549	6.4	19	1.6
	Lower Secondary	445	36.0	2035	23.8	134	10.9
	Hi Sec/TechVoc/UppSec+Tech/Voc	399	32.3	3145	36.7	455	36.8
	Non Degree	128	10.4	1363	15.9	236	19.1
	Primary Degree	64	5.2	962	11.2	254	20.6
	Postgraduate	21	1.7	514	6.0	137	11.1
Household employment	No caregiver employed	413	33.4	1498	17.5	101	8.2
	One caregiver employed	365	29.5	2915	34.0	458	37.1
	Two caregivers employed	458	37.1	4152	48.5	675	54.7
In receipt of social welfare	Yes	613	49.6	2408	28.2	165	13.4
	No	622	50.4	6147	71.8	1067	86.6

Table 6 Number of children scoring in the top and bottom 15 % in each domain

		Number of domains scoring in top 15 %				Total
		0	1	2	3	
Number of domains scoring in bottom 15 %	0	2978 (36.1 %)	1836 (22.3 %)	526 (6.4 %)	68 (0.8 %)	5408 (65.6 %)
	1	1576 (19.1 %)	445 (5.4 %)	50 (0.6 %)	–	2071 (25.1 %)
	2	565 (6.9 %)	78 (0.9 %)	–	–	643 (7.8 %)
	3	116 (1.4 %)	–	–	–	116 (1.4 %)
	Total	5235 (63.5 %)	2359 (28.6 %)	576 (7.0 %)	68 (0.8 %)	8238 (100.0 %)

within the Social & Emotional Functioning and Educational Attainment domains were of medium to large magnitude, the relationships between child BMI and the other two variables (health status and long term illness) in the Physical Health domain were very small with co-efficients of .06. Despite this, these indicators were the most theoretically meaningful direct measures of actual physical health available in the dataset so they were all included. Associations between scores on each domain were statistically significant and ranged from small to medium. This highlights not only the multidimensional nature of well-being but that well-being does not occur uniformly. In this respect, domain scores might be better to use when the focus is on a particular facet of well-being. Finally, a Principal Components Analysis illustrated that the three domains loaded onto a single construct, lending further support to the structure and relevance of this Index of Well-Being.

4.2 Illustrative Uses of Continuous Scores

The gender and income comparisons of children's scores on the index illustrated ways in which continuous forms of the index and its domain can be utilized. Females scored higher than males on the Social & Emotional Functioning domain, as is a typical finding in the literature (Buchmann et al. 2008). Conversely, males outperformed females in the Physical Health and Educational Attainment domains. Females were more likely to be overweight or obese in this study, which may explain the better position of physical health well-being in males than females (Williams et al. 2009). On closer examination of the Educational Attainment domain, males performed significantly better than females on the Numeracy Subdomain, while the opposite was true for the Literacy Subdomain. These patterns are typical of the trends in Irish children's gender differences in mathematical and reading skills (Eivers et al. 2010). A clear income gradient were observed in relation to children's well-being which is particularly interesting considering the data collection for this study was conducted during a period of economic boom when government assistance and spending for children and families was at its peak.

4.3 Illustrative Uses of Categorical Scores

The potential of using the index categorically by applying cut-points to the top and bottom of the score distribution was illustrated with the comparison of the demographic profiles of the children included in the bottom and top 15 % of the Index of Well-Being with the overall sample. The results indicated that this form of the index also functioned as expected, with the bottom 15 % of children being overrepresented by children from single parent, low income, urban households, with unemployed, lower educated primary caregivers. Conversely, in the top 15 %, children with employed, highly educated primary caregivers in two parent, high income families were overrepresented. These parental and household demographics are all associated with children's development and well-being in the research literature.

The number of domains in which children scored in the top 15 % and in the bottom 15 % on each domain of the index provides another perspective from which to examine well-being. The results indicated that less than 1 % of children were consistently doing

well across the different domains of well-being. Additionally, a significant proportion of just over one third of children scored in the bottom 15 % on at least one domain of well-being. The interrelated nature of these three domains mean that the difficulty a child is experiencing in one area could start to impinge on other aspects of their well-being. Thus it is important to look at the different combinations of children doing well and performing poorly to see a true picture of how all of the children are doing.

4.4 Conclusions and Future Directions

This study describes the conceptualization and process involved in the development of a composite index of child well-being in Ireland. The Index of Child Well-Being was created using data from the first Irish longitudinal study of children, Growing up in Ireland (GUI), and consists of three domains constructed using fourteen indicators of children's physical, social and emotional, and educational development. The indicators used were subjective and objective measures from multiple informers including the child themselves. In this way, it is a step closer to looking at the child's life through a holistic lens. Furthermore, positive and negative indicators were included and as a result this index enables a shift away from the typical "deficit" approach to the measurement of well-being and one can look at either ends of the spectrum, of remediation and promotion of well-being. Analyses of the structure of the index and relationships between the index and particular demographic variables indicate it is functioning as expected. This composite index addresses the need to portray a complex and multidimensional concept like well-being in a parsimonious, understandable way.

The ecological framework within which the GUI study was developed means the full potential of this index can be realized with the current wave of data and future waves of the Child Cohort. Research using this index is currently underway to assess those individual and contextual factors, and proximal processes (Bronfenbrenner and Morris 2006) that either promote or hinder well-being. As illustrated in the descriptives presented in this paper, caregiver employment and education are clearly associated with differences in child well-being, but it is more important to understand the mechanisms through which these factors are having an impact, therefore future work is vital.

Using the next wave of data for the Child Cohort, the index can be used to assess which factors at aged nine appear to predict well-being at aged 13. Furthermore, the trajectories of groups of children scoring in the top and bottom 15 % can be examined for changes across time. The profiles of these children would be valuable to assess patterns in the contextual factors placing a child at risk for poor well-being as well as the factors that promote well-being.

This index provides an opportunity for stakeholders to gather important information on what influences children's well-being and more specifically, children's physical health, their social and emotional functioning, and their educational attainment. This type of statistic will be more easily understood by people outside of the academic sphere, such as the media, the public and the government. Furthermore, it can help inform the development of programs and policies for children and families and examine changes in well-being across time.

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