

Application of the Human Well-Being Index to Sensitive Population Divisions: a Children's Well-Being Index Development

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Abstract The assessment of community well-being is critical as an end-point measure that will facilitate decision support and assist in the identification of sustainable solutions to address persistent problems. While the overall measure is important, it is equally vital to distinguish variations among groups within the population who may be impacted in a different manner. The U.S. Environmental Protection Agency (US EPA) developed the Human Well-Being Index (HWBI), as a way of measuring these outcomes and assessing community characteristics. The HWBI approach produces a suite of indicators, domains and a final composite index appropriate for characterizing well-being of a population. While generalized approaches are needed, it is important to also recognize variations in well-being across community enclaves. This paper presents an adaptation of the HWBI for child populations to test the applicability of the index framework to specific community enclaves. First, an extensive literature review was completed to ensure the theoretical integrity of metric and indicator substitutions from the original HWBI framework. Metric data were then collected, refined, imputed where necessary and evaluated to confirm temporal and spatial availability. A Children's Well-Being Index (CWBI) value, representing the same indicators and domains of well-being as the original HWBI, was calculated for the population under age 18 across all US counties for 2011. Implications of this research point to an effective, holistic end-point measure that can be tracked over time. Similarly, there is great potential for the application of the original HWBI method to other statistical population segments within the greater US population. These adaptations could help identify and close gaps in equity of resource distribution among these groups.

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1 Introduction

For many communities, making decisions that support growth and protect the environment are becoming increasingly more important. In recent years, decision support tools have been developed to assist communities with identifying sustainable solutions to address concerns such as a growing or shrinking population, changes in the local economy and community resilience. Yet few products help communities assess the integrated economic, ecological and social aspects that influence the state of the human condition. Fewer still may be used to track changes in that state over time. As a way to help fill this information gap, the U.S. EPA developed the Human Well-Being Index (HWBI) which is intended to act as an endpoint measure for assessing social, economic, and ecological service flows on human well-being (Summers et al. 2012). It is distinct in that it measures a composite of all contributors to life quality, not just a single component like health or money. The original HWBI is comprised of eight domains of well-being, described by 25 indicators and measured by 80 metrics in total (figure included in original text) (Summers et al. 2012; Smith et al. 2013). By analyzing components individually, it is possible to create a more complete picture of a population's strengths and weaknesses.

Since its development, the Human Well-Being Index (HWBI) has undergone two adaptations in order to both assess its applicability and highlight specific populations – U.S. adults (Summers et al. 2014; Smith et al. 2015). In Puerto Rico, the application of HWBI focused on data and adapting existing metrics and index structure (county to municipio) to a US territory, whereas the Native American application focused on distinct populations living within the US boundaries. Results from these studies demonstrate the adaptability of the HWBI which allows selected population groups to be highlighted and compared to the larger US population. However, characteristics such as age and ethnicity also play large roles in how groups are either benefited or harmed by the access to resources on a larger scale (Crimmins et al. 2004). While the average citizen may benefit from a community characteristic, individuals existing outside of the socio-demographic norms may be adversely impacted.

In this paper, an adaptation of HWBI is undertaken in order to both conceptually and empirically test a version of the index specifically adapted to children. This effort requires a clear definition of the term “child”. In the United States, the definition tends to coincide with legal autonomy, which is 18 years old. People under this age are considered dependents and the majority will graduate from high school and move out on their own, whether this be to attend college or to simply begin their lives as working, independent adults. Of course, there are exceptions to this rule and not all will be independent or out from under their parent's care and guidance; however, from a societal perspective, these individuals are considered to be adults and have most rights afforded by that designation. In addition, age categories in the U.S. Census, as well as most other child-specific collection efforts, impose a similar set of constraints on the uppermost age. The other age breaks in data collection are relevant as well, generally with defined breaks around six and twelve. These age-categories are not utilized in the index at this time. Following the effort to estimate children's well-being, further investigation may be merited into specific age-ranges.

Benefits of child-specific research are two-fold. First, children are very susceptible to environmental conditions, whether natural, built or social (Ruiz et al. 2016). From pregnancy up to adulthood, children are developing physically and emotionally and are more vulnerable to poor environmental conditions than adults (Goldman 1995; Punch 2002). Another reason for interest in child-specific well-being is to serve as a point of reference for children within the larger societal constructs. Developing a conceptually identical index that examines a specific sub-population (statistically speaking) allows for direct comparisons between groups. In the case of children, they are future adults; hence, their development and current well-being can provide a window into adult well-being ten to twenty years in the future. If the well-being of children is higher compared to the general population, there is a possibility that the general population's well-being will improve over the next few generations. Conversely, if children are doing poorly in comparison to the general population, the future may not look quite as bright. There also exists the possibility that both the present and future well-being of adults will be positively influenced by investments in family and community centered issues. While, most communities recognize the importance of investing in children to improve their well-being, not all investments pay off in predictable ways. A forecasting assessment tool for adult well-being based on leading indicators of children's well-being in the present would be preferable to waiting 20 years for the resultant well-being to materialize.

The primary objective of this research is to determine whether the HWBI can be effectively calculated for an age-specified sub-population in the United States (i.e., children). This requires identification of clear theoretical connections between the original HWBI metrics and the CWBI in addition to data isolated by age. Success in this age-specific application is defined by: 1) a clear model for adaptation of the index, 2) availability of data at appropriate scale and capturing the proper concepts, and 3) a resulting index that is statistically robust and consistent with other indices of children's health and well-being.

A few difficulties are inherent in the assessment of children-specific well-being. The first is related to data availability. The same regulations meant to protect children are also those that limit data collection due to their inability to provide consent which is necessary for release of medical records or participation in surveys. Second, children are, as mentioned previously, not fully autonomous. They rely on parents or caregivers for most needs, and are heavily imprinted by the views and parenting styles they are exposed to from birth onward. Despite this reliance, there is evidence that a certain amount of autonomy helps children to establish an identity and experience higher levels of well-being throughout their lives (Lekes et al. 2010). When it comes to assessment of well-being separate from their parents, there is, of course the question of distinction between parental or family well-being and that of the child. As mentioned previously, there will be an inescapable link between the well-being of the parents and children. Issues of importance to one group will likely be passed along to the next along with general concepts attributed to life satisfaction.

Confounding the issue of well-being assessment further is the decision for an acceptable age-range that designates a child, teen, or young adult, and whether any of these age ranges is more representative of the target group. Younger children are far more reliant on their parents and likely to mimic views and attitudes conveyed to them through their parents (Bronfenbrenner 1986). Older children, beginning around age 11,

will begin to push back against their parent's views and ultimately begin to establish their own views and identity as they approach independence. Lumping all people aged from birth to 18 in the same category is difficult due to these vast differences, yet it is unavoidable in most counties due to data limitations.

Data imputation is another question in this application to consider. In the original HWBI, the index was calculated at both the annual and decadal level. In order to achieve this, the missing values were imputed using spatial methods to fill gaps when necessary to estimate well-being at the county level using regional or state level data. In the CWBI, the coarsest spatial data was available at the state level. This helped to improve the county level estimations. In addition, an alternative imputation method was used that disaggregated state level data based on the distribution of population characteristics among the counties (Buck 2016). This may result in slightly different outcomes in the final index.

Despite these difficulties, a children specific well-being index is still laudable. Tracking childhood well-being is an effective way to determine societal trajectory in the short term when compared to a general well-being index. Children make up a vulnerable group due to their reliance on others, yet also have great potential to benefit from changes in their physical and social environments for the positive. There are a number of indices and data compilations currently assessing children, where health and well-being are treated interchangeably, including those conducted by the United Nations Children's Fund (UNICEF), the U.S Census Bureau's National Survey of Children's Health (NSCH), Environmental Protection Agency (EPA), National Institutes of Health' Child Health and Human Development (NICHD), and the Organization for Economic Co-Operation and Development (OECD) (UNICEF 2007, NSCH 2012, NICHD 2010, OECD 2009). The present index formulation that is a holistic representation of their well-being would mark the first time a value was attached to specific, non-health dominated end-point measures meant to assess the effectiveness of child-specific policies in the US. By encompassing additional measures of well-being, it is anticipated that a better sense of both current and future trends regarding the well-being of children and the community can be established.

2 Methods

The applicability of HWBI domains and indicators has already been established among the general U.S. population, American Indian and Alaskan Native populations as well as in Puerto Rico (Smith et al. 2015; Summers et al. 2014). Similar to these adaptations of the HWBI, the child-specific well-being index captures the core concepts of the original HWBI theoretical structure as closely as possible while also reflecting the more specific conditions unique to children. Domains in the CWBI remain identical to those of HWBI, allowing for future linkages to services provisioning for predictive modeling. The overall number of indicators are retained as well, although in some cases the name is altered to better reflect a child-equivalent concept. The structure of the indicators is maintained in line with the original HWBI for comparison purposes. The number of metrics for each indicator may have changed in cases where either, the data do not apply to children's well-being or simply do not exist. In these instances, alternative metrics are introduced to best maintain the original intent of the HWBI

domains and indicators. In many cases, data availability is actually better for children and more metrics are included. Only Connection to Nature and Health indicators required a reduction in metric numbers. Biophilia is the sole indicator within the Connection to Nature Domain, and consists of two metrics in the HWBI. Of those two, only proxies for connection to nature is available. No quantitative data exists on the spiritual connection to nature among children. Applicability to children plays a role in the number of metrics in the Health Domain (e.g. many conditions, such as coronary heart disease, are simply not a concern). The reduction in metrics within this domain results from the collapsing of the Physical and Mental Health Conditions and the Life Expectancy and Mortality indicators. Between these two indicators, nine metrics are condensed to two, Child Mortality and General Health. A complete list of indicator and metric count changes per domain is shown in Table 1.

In order to successfully adapt the HWBI to children, a strong theoretical base is required that justifies alteration of the indicator structure and data sources for some metrics. A flow chart was created (Fig. 1) to provide guidance on metric applicability and retention. In addition, a thorough literature search established the linkages between the HWBI and child-specific outcomes. This process begins at the metric level within the HWBI structure and examines both the availability of data and the extent to which each potential metric replacement, if needed, can retain the intent of the original HWBI structure. The goal is to find a replacement metric that best evaluates children or families. In many cases a new, comparable metric is necessary to adequately represent children and a connection between the original intent of HWBI and the modified intent of CWBI must be carefully drawn from the literature.

In addition to maintaining the theoretical intention of the HWBI, it is important that the acquisition of data representing children's well-being adequately matches the original concepts of the HWBI and its temporal/spatial scale with only a few minor exceptions. While the spatial refinement of the data is of equal, or maybe even better quality for children, the temporal availability is not always as strong. For the HWBI, total population data has some availability in most years and can be imputed on a spatial and temporal basis to fill gaps. For consistent survey-based children's data, availability is more sporadic making temporal imputation highly difficult. Because of this, the CWBI is calculated for a single year (2010) and any required imputations are

Table 1 Indicator and metric count per domain. Data representation (HWBI count/CWBI count)

Domain	Indicator count	Metric count
Social cohesion	5/5	17/17
Living standard	4/4	9/12
Education	3/3	11/12
Connection to nature	1/1	2/1
Cultural fulfillment	1/1	2/3
Health	5/5	26/19
Safety and security	3/3	6/8
Leisure time	3/3	6/7

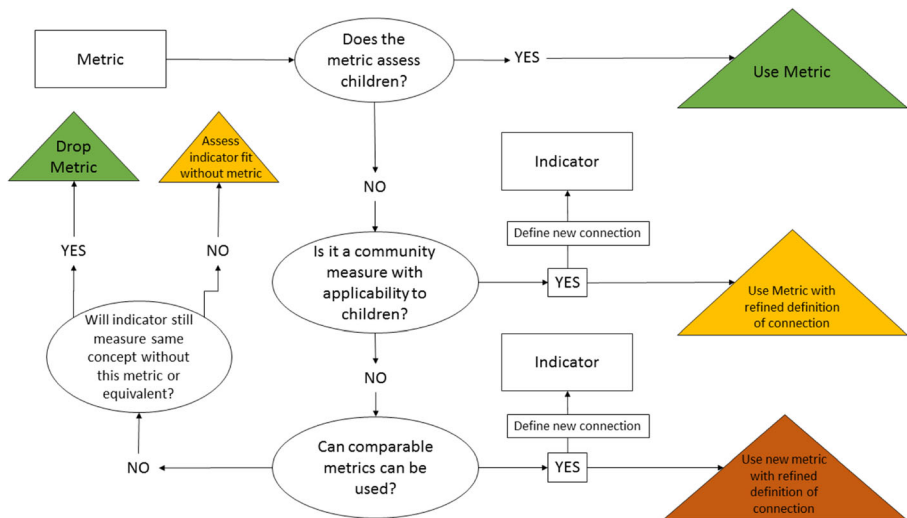


Fig. 1 Decision flow chart for metric adaptation in children's well-being index creation for the original HWBI. Start with metric in order to minimize changes at indicator or domain level. *Move to right* indicates metric retention, while *move to left* indicates dropping of metric

done spatially. This likely does not impact the quality of the index, but it is worth noting for comparison of the two indices.

In the assessment of metrics for retention, the dependency of children on their parents creates a major theoretical hurdle. Since children are reliant on their parents for support across all well-being domains, it is easy to assume that measures of adult well-being will translate down to children. The problem with this assumption is that children are a unique group with unique vulnerabilities as well as potentials often not aligning with those of adults. These vulnerabilities are considered in the construction of this index and are discussed as they apply to each domain of well-being below. Tables describing metrics and indicators within each domain provide an overview of the changes made within each domain along with descriptions to provide the theoretical justification for these modifications.

2.1 Social Cohesion Domain

Social cohesion is something that develops throughout childhood and into early adulthood (Bronfenbrenner 1986). At a very young age, parent and sibling relationships form the backbone of a child's social interactions, and exert most, if not all of the influence on their behaviors. The influence of a child's parent decreases as the child ages and begins to make friends and interact with a wider range of individuals. While social spheres are not as large as those of an adult; interactions with other children, adults, and the community play an important role in the well-being of children, thus the original interpretation of this domain is retained.

Engagement with their school, community, peers and families are assessed with five indicators to include attitudes toward others and the community, social support, social engagement, family bonding, and school engagement. Within these indicators, the metrics representing discrimination, close friends and family, extra-curricular

participation, volunteering, parent child-reading, family meals frequency and extended screen time correspond to the original HWBI (R. E. Anderson et al. 2015; Booker et al. 2015; Casey et al. 2014; Denner et al. 2005; Harris and Marmar 1996; Hofferth and Sandberg 2001; Chu et al. 2010; Komro et al. 2011; Ludden 2011; Marshall et al. 2014; Jones et al. 2012; Bailey 2005; Fiese and Samdal 2008; Irwin et al. 2007; Eisenberg et al. 2004) Changes at the metric level involve adjustments to data sources that account for child-specific measures. Deletions and insertions of metrics allow the data to maintain the original intent of the indicator while accommodating data availability and differences inherent in assessing children's well-being. All metric changes, along with a brief description of reason and research supporting the metric are provided in Table 2.

The community-centered metrics, including trust, city satisfaction, and belonging to community were all dropped both due to lack of data on the topic and because they do not capture the social sphere appropriate to children. The "community" for children is their group of friends, typically from the neighborhood or school. They do not have, in general, a broader understanding of the community. Other than these modifications, there is one other change at the metric level and three additions. Helping others is changed to getting along with others. This change was made due to data constraints and represents a very close theoretical match to the original index, and many times children do not grasp the benefits of helping, while the connections they make to their family, friends community is tied to the same beneficial outcome (Armsden and Greenberg 1987; Kawachi and Berkman 2001; Layous et al. 2012). Single parent households are added because they often result in a severely decreased social sphere (J. Anderson 2014; Marshall et al. 2014). Whether a result of divorce or simply the lack of a second parent, the demands placed on the single parent are much higher than a two parent household and leave less time for social interaction and bonding with children (R. E. Anderson et al. 2015; Marshall et al. 2014). Adult mentors were added to account for additional support that may be available to children and has been proven to effect a positive change on social development (Beier et al. 2000; Grossman and Tierney 1998). Time spent on digital devices is added as well to more thoroughly flesh out the impact of technology on social interactions within the household. Many children spend more time on devices than watching television, and this metric helps to capture that change as a deterrent to social cohesion (Kraut et al. 1998; Page et al. 2010; Vandewater et al. 2006). It is important to note here that as social media research progresses, there may be new information that supports an increase in children's social networks as a result of time spent on digital devices. In that event, further divisions of this indicator would be required to flesh out "digital" versus "face-to-face" socialization benefits to well-being.

In addition to more minor changes in the metrics, there is also an adjustment made to the Democratic Engagement indicator, since children are not actively involved in voting or politics. The original intent of democratic engagement in HWBI is to establish the level of investment, engagement and trust in the community. Questions such as, "do people trust their local/state/federal politicians?" or "do people believe their voice is heard?" can be answered through this indicator (Summers et al. 2014). A similar concept for children is trust and engagement in school, so the indicator is altered to "School Engagement". Much like society and politics, higher levels of engagement in education tend to result in stronger feelings of control, and by extension higher levels well-being (Crede et al. 2015). The question of whether an individual not only engages in the community, but also trusts the community is an important proxy for life

Table 2 Social Cohesion domain. Changes, additions, or subtractions in Indicators and Metrics listed by indicator with justification of reasons for change at the metric level

Original indicator	New indicator	Original metric	New metric	Justification
	Attitudes toward others	Trust	Dropped	There is no data available to support this metric.
	Attitudes toward others	City Satisfaction	Dropped	There is no data available to support this metric.
	Attitudes toward others	Belonging to Community	Dropped	There is no data available to support this metric.
	Attitudes toward others	Helping others	Getting along with others	Data on this metric was not available for children specifically. Close match chosen.
	Social Support		Single parent households	Added based on change in social sphere in SPH.
	Social Support		Adult Mentor	Research based on improvement in well-being when mentor present.
	Family Bonding		Time spent on digital devices	Added to account for online time.
Democratic engagement	School Engagement	Interest in politics	Chronic school absences Suspensions and expulsions	Change in indicator to represent school as community required shift in metrics to reflect involvement in school processes.
		Trust in Government Registered voters Satisfaction with democracy Voice in democratic decisions Voter turnout	School achievement (college entrance exam scores)	These five metrics represent concepts attached to people over 18 and cannot be used as a measure.

satisfaction as well. Children who feel more engaged in their school tend to also exhibit better health, higher academic performance and, again, wellbeing (McNeely et al. 2002; Waters et al. 2009). Each of the metrics assessed in this index are meant to serve as a parallel to the democratic engagement indicator and assess the level of engagement a child demonstrates in their school (through proxies of discipline and attendance) and the importance they place on education through their achievement (scores on college entrance exams) (Cavanagh and Huston 2006; Suldo et al. 2011).

While there exists some connection between metrics for school engagement among the young and democratic engagement among adults, there are also confounding factors that may contribute to outcomes such as school absences or poor academic achievement. Absences and behavioral issues (suspensions and expulsions) may also be influenced by home environment, health issues, or other problems not related to actual interest in school. The same logic could also apply to possible links between achievement and engagement. Other explanations for achievement could just as easily include intelligence or home environment. Ultimately, the same argument could apply for any proxy measure, including those assessing democratic engagement for adults. There is going to be some error associated with any metric choice. The challenge is to best identify metrics best representing the intent.

2.2 Living Standard Domain

The living standard domain contains a number of indicators and metrics that align closely with family characteristics. Adults are responsible for income levels that to a large extent dictate living standards. However, the presence of children in a household is critical to effectively translate data relating to living standards to the sub-population of children. The overall income level of a community is not completely meaningful without some sense of how many children reside in the community and how many specifically are impacted by the metrics. For example, retirement communities may have very high living standards with very low numbers of children. Assessing retirement communities as high in this domain for children would be a complete misrepresentation of the data.

Within the living standard domain, there are four indicators: basic necessities, school, income and wealth. The only shift at the indicator level from the original HWBI terminology is from work to school. Similar to the shift made in the social cohesion domain, work is not applicable for most children in the US, and even then it is typically a part-time endeavor to earn spending money rather than to impact living standards. School replaces work as the place where they spend most of their day time and is tied to emotional and physical well-being (Diseth and Samdal 2014; Grigoryeva and Shamionov 2014; Jimerson and Ferguson 2007; Ou and Reynolds 2010; Stevens and Schaller 2011). Within this indicator, grade level retentions and school engagement intend to represent the overall level of satisfaction and success that equate to job quality and satisfaction. School engagement, used in this domain, differs from the indicator previously assessed in the Social Cohesion domain. In this case it is a metric directly assessing the engagement children feel in the classroom, which matches up very closely to the original intent of the HWBI framework.

There are a few additional changes to metrics meant to characterize the attributes directly impacting children's well-being (Table 3). Within the basic necessities indicator, both food security and housing affordability are community level metrics of great importance to children's well-being. Issues pertaining to housing quality and density, as well as the affordability of housing in a community have shown numerous links to performance in school and general health (Coley et al. 2013; Leventhal and Newman 2010; Pollack et al. 2010; Solari and Mare 2012; Suglia et al. 2010). Food insecurity is closely linked to numerous family stressors as well as health outcomes in children and data specifically tied to children is of particular interest for this metric (Asfour et al.

Table 3 Living standards domain. Changes, additions, or subtractions in Indicators and Metrics listed by indicator with justification of reasons for change in the Metric

Original indicator	New indicator	Original metric	New metric	Justification
Work	School	Job Quality	Grade Level Retentions	School is equivalent of work in adult world.
Work	School Income	Job satisfaction	School Engagement Income Inequality	

2015; Chilton et al. 2015; Kimbro and Denney 2015; Mangini et al. 2015). Other metrics with retained names and concepts, but different data sources include: incidence of low income, persistent poverty, and median household income. Each of these metrics has a clear connection to the well-being of children (Ciula and Skinner 2015; Schickedanz et al. 2015; Sobolewski and Amato 2005; McLeod and Nonnemaker 2000; Luthar and Latendresse 2005; White and Rogers 2000). Wealth metrics remain unchanged from the original HWBI interpretation for the same reasons, with median home value and mortgage debt used (Hudson 2013; Grinstein-Weiss et al. 2008; Luthar and Latendresse 2005). These are reflections of the community and the benefits associated with wealth for adults that should impose the same benefits upon the children in these families. Income inequality is added as an additional metric to the income indicator to help gauge the double-disadvantage (defined as a combination of disadvantages faced due to both lesser financial and educational resources available) experienced by children living in poverty who live in close proximity to wealthier children (Odgers 2015). Other studies link income disparities to psychological well-being and maltreatment of children as well (Eckenrode et al. 2014; Piotrowska et al. 2015; Ho et al. 2015).

2.3 Education Domain

The education domain is comprised of the indicators and metrics meant to assess the state of the educational system as gauged by student performance and the social environment. The link between education and well-being is theoretically consistent between adults and children, therefore the names of all indicators in this domain remain unchanged. Changes made at the metric level primarily accommodate measures with no child equivalent, such as adult literacy or post-secondary attainment. In these cases, the intent of the original metric is captured using a proxy metric for kids (Table 4).

In the Basic Educational Knowledge and Skills indicator, the same set of metrics as used in HWBI are found to influence well-being in children (Barbarin et al. 2006; Ritchie and Bates 2013; Turney and McLanahan 2015). In fact, the data used in the HWBI is based on a very similar set of test scores. The only difference in the HWBI and proposed CWBI is the age at which the test is taken; adults in HWBI and 4th and 8th graders in CWBI. Multiple adjustments are required in the Participation and Involvement indicator, where three of the four metrics are adult-specific (only Participation remains unchanged). Adult literacy becomes reading on grade level to capture the concept of having the basic skills necessary in society or school to be capable of maintaining a decent level of well-being. For children, the reading level relates to

Table 4 Education domain. Changes, additions, or subtractions in Metric listed by indicator with justification of reasons for change. There are no changes to the indicators from original HWBI

Indicator	Original metric	New metric	Justification
Participation and involvement	Adult Literacy	Reading on grade level	Literacy is a sliding scale for youth. Being on target at a certain age will account for this.
Participation and involvement	High school completion	High school drop-out rate	Adjustment made to accommodate post-secondary attainment in adults. Dropping out would be equivalent to high school diploma among adults.
Participation and Involvement	Post-secondary attainment	High school completion	Age restricts post-secondary attainment. High school marks top academic achievement in this age range.
Participation and involvement		Late graduation	Added to capture children who struggle academically, but still complete school.
Social, emotional, and developmental aspects	Bullying	Face-to-face bullying	This is same as original, except split into two different forms to account for varied social interactions.
Social, emotional, and developmental aspects		Electronic bullying	Specific to online community. The other half of the bullying metric.
Social, emotional, and developmental aspects	Social relationships and well-being	Flourishing	This is the same general concept retained, except called by different name. Looks at health of social relationships.

confidence (McGeown et al. 2015). The high school completion metric is changed to drop-out rates coupled with the addition of late graduation rates in order to capture the proportion of at-risk children under 18 with health outcomes having the strongest tie to this metric (Freudenberg and Ruglis 2007). Lastly, within the Participation and Involvement indicator, post-secondary attainment is changed to high school attainment. This shift is executed in order to depict effective engagement in the school environment leading to a diploma and typically linked to health outcomes (Ruglis and Freudenberg 2010; Ross and Wu 1995; Woolf et al. 2007).

There are a number of minor changes made to the metrics within the Social, Emotional and Developmental Aspects indicator. Preprimary Education and Care remains unchanged having similar links to well-being in both adults and children (Allhusen et al. 2002; Geoffroy et al. 2010), however, the social relationships and well-being metric required a shift in the naming convention and measurement altering to the word “flourishing” in the CWBI. Flourishing, according to *Child Trends*, is the presence of “positive relationships, curiosity, interest and persistence in learning, and resilience” (Trends 2013). The measures captured by this concept are very similar to those originally developed in the HWBI metric making it a very suitable replacement (Keyes 2006; Van Rossem et al. 2015).

In addition to these minor changes, two metrics (electronic bullying and late graduation) are added to account for changes in social interactions and reflect academic challenges potentially influencing future well-being. The bullying concept is represented by two metrics for the CWBI with measures for specific face-to-face bullying and electronic bullying. An increasing internet presence makes children more susceptible to

bullying through this medium and many studies support the connection between this form of electronic bullying with depression and a host of other physical and social problems (Claes et al. 2015; van der Ploeg et al. 2015; Aboujaoude et al. 2015; Salmivalli et al. 2013).

2.4 Connection to Nature Domain

The Connection to Nature domain is represented by a single indicator and metric due to lack of data availability. Much like the original HWBI construction, locating data that quantifies an individual's connection to nature is quite difficult and typically originates from survey responses. While the biophilia indicator remains unchanged, there are a few alterations at the metric level to accommodate different or lacking data sources relevant to children and nature. The connection to nature metric is retained with a different data source, but the metric of spiritual fulfillment originally used in the HWBI is dropped in favor of a metric dealing more directly with children. In the HWBI, biophilia is meant to represent the bond with nature instinctive to all human beings, but at varying levels (Summers et al. 2014). Adult survey responses are utilized to represent this relationship, however, surveys of children addressing this topic do not exist in the US. As a proxy for biophilia in the CWBI, participation in 4H programs is utilized due to its broad mission focusing on experiential learning, health and citizenship. Although there are other programs, data does not currently exist that reports the number of children involved in these wilderness, nature or outdoor programs. Most of their programs involve outdoor activities and are based on a strong connection to natural ecosystems, making investment and participation in this program a strong measure of a community's interest in the natural environment for children. Exposure to nature, or even just urban green space is important to mental and physical health, particularly for children in urban environments, (Chawla 2015; Beyer et al. 2015; Herrington and Brussoni 2015; McGee and Marshall-Baker 2015; Mainella et al. 2011).

Despite this connection, however, there is a potential divergence in the underlying concept captured by this metric as a result of the significant change in data. Application of this domain to children merits further investigation regarding the correlation of the metrics with the original HWBI concepts. Additionally, the creation of more data of this type should be captured for children in the future.

2.5 Cultural Fulfillment Domain

The single indicator within the Cultural Fulfillment domain, Activity Participation, remains unchanged. However, the three original HWBI metrics, are slightly altered to better reflect the involvement at younger ages. The new metrics are used to assess the range of cultural activities that children may participate in for enrichment. Both attendance and participation in the arts have positive outcomes on children (Stuckey and Nobel 2010; Connolly et al. 2011; Lekes et al. 2010; Sivvas et al. 2015). While, no link has been established between well-being and church membership, active involvement in church activities by youth has demonstrated a reduction in risk behaviors and an improvement in overall mental health (Dohn et al. 2014; Holder et al. 2010; Michaelson et al. 2015). Table 5 shows the changes made to the indicators as well as the justification for changes to the metrics for the CWBI cultural fulfillment domain.

Table 5 Cultural fulfillment domain. Changes, additions, or subtractions in Metric listed by indicator with justification of reasons for change. There is no change to the Indicator in this Domain from the original HWBI

Indicator	Original metric	New metric	Justification
Activity participation	Rate of congregational attendance	Participation in church activities	Congregation attendance is not tracked for children, but participation in activities associated with the church is tracked.
Activity participation		Art or music outside of school	This metric is added to capture more than just viewing arts, but actually participating in the arts outside of the school environment.

2.6 Health Domain

The health domain represents both mental and physical health states as well as behaviors leading to health risks. While there are no changes to the indicators used by the original HWBI within the domain, there are multiple alterations made to the metrics (Table 6). Most of the changes are related to either a lack of data for the specific metric or the fact that the metric does not address concerns present within a younger population (e.g. certain prevalence or mortality statistics).

Changes to the Healthcare indicator are relatively minor and based on the availability of data sources. Information from the National Survey for Children's Health is used in the CWBI formulation. Rather than providing data on the prevalence of a regular family doctor, this survey captures whether or not the child has a usual source of care (NSCH 2012). Both of these metrics depict similar concepts to those in HWBI and have strong connections to improved health and educational outcomes in children (McCord et al. 1993; Mulye et al. 2009). In addition to these changes, a metric for well-child check-ups has been added due to the strong connection between early detection and prevention of childhood abnormalities or illnesses and future health outcomes (Thaiss et al. 2010).

The Life Expectancy and Mortality indicator is reworked to better represent children's health issues. Both life expectancy and infant mortality are representative of the total population with infant mortality especially being linked to family dynamics and a number of social components (Guadagno et al. 2013). Suicide mortality is retained as well, although with age-specific data being collected. Suicides are linked to monetary resources of parents and also to the emotional well-being of friends and classmates (Bartik et al. 2013; Mathur and Freeman 2002). While these three metrics remain conceptually the same as those used in HWBI, mortality statistics for children are quite different and require adjustments to account for altered health threats. In HWBI, mortality is split into four individual causes, but in CWBI, the data are collected as an all-causes rate. This integration helps to provide enough counts per county while still representing health outcomes.

The Lifestyle and Behavior and Personal Well-Being indicators both retain almost exactly the same structure as the HWBI. The only major difference is that the life

Table 6 Health domain. Changes, additions, or subtractions in Metric listed by indicator with justification of reasons for change. There are no changes to the indicator names from the original HWBI

Indicator	Original metric	New metric	Justification
Healthcare	Population with regular family doctor	Usual source of care	Change made to account for different data source. Same concept measured.
Healthcare		Medical needs met	This metric is added to measure the quality of care received. It should align closely with frustration metric.
Healthcare		Well-child check-ups	This metric is added to capture the likelihood of children getting routine medical care and/or vaccinations.
Life expectancy and mortality	Asthma Mortality Cancer Mortality Diabetes Mortality Heart Disease Mortality	Child Mortality	Four metrics are collapsed down to a single mortality metric that captures all non-intentional deaths among children 2–17.
Lifestyle and behavior	Alcohol Consumption	Alcohol/Drug Abuse	Metric changed to reflect the YRBS survey questions as well as a more holistic picture of risks posed to their health.
Physical and mental health conditions	Asthma Prevalence Diabetes Prevalence Heart Attack Prevalence Heart Disease Prevalence Stroke Prevalence	General Health	Collapsed down to single metric due to data limitations and lack of impact among children.
Personal well-being	Life Satisfaction	dropped	Data is not available for this metric in children.

satisfaction metric is dropped due to lack of data that is specific to children. Of the risk behaviors, minor changes are made only to alcohol consumption, which is expanded to account for drug use as well due to survey question construction. The healthy behaviors index used in HWBI is re-created using youth specific survey tools and both teen pregnancy and teen tobacco use are kept exactly. The representation of each of the metrics (soda and milk consumption, multiple sex partners and sex before age of 13, lack of exercise, fruit and vegetable consumption) to children's health is supported by research and demonstrates clear connections to mental and physical health outcomes (Hemphill et al. 2014; Lemma et al. 2015; Persch et al. 2015; Klein et al. 2005; Mistry et al. 2014; Rosiek et al. 2015; Yan and Brocksen 2013). Both happiness and perceived health are retained in the personal well-being indicator, although with slight modifications. Happiness is represented through a Youth Behavioral Risk Survey (YRBS) question about number of days the respondents felt sad (CDC 2011). Perceived health is represented by a question from the same YRBS survey related to the respondent's

opinion on whether they are overweight, since this is a good proxy for general health. Both of these metrics are good measures linked to life satisfaction and good mental health (Street et al. 2004; Matthews et al. 2015; Singh and Junnarkar 2015).

The Physical and Mental Health Conditions indicator is adjusted in a very similar manner to Life Expectancy and Mortality. There are six prevalence metrics integrated into a single metric that represents the general health of the child as assessed by the parent. This allows metrics such as heart attack prevalence or stroke prevalence to be removed since they are not relevant to this age group. At the same time, a general health assessment is important due to its link with overall well-being (Bass 2011; Felix et al. 2014). All remaining prevalence metrics are retained and reflect child-specific outcomes with proven links to well-being (Bitsko et al. 2014; Makinen et al. 2015; Street et al. 2004; Wengenroth et al. 2015).

2.7 Safety and Security Domain

The Safety and Security domain examines both actual and perceived safety in communities as well as the general risk posed by social structures. This represents a child's connection to their community and physical surroundings, not just nature. Their sense of place can be very strong and very highly correlated to their well-being (Jack 2015). A stronger connection with their surroundings will be fostered when they feel safe and secure. Lack of safety will not only harm a child's well-being but also make their connection with a place less strong. This weakening increases the likelihood that children (as well as adults) will seek other places as soon as they are able. Within this domain, community characteristics and the perception of those characteristics are key. As a result of this important connection, none of the metrics change. There are, however, a few additions, shown in Table 7.

The indicator for Actual Safety is changed to reflect more child-specific measures. Loss of human life and accidental morbidity and mortality are modified to Witness Neighborhood Violence and Witness Domestic Violence, which have significant

Table 7 Safety and security domain. Changes, additions, or subtractions in Metric listed by indicator with justification of reasons for change. There are no changes to the Indicator names from the original HWBI

Indicator	Original metric	New metric	Justification
Actual safety	Accidental Morbidity and Mortality	Witness Neighborhood Violence	These two metrics are changed to represent witnessed trauma that results in lower levels of well-being.
Actual safety	Loss of Human Life	Witness Domestic Violence	
Perceived safety		School Safety	The school environment and the perceived safety within that environment are as important as the safety perceived in the community.
Perceived safety		Child Perceived Safety	Surveys are available from both the parent's and the child's perspective, which helps to add some more detail.

impacts on the emotional development of children (Aisenberg and Herrenkohl 2008; Ceballo et al. 2003; Johnson et al. 2002; Kliewer et al. 1998). Both property crime and violent crime rates are community-wide, and are kept. Risk, represented through the Social Vulnerability Index (SoVI), is also preserved since it is a community metric in the HWBI.

The Perceived Safety indicator addresses two new metrics to better represent the community of children. School Safety and Child Perceived Safety are added to Parental Perceptions of Neighborhood Safety. This modification was done due to the structure of the survey questions used from one tool and the importance of capturing both the child's and parent's perspectives since each has the potential to influence a child's perceptions (Curtis et al. 2004; Matthews et al. 2015; Rosenthal et al. 2015; Sampson 2003). Since school is such a large part of a child's life and is largely outside of the child's control, the perception of safety in the school environment is very important in determining how much daily stress could impact a child (Reid et al. 2015).

2.8 Leisure Time Domain

Leisure time plays an important part in both physical and mental well-being through the ability to get out and exercise as well as time to spend with friends and family. There are some significant changes made to the metrics in this domain due to the conceptual difference in leisure time between children and adults. Like in many of the previously discussed indicators and domains, children are highly reliant on the activities and leisure time availability of their parents. Where and when possible, metrics are chosen that represent child-specific issues as opposed to making an assumption that high levels of free-time among adults will translate to similar measures among children. The general idea of leisure and obstacles to leisure do remain the same as utilized in the HWBI, which allows for alternative metrics to be used in order to assess a similar set of indicators. The changes made to metrics for the leisure time indicators are listed in Table 8.

Metric changes include those made in the Activity Participation indicator, where physical activity is retained while average nights on vacation is swapped out for number of family outings per week. This is a relatively close representation of the HWBI metric and captures family-based leisure time and the importance of building family bonds for well-being (Lehto et al. 2009). There are no metrics available that represent child-specific leisure activity. In order to accurately assess the barriers to leisure, the indicator for working hours requires adjustment. Instead of working hours and additional responsibilities being represented, after school jobs, unemployment, long hours of homework, and kids from working poor families are utilized in this index. Work, for instance, is applicable to some older children, but not all when it comes to daily time spent. These types of working hours may cut into leisure or family time. On the other hand, school and homework are more broadly representative of the majority of children when considering time spent. Assessing both part-time employment and hours spent doing homework thus provides a more complete picture of the constraints to leisure time (Iosua et al. 2014). Time spent in leisure activities is narrowed to only time spent reading for pleasure due to lack of additional data available on the topic. Along these same lines, metrics are added for working poor families and for unemployed families due to the stress imposed by working multiple or temporary jobs and not having the income or time for leisure (Jacobs and Gerson 2001; Crouter et al. 1999; Strazdins et al. 2006).

Table 8 Leisure time domain. Changes, additions, or subtractions in Metric listed by indicator with justification of reasons for change

Original indicator	New indicator	Original metric	New metric	Justification
	Activity Participation		Number of family outings	This metric is added to account for the reliance of children on the family dynamic. In many cases an adult is required to get quality leisure time.
Working age adults	Work	Adults working standard hours	Deleted	There is not a comparable replacement metric that assesses this concept.
		Adults working long hours	Longer hours of homework	Longer hours of homework would be closest comparable metric to long hours of work among adults.
			Kids working outside the home	This is added to assess the same general concept as the longer hours of homework. A part time job will place addition time demands on children and cut down on leisure time.
			Working poor	This metric provides a refinement to the leisure time concept by identifying those children in families with both limited income and job time constraints.
			Unemployed	This metric serves as proxy for the concept of limited income and potential stress leading to lower amounts of leisure times.
	Time Spent	Leisure activities	Time spent reading for pleasure	There are limited metrics to assess children's time spent in general leisure activities. This measure provides a decent assessment of time that may be free from other responsibilities.

3 Results

The primary aim in creating a child specific adaptation of HWBI is to determine whether the HWBI theoretical construct can be successfully transferred. Through the review of existing literature summarized in the section 2, the indicators and domains of the original HWBI are shown to effectively adapt to measures of well-being in children. Only slight adjustments are necessary at the metric and indicator level to accommodate

the differences in social status and independence unique to children. In addition to the construction of the CWBI, there are a number of questions regarding the outcomes and regional trends revealed by the index as well as comparisons between the results of the CWBI, the original HWBI, and any other child specific indices in the United States. The section 3 will look specifically at the outcomes of the CWBI, while the section 4 will look in more detail at how the CWBI compares to other indices, including the original HWBI.

The end result of the adaptation is a set of 8 domains matching those of the original HWBI, 3 changes of indicator terminology, and the adjustment of 42 metrics to accommodate data availability and theoretical differences between an index meant to represent an entire population and one specific to children. While many of the metrics are altered, they are all able to maintain a structure and premise closely resembling the original HWBI (Summers et al. 2014). All of these changes are made based on data availability and the extent to which the original metrics assess children or family specific characteristics.

Looking at the national CWBI domains, shown in Fig. 2, most scores fall in the range of 0.5 and 0.6. Safety and Security scores the highest, with a median of 0.598, closely followed by Health, Social Cohesion, Education, and Living Standards (0.5628, 0.5484, 0.5479, and 0.515 respectively). The domains of Leisure Time, Cultural Fulfillment, and Connection to Nature all fall below the 0.5 threshold with median scores of 0.497, 0.390, and 0.208 respectively. This is an interesting finding, and mirrors some of the concerns expressed in the well-being of children. More immediate concerns for the well-being of children have revolved around adequate healthcare, safety, and education, evidenced by the plethora of research and data available on these metrics. It helps that these are more easily assessed as well. More ethereal concepts, such as children's cultural fulfillment, connection to nature, and access to leisure time are difficult to assess. It is difficult to determine cause and effect in this case; whether

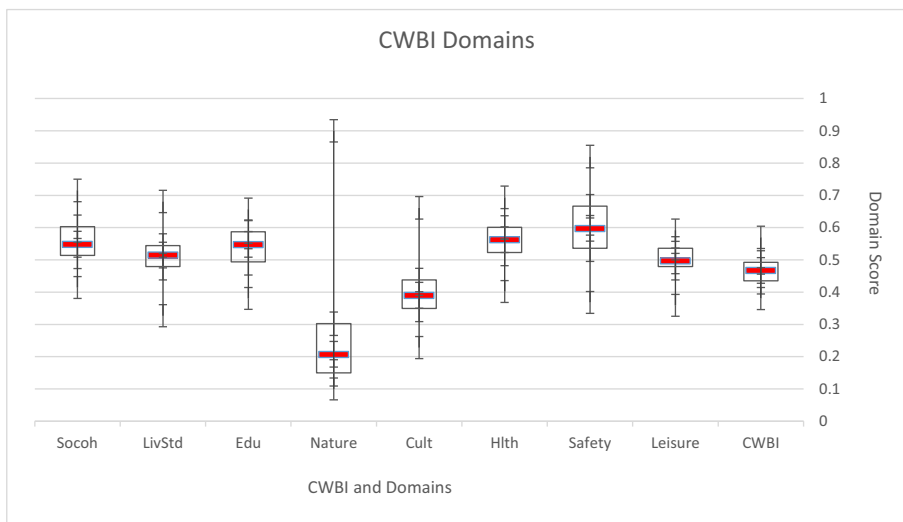


Fig. 2 Children's well-being domains box plot. Center lines represent the median of each domain, while the boxes bound the 1st and 3rd quartiles. Lines extend to the minimum and maximum values for each domain as well as the overall CWBI

the difficulty in assessment of these concepts has resulted in a lack of research and development in these areas, or whether a lack of regard for these aspects of a child's well-being has led to little time, money or energy being poured into research on these topics. In either case, the measurement of these three domains is based on far less data, and at a far coarser scale (temporally and spatially) than the other 5 domains. This is especially evident in the Connection to Nature and Cultural Fulfillment domains, which have a very wide range between the minimum and maximum county scores.

The national domain scores highlight the disparity that exists between the domains in children's well-being. There is an obvious discrepancy in scores, with Cultural Fulfillment and Connection to Nature falling well below the median of other domains. To be fair, these two domains also have the least number of measures contributing to their score, with a collective 4 metrics and 2 indicators between them, whereas no other domain has less than 3 indicators and 7 metrics. This lack of data points to two likely scenarios, however. On one hand, there is a serious lack of data collected within these domains of well-being, which points to an area of necessary development in the future of well-being assessment if it is to be considered truly a holistic concept. On the other, even given data constraints, this index can be used as a comparative tool for assessing childhood well-being between counties and through time. As interest continues to increase, hopefully enhanced collection tools and techniques will aid in providing additional data in areas where they are currently lacking.

Much of what makes the original HWBI, and by extension the CWBI unique is the ability to assess individual counties across all of the indicators and domains. This allows for the identification of not only regional trends, but also approaches community level assessment where scores can be compared given time, monetary and policy investments to determine effectiveness. While there is a benefit to state level analysis of well-being to help drive policy decisions, county level indices provide even more information to local resource managers. To demonstrate the utility of more localized information, the variability of well-being at the county level is compared within each state across the entire county. The results of the test show that sufficient variability exists, with 2388 of the 3143 counties in the US being statistically significantly different than their state CWBI at a 95% confidence level. Obtaining county level scores allows for improved decision-making power at a level where it matters most. Previous research has extolled the benefits of state level well-being indices due to many state driven policies related to children (O'Hare 2016). There is also an established pattern of state data differing from national data (O'Hare 2006, Patterson and O'Hare 2014). In this research, over 70% of state-level indicators were found to significantly differ from the national measures. Extending this argument to the county level, it is possible to argue that even more responsibility and control is exerted at the county level, with school districts, courts, and health agencies typically operating at the county level with great variability. The overall CWBI as well as the domains are displayed in Figs. 3 and 4.

Looking first at the overall CWBI scores, there are definite regional clusters apparent. The highest well-being values exist in the much of the upper Midwest and in the Southeast. The lowest scores are in parts of the deep South, the Southwest, and along areas of the East Coast.

Domain scores also display a similar clustering pattern with much of the higher scoring counties in the Northern states. Again, worth noting, is that economics do not

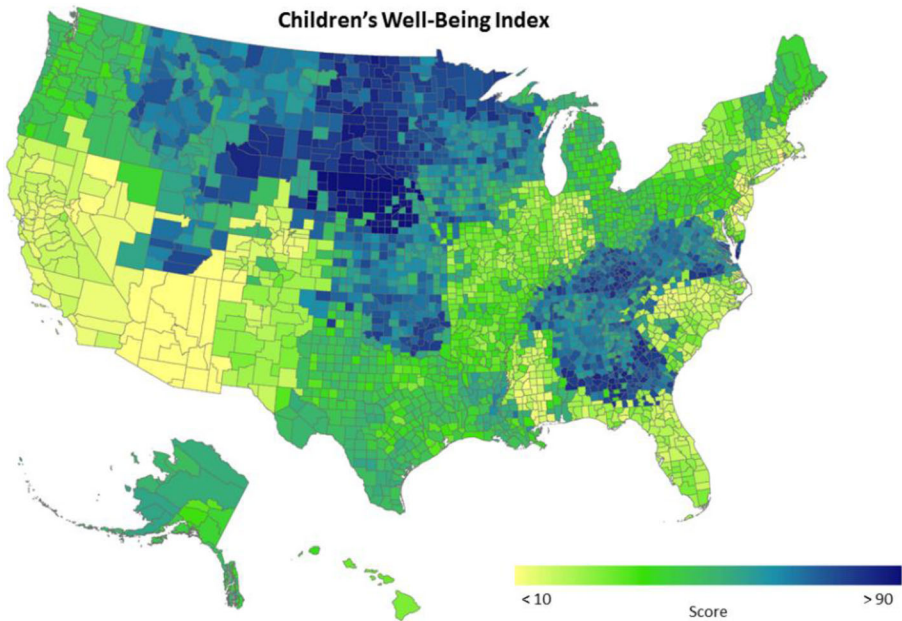


Fig. 3 Children's well-being index scores for all US Counties in 2010

dominate this index. Evidence for this can be seen when comparing the Living Standards domain, where all of the economic metrics are held, to the overall CWBI. In the Northeast, the Living Standard domain is higher, whereas the overall CWBI for that same region is relatively low, likely driven by lower values in the Connection to Nature, Leisure Time, and Safety and Security domains.

Emphasis on non-monetary well-being is an important aspect of this index, especially for children, where experiential learning is important. Lack of safety and exposure to the natural environment may play a large role in their development and future well-being.

4 Discussion

In the development of a well-being index specifically for children, there is a fine line to walk when altering the data. While too drastic of a change in the metric may result in loss of the crux of the indicator, too little of a change implies no need for an adaptation in the first place. Parent's attitudes, beliefs, income level, and number of other singular attributes will impact a child, but the distinction is less clear when it comes to something as nebulous as well-being. Simply saying a parent has high well-being does not mean their child automatically inherits this quality. In addition to the distinction between parents and their children, there is also the community demographics to consider in index development (i.e. population age structure may impact the accuracy of the index). Counties with higher numbers of children should, in theory, be more heavily influenced by the metrics specific to children, while counties with an older population and few children may be less influenced.

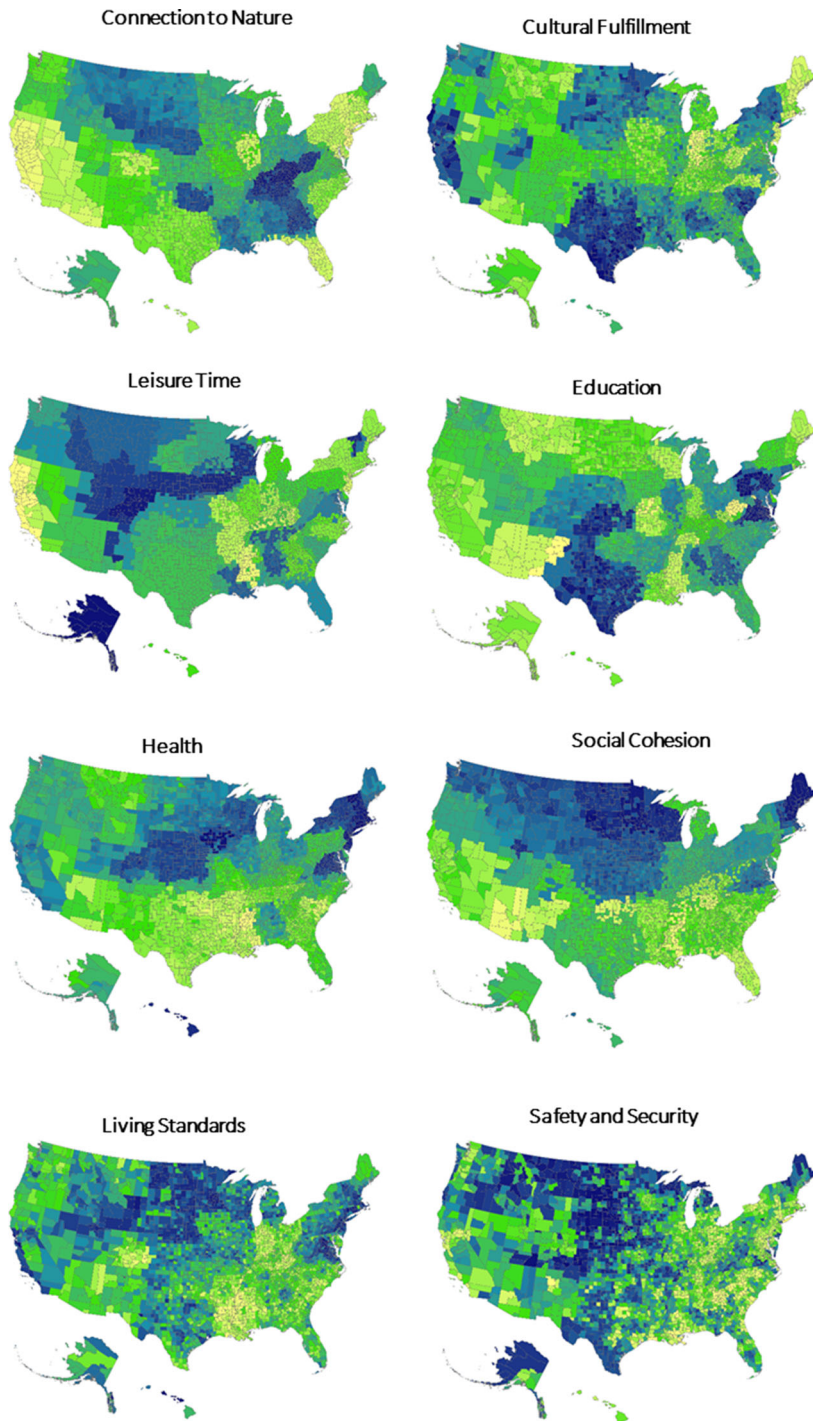


Fig. 4 8 Domains of children's well-being shown for all US Counties in 2010. *Blue* represents areas of higher well-being (darker = better) and *yellow* represents lower well-being (lighter = worse)

Every effort is made in the development of this index to strike the balance of change from the original HWBI and to find metrics directly representative of children in the community. Such an approach was intended to help to draw distinct conclusions about their well-being while also remaining rooted in the general well-being of the community. Unfortunately, there are other hurdles to contend with, in particular, data sources are not consistent for many of the metrics. Different groups collect child-specific data versus holistic, community level data. In addition to their collection methods being slightly different, the sampling time frames are also dissimilar. In some metrics this is not a major concern, however for others, it is worth at least noting that waiting a year or two can make a big difference. Trying to tease out these differences, while also discussing the usefulness of the adaptation and demonstrating how the final index compares to other indices measuring children's well-being will make up the bulk of the discussion from this point forward.

Looking first at the adapted CWBI in comparison to the original HWBI, a bivariate choropleth map is created (Fig. 5). The primary goal of this map is to illustrate the locations in the US where the two indices converge or diverge by highlighting the counties with one of four index pairings, High CWBI/High HWBI, High CWBI/Low HWBI, Low CWBI/High HWBI, and Low CWBI/Low HWBI. Scores for each index are divided into well-being classifications, of which the corners are highlighted to call out areas with the greatest difference. Only the colors in the four corners of the legend are retained for display purposes.

Looking first at the red and green colors (counties index values are either both high or both low), note the regional clustering of low well-being in the Southwest and

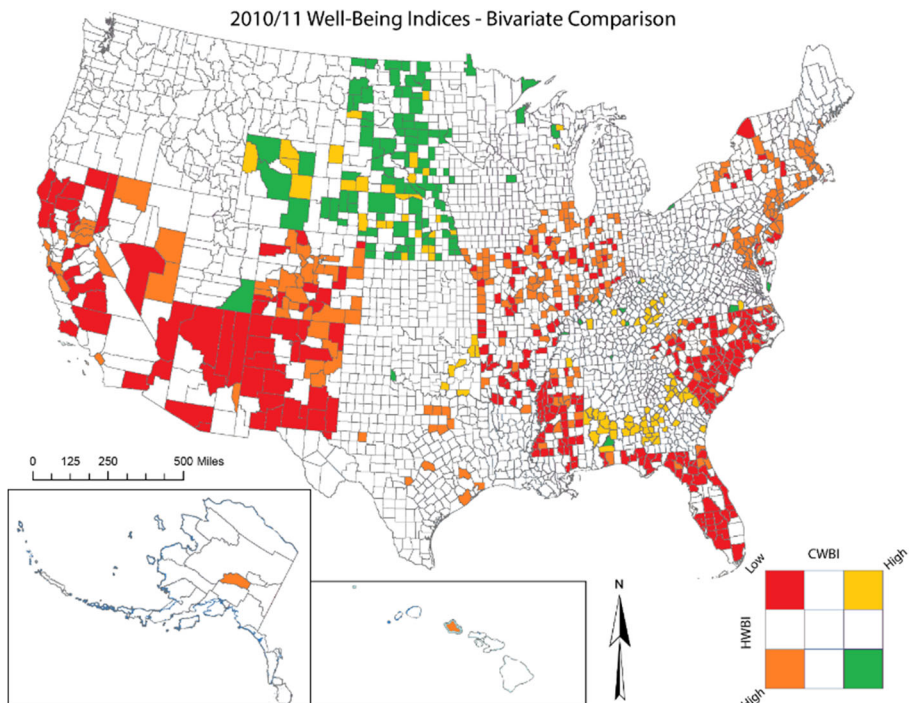


Fig. 5 Bivariate choropleth map for comparison of the HWBI and CWBI Indices

Southeast US, as well as the large area of high well-being in the upper Midwest. The other two colors, yellow and orange, where the indices are divergent, are not nearly as prominent. There are not many areas where the clusters of scores are heavily divergent (i.e. high-low or low-high), with the exception of Colorado and some of the coastal counties in the Northeast, where the HWBI is higher than the CWBI. The opposite (shaded yellow denoting low HWBI and high CWBI) seems to exist primarily in the Southeast in Georgia and Alabama.

After an analysis of the domains, a few key points stand out. The first involves drivers of well-being between the general population and children. Much of the influence in a more adult-centric index comes from economic drivers, whereas health and education tend to drive more of the CWBI. Areas with higher disparities in the overall index as well as the domains tend to be those who took the biggest financial hits from the economic turn-down around 2008. Many of these counties experienced a loss of population following the economic hit and, in turn, a loss in the tax base that lead to a disinvestment in education and other expenditures to improve the community for future generations. There is a lag between these events, however, and different temporal scales would be required to see the full impact of decreases in HWBI on the CWBI.

In addition to spatial differences, three statistical analyses are conducted for comparative purposes, a Pearson's Correlation, a Paired t-test, and a Chi-Squared test. In the correlation and t-tests, index scores are compared across domains for each county in the U.S. Results of the tests are shown in Table 9. Only a few of the domains, principally Living Standards and Health, have a moderate correlation, while Social Cohesion has a very weak correlation across the indices. In the case of Living Standards, many of the metrics used to assess this domain are community level and traits of parents should be very similar to those of the children. Along the same lines, healthy parents will be more likely to have healthy kids. The remaining domains: Leisure Time, Safety and Security, Education, and Social Cohesion are more subjective and it is possible that parent's views do not align with those of their children, or the domain simply measures a very different conceptual piece when comparing children to the greater community.

The Chi-Squared test was conducted on only the counties where index scores diverged, the 315 high/low and low/high counties shown in Fig. 5. Overall index scores were used to test against a standard chi-squared distribution. Based on this

Table 9 Correlation and paired t-test results between the Decadal HWBI and 2011 CWBI

Domain	Correlation	P(T < =t) two tail
Social cohesion	0.3621	0
Living standards	0.5145	0
Education	-0.0318	0
Connection to nature	0.1575	0
Cultural fulfillment	-0.0293	0
Health	0.4144	0
Safety and security	-0.1720	0
Leisure time	-0.1445	0

analysis, even the most divergent index scores between the CWBI and HWBI are still similar ($\chi^2 = 1, p = 0.303$) and likely come from the same distribution.

Concerning the matter of population distribution and its influence on the comparison of index scores, an analysis of age distributions and likely impacts on the index scores is conducted. The map in Fig. 6 shows the distribution of the population under 18 by county. With the exception of some areas in Western Texas, Southern California and Idaho, and most of Utah, the under-18 population remains under 25%.

In order to assess whether age distribution impacts the CWBI scores, a weighting method is applied to the HWBI scores, with the goal being to scale the HWBI based on the percentage of children living in the county. Higher numbers of children would indicate a more heavily adjusted HWBI. It is an adjustment based on relative representation in the county and calculated by dividing the percentage of adults in the county by the average percentage of adults in the entire United States. This proportion is then used to weight the HWBI domain values. Higher proportions of adults in comparison to the US average will yield higher HWBI values versus those with lower proportions. After this is done, the correlation and paired t-test is repeated, with results shown in Table 10.

Based on these tests, the distribution of data in the domains is not strongly influenced by the distribution of children in each county. This may have turned out differently if the data were similar, but with major underlying changes to the structure of the metrics, the indices are truly measuring two entirely different phenomena.

In addition to comparing the CWBI with the original HWBI, the index is also compared to existing child well-being measures and indices in the US. While there is

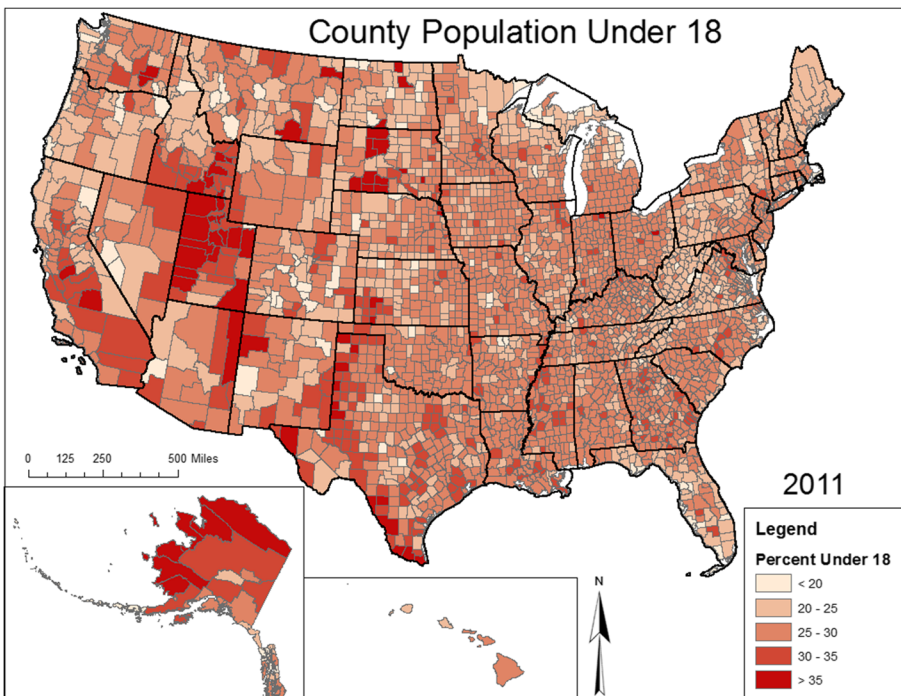


Fig. 6 Under 18 population shown by quintile

Table 10 Scaled HWBI versus 2011 CWBI domains

Domain	Correlation	P(T < =t) two tail
Social cohesion	0.3464	0
Living standards	0.4500	0
Education	-0.0344	0
Connection to nature	0.1553	0
Cultural fulfillment	-0.0572	0
Health	0.4139	0
Safety and security	-0.0610	0
Leisure time	-0.0982	0

more child specific data available currently, and indices on children have existed for about 40 years, there still exists no composite index of child well-being at the county level for the US. There are a few states, like California with its Children Now County Scorecard system, that maintain county scorecards for multiple measures of well-being among kids. In addition, many states do administer their own Youth Risk Behavior Surveys (YRBSSs) through either State Departments of Health or Education to complement the Center for Disease Control's (CDC) Youth Risk Behavior Surveillance System (YRBSS) data. Many of the national indices have values broken into groups by age, gender, or ethnicity, such as the Child Well-being Index of the Census Bureau's Survey of Income and Program Participation (SIPP) or the Foundation for Child Development's Child Well Being Index (CWI). Most prominent in the children's well-being arena is the Annie E. Casey Foundation's Kids Count Data Book, which serves a majority of the data used to calculate all children's indices in addition to creating their own state rankings.

While all of the indices derive scores from the same basic data sets, there still exists divergence resulting from metric selection, and to a lesser degree, the choice of how to aggregate the metrics. Choices for inclusion and aggregation are largely driven by the aim of the group creating the index and the desired application of the index, although there seems to be a convergence toward the development of a holistic set of measures to represent all aspects of well-being, not simply health, education, or safety. Even with the move toward a more holistic index of well-being, measures of cultural enrichment, environmental connection, and leisure time are still lacking. As mentioned previously, this is likely due in part to lack of data, yet the importance of these attributes for children's development still remains and should be emphasized when considering a holistic assessment of well-being.

Kids Count Data is based on 16 key indicators standardized, organized into 4 domains; economic well-being, education, health, and family and community. The domain scores are derived by summing indicators. The final index value is a sum of the domains with no weighting. Final scores are reported on the state rank. Figure 7 shows a chart with ranked Kids Count data along with the ranked CWBI index.

Despite divergence between the indices, the overall state rankings are statistically the same. A Wilcoxon Signed-Rank Test shows that there is no difference between the median of the two indices ($p = 0.948$, $n = 50$, $\alpha = 0.05$), although higher divergence

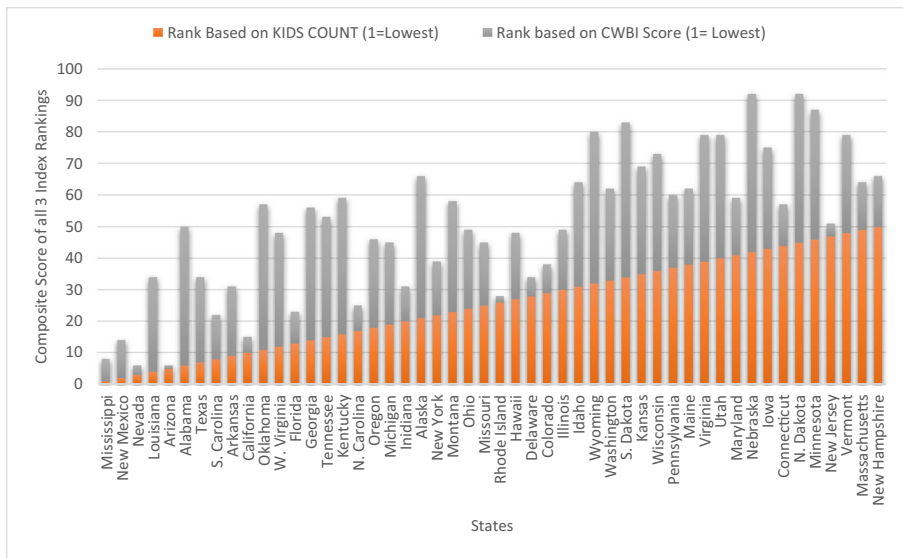


Fig. 7 Comparison of Children's Well-Being Index (CWBI) with Kids Count Scores Ranked by State. Composite Scores from each index are ranked (1-50)

seems to be present in the Northeastern states of New Jersey, Rhode Island, and Delaware, where Kids Count Data ranks the states highly while CWBI ranks them quite low. There is also a significant difference between the indices in the Southeast states of Louisiana, Alabama, Georgia, Tennessee, and Kentucky where the CWBI score rankings are considerably higher than those of Kids Count. The differences here are important to note due to the additional data used, specifically in the Culture and Connection to Nature domains. If indices aimed at the assessment of holistic well-being are the goal and existing indices are complete and accurately measure the desired outcome, then the addition of data should not significantly change the results. This, however, is not the case, and the addition of domains yields a different picture of children's well-being than has been shown through other indices. Despite issues with data in the areas of cultural fulfillment and connection to nature, the need still exists for a multi-dimensional index of child well-being that both includes these aspects and accomplishes it at a finer spatial scale. This adaption of the HWBI will hopefully be a first step in attempting to fill this need and hopefully allow for better policy decisions at the county level.

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