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An Index of Child Well-Being at a Local Level in the U.S.: The Case of North Carolina Counties

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Abstract To measure child well-being, we constructed composite indices with equal weights to component indicators for four domains such as health, safety, education, and economic well-being. The overall index was also constructed in the same way with equal weights to component domains. Based on the index scores (overall and four domains), North Carolina counties were ranked. In addition, urban and rural counties as well as four physiographic regions were also compared in terms of child well-being. According to the findings in the present study, urban counties generally provide better environments for child well-being although they are not statistically different in most domains of child well-being. Among four physiographic regions, the Inner Coastal region provides a significantly lower level of child well-being than the other regions in most domains, whereas the Blue Ridge and the Outer Coastal regions provide a generally higher level of child well-being than the Piedmont and the Outer Coastal Regions in most domains. These findings would not only help citizens make a more informed decision about where to live and where to raise their children, but also provide policy makers and implementers an idea about the strengths and weaknesses in their communities and what they should do to make their communities more attractive.

Keywords Child well-being · County government · Rankings · Composite index · Indicators · Urban and rural areas · Physiographic regions

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1 Backgrounds

Americans have been concerned about their children's conditions in health, safety, educational progress, and moral development ever since the 1970s (K. C. Land et al. 2007, pp. 105–6) and this concern led to a sustained interest in indicators of child well-being. In addition, our interest in constructing indicators is also attributed to "a movement toward accountability-based public policy, which demands more accurate measures of the conditions children face" (Ben-Arieh 2008, p. 5). However, the quality of life (or well-being)[1] is "notoriously vague in content, and inadequate appreciation of this fact has led to a number of problems in research on the subject" (Gerson 1976, p. 794). Theoretically, both descriptive (or objective) and evaluative (or subjective) measures should be adopted to properly embrace the quality of life (Sirgy et al. 2006, pp. 346–7; Cummins 2000, p. 56).

Different researchers (e.g., Kenneth C. Land et al. 2001; Lee et al. 2009; Moore et al. 2008; Vandivere and McPhee 2008) and institutes (e.g., the Annie E. Casey Foundation; the Foundation for Child Development) have measured child well-being by adopting different well-being domains and indexing methods. For instance, the Foundation for Child Development (FCD) adopted 28 indicators in seven domains and constructed the FCD-Land Index of child well-being (Kenneth C. Land et al. 2001), whereas the Annie E. Casey Foundation selected 10 indicators without designating specific domains of child well-being to produce the Kids Count Index (The Annie E. Casey Foundation 2010).

Summary indices have been developed due to an increased supply of information about child well-being (Ben-Arieh 2008, p. 12). While having a single number would make easier for the public to know about the conditions and to hold policy makers accountable, creating an overall index can be a challenge for researchers (Moore et al. 2007, p. 292). As Moore and colleagues (2008) pointed out, different trends of individual indicators may be masked once they are included in an overall index (p. 19) and "inevitably, the indicators used to capture the domain constructs are constrained by available data" (p. 20). One of the major criticisms about constructing composite indices is that essential components can be excluded when making a single index (see Booysen 2002, for the summary of criticisms).

Sustained efforts have been made to compare child well-being among different countries (e.g., T. E. Jordan 1983; Thomas E. Jordan 1993; Bradshaw and Richardson 2009) or among provinces within a nation (e.g., Kenneth C. Land et al. 2001; Casas et al. 2007; Bradshaw et al. 2009; Hanafin and Brooks 2009; Vandivere and McPhee 2008). For instance, Jordan (1983; 1993) compared child well-being among 122 countries using a national index of children's quality of life score, consisting of nine variables largely from the UNICEF reports on the conditions of world children. In Bradshaw and Richardson's (2009) study, 29 European countries were compared and ranked based on a single composite index as well as seven domain indices in child

[1] The quality of life and well-being will be regarded synonymous in the present study as in other studies (e.g., Rossouw and Naude 2008).

well-being such as health, subjective well-being, children's relationship, material situation, risk and safety, education, and housing and environment.

While a national level or a state level comparison of child well-being has been conducted by many studies, only a few studies (e.g., Menanteau-Horta and Yigzaw 2002; Lee et al. 2009; Niclasen and Kohler 2009) investigated child well-being at a local level. For instance, Lee and others (2009) constructed five domain-specific indices of child well-being for each county in the San Francisco Bay Area, aggregated them into an equally weighted composite child well-being index (CWI), and tracked the changes of overall CWI over a decade. Menanteau-Horta and Yigzaw (2002) compared each of 16 child welfare indicators with a composite index of social well-being at a county level in Minnesota, focusing on the comparison between rural and metropolitan counties.

We believe child well-being research at a local level brings practical benefits to citizens paricularly with children. In his seminal article *"A Pure Theory of Local Expenditures,"* Charles Tiebout (1956) argues that citizens may choose the community that best satisfies their preference for public goods (p. 418) unlike the argument of classical theories in public finance (e.g., Musgrave 1939; Samuelson 1954). Although the Tiebout's model has limitations in its assumptions such as citizen's full mobility and full knowledge of differences among communities (see p. 419 for all six assumptions), it can be applied to the case of child well-being, too. Given the growing concerns about child well-being among parents, the level of child well-being at local communities can be one of the critical factors that would affect the decision about where to live. Different studies examined a possibility that child well-being can be affected by neighborhood characteristics. For instance, neighborhood characteristics have influence on child maltreatment (Coulton et al. 2007; McDonell and Skosireva 2009), child health (Lumeng et al. 2006; Xue et al. 2007), child safety (Lumeng et al. 2006; O'Campo et al. 2000; McDonell and Skosireva 2009), and education outcomes (McWayne et al. 2007; Ceballo et al. 2004).

In the present study, we investigated child well-being in North Carolina counties because counties, as administrative units between states and municipalities in the U. S., largely determine the living conditions for their residents through delivering social services to their residents (Menanteau-Horta and Yigzaw 2002, p. 711). To measure child well-being, we chose four domains such as health, safety, education, and economic well-being, each of which consisted of four indicators (see Table 1 for their definitions and sources). For each domain, we constructed a composite index with equal weights to component indicators. An overall index was also constructed, based on composite indices of all domains with equal weights to component domains. In the end, counties were ranked based on each domain's index as well as an overall index. In addition, child well-being was also compared between urban and rural areas and among four physiographic regions such as Blue Ridge, Piedmont, Inner Coastal, and Outer Coastal regions. The findings in the present study would not only help citizens make a more informed decision about where to live and where to raise their children, but also provide policy makers and implementers an idea about the strengths and weaknesses in their communities and what they should do to make their communities more attractive.

Table 1 Indicators and data sources

Domain	Indicator	Definition	Date Source (& Data Year)
Health	Infant/child death by illness	Infant and child death caused by illness per 100,000 residents for five years	NC Department of Health and Human Services (Data year: 2004–2008)
	Infant mortality rate	Number of infant deaths per 1,000 live births Infant mortality is a death of a liveborn child under one year of age	NC State Center for Health Statistics (Data year: 2008)
	Teen pregnancy rate	Teen pregnancy cases per 1000 girls with age 15–19	NC State Center for Health Statistics (Data year: 2008)
	Low birthweight infant rate	Percent of low birthweight Infants Infants weighing less than 2,500 grams (5 lbs, 8 oz) are low birthweight	NC Department of Health and Human Services State Center for Health Statistics (Data year: 2008)
Safety	Violent crime rate	Violent crime cases per 1000[a] Violent crimes include murder, rape, robbery, and aggravated assault	NC State Bureau of Investigation (Data year: 2008)
	Child abuse rate	Child abuse cases per 1000 children Only first ever reports were included	University of North Carolina Jordan Institute for Families (Data year: 2007)
	Juvenile delinquency rate	Juvenile delinquency cases per 1000	North Carolina Department of Juvenile Justice and Delinquency Prevention Justice Annual Report 2008 (Data year: 2007)
	Homicide rate	Homicide cases per 1000	State Bureau of Investigation (Data year: 2008)
Education	Dropout rate for high school students	Percentage of dropout students in grades 9–12 It only included 100 county school systems and did not include 5 additional city schools, private, alternative, charter or home schools	Report to the North Carolina Joint Legislative Education Oversight Committee by the NC Board of Education (Data year: 2008–9)
	SAT score	Out of 2,400 points (reading, math, and writing)	NC Department of public instruction (Data year: 2009)
	8th grader's combined proficient rate for reading and math	Percent of 8th grade students who got proficient or above on end-of-grade reading or math testing Combined proficient rate was calculated by adding both reading and math proficient rates of 8th grade students and dividing them by two	NC Department of Public Instruction (Data year: 2008)
	3rd grader's combined proficient rate for reading and math	Percent of 3rd grade students who got proficient or above on end-of-grade reading or math testing Combined proficient rate was calculated by adding both reading and math proficient rates of 3rd grade students and dividing them by two	NC Department of Public Instruction (Data year: 2008)

Table 1 (continued)

Domain	Indicator	Definition	Date Source (& Data Year)
Economic Well-being	Unemployment rate	Percentage of workforce not working Not seasonally adjusted	Employment Security Commission of North Carolina (Data year: 2009)
	Free and reduced lunch rate	Percent of children enrolled in free and reduced lunch	N.C. Department of Public Instruction (Data year: 2006–7)
	Children poverty rate	Percentage of children under age 18 living in poverty	U.S. Census/American Community Survey three year estimate (Data year: 2005–7)
	Median household income	Median household income in dollars	U.S. Census/American Community Survey three year estimate (Data year: 2005–7)

[a] Graham, Mitchell, Hyde, and Washington counties did not report data for 2008. Missing data were substituted with state violent crime rate of 4.74/1,000

2 North Carolina

North Carolina is the fourth fastest-growing state in the United States with over 9.3 million population and 16.6% population change rate[2] (2009 estimate, U.S. Census Bureau 2010). North Carolina has a multitude of rich resources and public goods and services for citizens in 100 counties that extend across 48,710 square miles (U.S. Census Bureau 2010). While boasting of one of the country's best higher public educational systems, North Carolina communities are also fighting issues such as crimes and unemployment. About 4.74 violent crimes and 40.8 property crimes per 1,000 people were reported during 2008 (State Bureau of Investigation 2009) and North Carolina's unemployment rate was 11.2% as of December 2009 (Bureau of Labor Statistics 2009).

Rapidly growing technology, shifting workforce demographics, diverse populations and an ever-shifting economy have opened the doors to allow citizens to become more mobile and migratory. Although theoretically quality of life for citizens in North Carolina should be equal regardless of the county in which they reside, communities and public officials often struggle to meet the demands of the public while facing decreasing tax revenues. North Carolina communities are indeed in a competitive market to attract and retain citizens and to generate tax revenues above a certain level. Citizens look for communities that match their specific sets of needs and have reasonable tax structures. Given the revenue and expenditure patterns, one could assume that citizens would move to the community that can best satisfy their needs (Tiebout 1956).

Citizens, and specifically children, thrive when their community provides resources and support that include adequate health care, safe neighborhoods, quality education, and stable economic well-being. If a citizen values a quality education system, they can seek out the community that will provide the best educational

[2] This change rate is between April 1, 2000 and July 1, 2009. The population change rate for the U.S. during the same period is 9.1 percent (US Census Bureau 2010).

outcomes for their family. Another citizen may value the availability of quality healthcare, safe neighborhoods, or stable economic well-being in their community and make their community choice based upon those values and needs.

3 Methodology

Before comparing child well-being among counties, we constructed an index for each domain and an overall index with an equal weight to each indicator and to each domain, respectively. With constructed indices, a county's child well-being was compared in three ways. First, counties were grouped into urban and rural areas, and child well-being was compared between groups (Table 2). Second, counties were grouped into four physiographic regions, and child well-being was compared among groups (Table 3). Third, counties were ranked based on their composite indices (see Table 4 for the summary of those ranks, and Appendices 4–8 for details in overall and four domains). To compare groups, we conducted *t*-test for comparing urban and rural counties, and analysis of variance (ANOVA) for comparing physiographic regions. According to the Kolmogorov-Smirnov test results,[3] all indices were normally distributed.

3.1 Selection of Domains and Indicators

Cummins (1996) proposed seven comprehensive quality of life (ComQoL) domains that were believed as import aspects of lives by most people after reviewing 173 terms and 27 definitions used to describe quality of life in the literature. Land and his colleagues (2001) applied these ComQoL domains to child well-being, and suggested seven constituent domains for child well-being such as health, material well-being, educational attainment, safety/behavioral concerns, emotional/spiritual well-being, social relationships (i.e., with family and peers), and participation in schooling, which have been used as a conceptual guide for many child well-being studies (e.g., Lau and Bradshaw 2010; Bradshaw and Richardson 2009; Richardson et al. 2008; Lee et al. 2009).

In the present study, the selection of component domains for child well-being was based on Land and his colleagues' (2001) suggestion. Although all suggested domains were not adopted due to data unavailability, we believe that major aspects of child well-being could be measured with these domains. Internal reliability among these selected domains was sufficient since the computed Cronbach's alpha value was 0.83.[4] In other words, the selected domains measured the same construct of child well-being. Principal component analysis was also conducted to see how many factors could be possibly extracted out of four component domains. As seen in part (a) of Appendix 1, only one factor (i.e., comp1) had a larger eigenvalue than one, which justifies retaining only one factor (Kim and Mueller 1978). This conclusion was also supported in the Scree plot (see part (b) in Appendix 2) because the Scree

[3] The Kolmogorov-Smirnov test is commonly used to check if the distribution is normal (Lilliefors 1967).

[4] Although there exist no universal threshold values for acceptance, Hair and others (1998) suggested 0.6, whereas Nunnally and Bernstein (1994) suggested 0.7 as an acceptable alpha value.

Table 2 *t*-test results for urban and rural county comparison

Index	Mean scores	t-statistic
Overall	Urban: −0.18, Rural: 0.11	−2.43*
Health	Urban: -0.09, Rural: 0.06	−1.18
Safety	Urban: −0.05, Rural: 0.03	−0.63
Education	Urban: −0.07, Rural: 0.05	−0.72
Economic Well-being	Urban: −.49, Rural:.33	−4.98***

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

test suggests to stop factoring at the point when eigenvalues begin to level off and form a straight line (Cattell 1965). In sum, child well-being was properly measured by the selected domains in the present study.

In each domain, we selected four indicators, most of which measured negative constructs of child well-being. Out of 16 indicators, there were only four positive

Table 3 ANOVA test results for physiographic regions

Index	Mean scores	F-statistic
Overall	Blue Ridge (17)[b]: −0.32	8.68***
	Piedmont (41): −0.11	
	Inner Coastal (30): 0.41	
	Outer Coastal (12): −0.21	
Health[a]	Blue Ridge (17): −0.53	10.47***
	Piedmont (41): 0.01	
	Inner Coastal (30): 0.40	
	Outer Coastal (12): −0.27	
Safety	Blue Ridge (17): −0.19	4.20***
	Piedmont (41): −0.08	
	Inner Coastal (30): 0.32	
	Outer Coastal (12):−0.25	
Education	Blue Ridge (17): −0.59	10.01***
	Piedmont (41): −0.05	
	Inner Coastal (30): 0.50	
	Outer Coastal (12): −0.24	
Economic Well-being	Blue Ridge (17): 0.04	4.27***
	Piedmont (41): −0.30	
	Inner Coastal (30): 0.43	
	Outer Coastal (12): −0.08	

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

[a] The health domain did not meet equal variance requirement for ANOVA test (see Appendix 3a). Kruskal-Wallis test confirmed that child well-being in health was significantly different among physiographic regions as seen in ANOVA test results.

[b] Number of counties

Table 4 County ranks

Rank	Overall	Health	Safety	Education	Economic Well-being
1	Watauga	Tyrrell	Camden	Watauga	Wake
2	Wake	Clay	Polk	Dare	Union
3	Camden	Davie	Davie	Carteret	Camden
4	Davie	Moore	Wake	Polk	Currituck
5	Union	Carteret	Watauga	Henderson	Orange
6	Orange	Alleghany	Caswell	Union	Cabarrus
7	Currituck	Watauga	Orange	Wake	Chatham
8	Carteret	Yancey	Ashe	Camden	Dare
9	Dare	Alexander	Currituck	Iredell	Mecklenburg
10	Henderson	Hyde	Yancey	Burke	Davie

indicators that measured positive constructs of child well-being such as SAT score, proficient rates for third and eighth grade students from the education domain, and median household income from the economic well-being domain. Better outcomes are not guaranteed by simply having more inputs. Therefore, we selected more outcome-related indicators in each domain as suggested in the child well-being literature (e.g., K. C. Land et al. 2007; Moore et al. 2008). Selection of indicators is basically constrained by data availability. However, selected indicators for a certain domain are supposed to measure the same construct to produce a meaningful composite index in the end. According to the computed Cronbach's alpha values, the internal reliability of selected indicators in most domains was acceptable.[5]

3.2 Composite Index Making

Indicators' values were first transformed into standard scores (i.e., z-values) because they had different scales. In fact, this is one of the popular methods in composite indexing (see Booysen 2002, pp. 123–126 for popular four methods of scaling composite index) and has been widely adopted (e.g., Gallardo et al. 2009; Norton 2007). If positive indicators were incorporated with negative indicators without changing the signs of their standard scores, we would not know whether a higher index score means good news or bad news to communities. Therefore, when transforming positive indicators that measured positive constructs of child well-being, we changed the signs of their standard scores before making composite indices. As a result, higher index scores mean lower levels of child well-being in the present study. To construct a composite index of each domain, standard scores of component indicators were summed up and divided by the number of indicators in a domain (i.e., four in our study) with equal weights to indicators. An overall index was constructed in the same way. That is, composite indices of component domains were added up and divided by the number of domains (i.e., four in our study) with equal weights to domains.

[5] Cronbach's alpha values for health, safety, education, and economic well-being domains were 0.54, 0.70, 0.77, and 0.91, respectively.

The usefulness of a summary index has been questioned due to disagreement on different weights given to its components among individuals, policy makers, and researchers themselves (M. R. Hagerty and Land 2007, p. 457). Still different summary indices have been suggested without justifying why equal or different weights were given to their components (Michael R. Hagerty et al. 2001). According to the results of principal component analysis conducted in the present study, each component domain similarly contributed to forming a summary index (see eigenvector table in Appendix 1).[6] Statistically, these results of principal component analysis can be a rationale for giving an equal weight to component domains. Even in this case, however, individuals may have different preferences and may not agree with the idea that component domains have equal importance in child well-being. Therefore, unless we have information about average weights of importance given to each component domain among individuals, equal weighting can be a minimax estimator that will make minimal individuals' disagreement about the importance of component domains (M. R. Hagerty and Land 2007, p. 486).

3.3 County Grouping

In addition to ranking counties (explained in Section 4.4), we grouped counties into urban and rural areas and compared child well-being between groups. Although there are diverse definitions of urban and rural areas (e.g., Belanger and Stone 2008; Landsman 2002; Whitaker 1984), we regarded metropolitan counties as urban areas, and non-metropolitan counties as rural areas. In the present study, counties with more than 50,000 residents were grouped into urban areas and counties with less than 50,000 residents were defined as rural areas[7] as a common approach (Belanger and Stone 2008, p. 103). According to this definition, North Carolina had 40 urban counties and 60 rural counties.

Counties were also grouped into four physiographic regions. North Carolina has physiographic regions such as Blue Ridge (or Mountains), Piedmont, Inner Coastal, and Outer Coastal (or Tidewater) regions (Gade et al. 2002). When a county was spanned over two physiographic regions, we assigned it to one specific physiographic region whose area seemed larger than that of the other region according to the North Carolina Geological Survey map (2004). [8] As a result, North Carolina's counties consisted of 17 Blue Ridge, 41 Piedmont, 30 Inner Coastal, and 12 Outer Coastal regions.

[6] As seen in comp1 column of table (c) in Appendix 1, the value was 0.50, 0.47, 0.53, and 0.51 for each domain.

[7] Micropolitan areas were included in rural areas. According to the U.S. Office of Management and Budget's (2009) notice, a metro area contains a core urban area of 50,000 or more population, and a micro area contains an urban core of at least 10,000 (but less than 50,000) population.

[8] According to the NC geological survey map (2004), seven counties (Polk, Rutherfield, MCdowell, Caldwell, Wilkes, Surry, Burke) were spanned over Blue Ridge and Piedmont, 13 counties (Richmond, Montgomery, Moore, Lee, Harnett, Wake, Johnston, Wilson, Nash, Edgecombe, Halifax, Northampton, Wayne) were spanned over Piedmont and Inner Coastal, and 12 counties (Gates, Perquimans, Chowan, Washington, Beaufort, Pamlico, Craven, Carteret, Onslow, Pender, New Hanover, Brunswick) were spanned over Inner Coastal and Outer Coastal regions.

4 Results

4.1 Comparing Urban and Rural Counties

Table 2 summarizes *t*-test results for the comparison between urban and rural counties (see Appendix 2 for details). Although urban counties had a significantly higher level of child well-being (i.e., lower index scores) than rural counties in overall and economic well-being, no considerable differences existed between urban and rural counties in other domains such as health, safety, and education. Therefore, it is obvious that the overall index was substantially influenced by a huge difference in economic well-being between urban and rural counties. Generally speaking, however, urban counties appear to have a better status (i.e., lower index scores) than rural counties in all component domains as seen in Fig. 1.

4.2 Comparing Physiographic Regions

Analysis of variance (ANOVA) test was conducted to compare child well-being among four physiographic regions. Since the health domain did not meet the equal variance requirement for ANOVA test (see Appendix 3a for details), we ran Kruskal-Wallis (K-W) test for the health domain to verify ANOVA results for health and found no difference between ANOVA and K-W test results (K-W results not shown). As seen in Table 3, physiographic regions in North Carolina were significantly different in all domains of child well-being.

By running a post-hoc test (the Sheffee method was used), we could identify which regions were better in a certain domain of child well-being, comparing with other regions. As seen in Appendix 3d, the Inner Coastal region had a significantly higher index score (i.e., a lower level of child well-being) than the other three regions in overall child well-being and most component domains except economic well-being.[9] In the economic well-being domain, only the Piedmont region had a significantly lower index score (i.e., a higher status) than the Inner Coastal region. In the health domain, the Blue Ridge region showed a significantly lower index score (i.e., a higher status) than the Piedmont region. As seen in Fig. 2 that shows a simple comparison among regions, the Blue Ridge and the Outer Coastal regions appear to have a higher level of child well-being than the Piedmont and the Inner Coastal regions in all domains except the economic well-being domain.

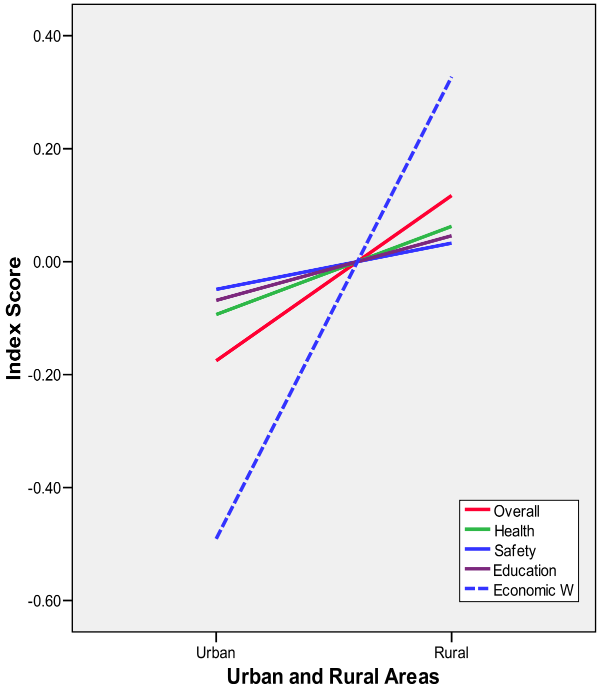
4.3 Comparing Urban and Rural Counties in Physiographic Regions

Useful information was revealed when we compared urban and rural counties in each physiographic region. In North Carolina, the Blue Ridge and the Outer Coastal regions have much more rural counties than urban counties, whereas the Piedmont region has more urban counties than rural counties.[10] As seen in Fig. 3, urban

[9] In the safety domain, the Inner Coastal region had a higher index score than others, but the *p*-value was a little bit higher (0.6) than the traditional threshold of significance (0.5).

[10] The number of urban and rural counties in each physiographic region is as follows: Blue Ridge (urban: 4, rural: 13), Piedmont (urban 24, rural: 17), Inter Coastal (urban: 11, rural: 19), and Outer Coastal (urban: 1, rural: 11).

Fig. 1 Index score comparison between urban and rural counties

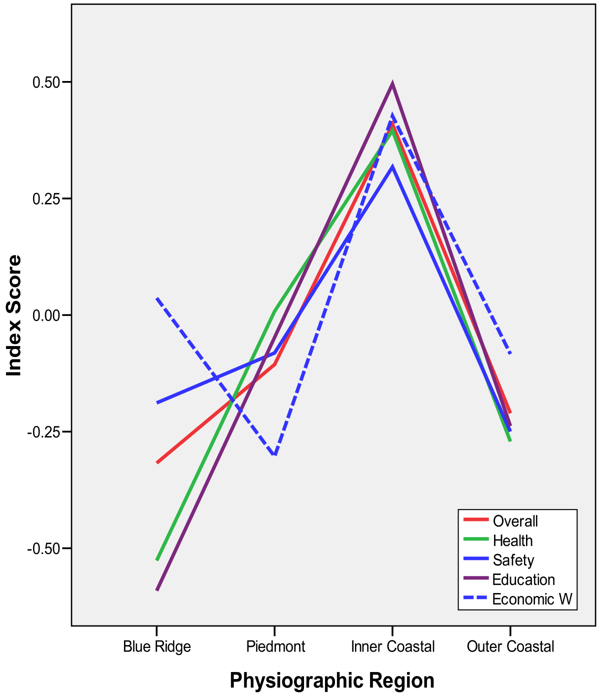


counties appear to have a better status (i.e., a lower score) than rural counties in overall child well-being and all component domains, regardless of physiographic regions. According to the *t*-test results (results not shown) that compared urban and rural in each region, overall child well-being was significantly different only in the Piedmont region ($p<0.05$), whereas economic well-being was significantly different in most regions such as the Blue Ridge, the Piedmont, and the Inner Coastal regions ($p<0.05$). In other domains such as health, safety, and education, however, urban areas were not significantly different from rural areas, regardless of physiographic regions. It needs to be also noted that although urban and rural counties appeared to be different in the Outer Coastal region, it was not supported by *t*-test results because there is only one urban county in that region.

4.4 County Rankings

North Carolina (NC) counties were ranked, based on their index scores. Recall that a lower index score indicates a higher status of child well-being in the present study. The top 10 counties in overall and four component domains are summarized in Table 4 (see Appendices 4–8 for complete lists of county ranking). The relationships between overall index and component domain indices and between component domains were also examined. Since all relationships were significantly positive ($p<0.01$) as seen in Table 5, a county that had a high ranking in the overall index was more likely to rank high in most component domains. For example, Watauga, the number one county in the overall index was also ranked seventh in health, ranked fifth in safety, and ranked first in education.

Fig. 2 Index score comparison among physiographic regions



5 Discussion

This cross-sectional study was conducted with an assumption that the level of child well-being would not change in the future, and we did not take into account county governments' previous efforts to improve child well-being in their counties. Although it is important to understand how much effort has been made and can be made in the future to improve child well-being in county jurisdictions, current county rankings can be also useful and help citizens decide where to live. While rankings can be good information to perspective residents, it should be also noted that low ranked counties do not necessarily mean they are bad places to live. Regardless of ways to rank counties, there should be high ranked counties and low ranked counties. Theoretically, it is possible that all North Carolina counties provide better environments to children than any other places in the U.S. and vice versa. In any case, however, it is not hard to imagine that parents want to provide their children with higher quality of life by relocating to a community that can provide better environments. From an administrator's perspective, county rankings can help them understand where their counties are located among peer counties, and motivate them to remedy certain areas that need to be improved. Through benchmarking peer governments that are advanced in a certain area, administrators in charge would make more informed decision and policy outcomes can be improved as a result (D. Ammons 1996; D. N. Ammons et al. 2001).

Disadvantages in rural areas have been investigated from different perspectives (e.g., Belanger and Stone 2008; Liao 2009; Menanteau-Horta and Yigzaw 2002),

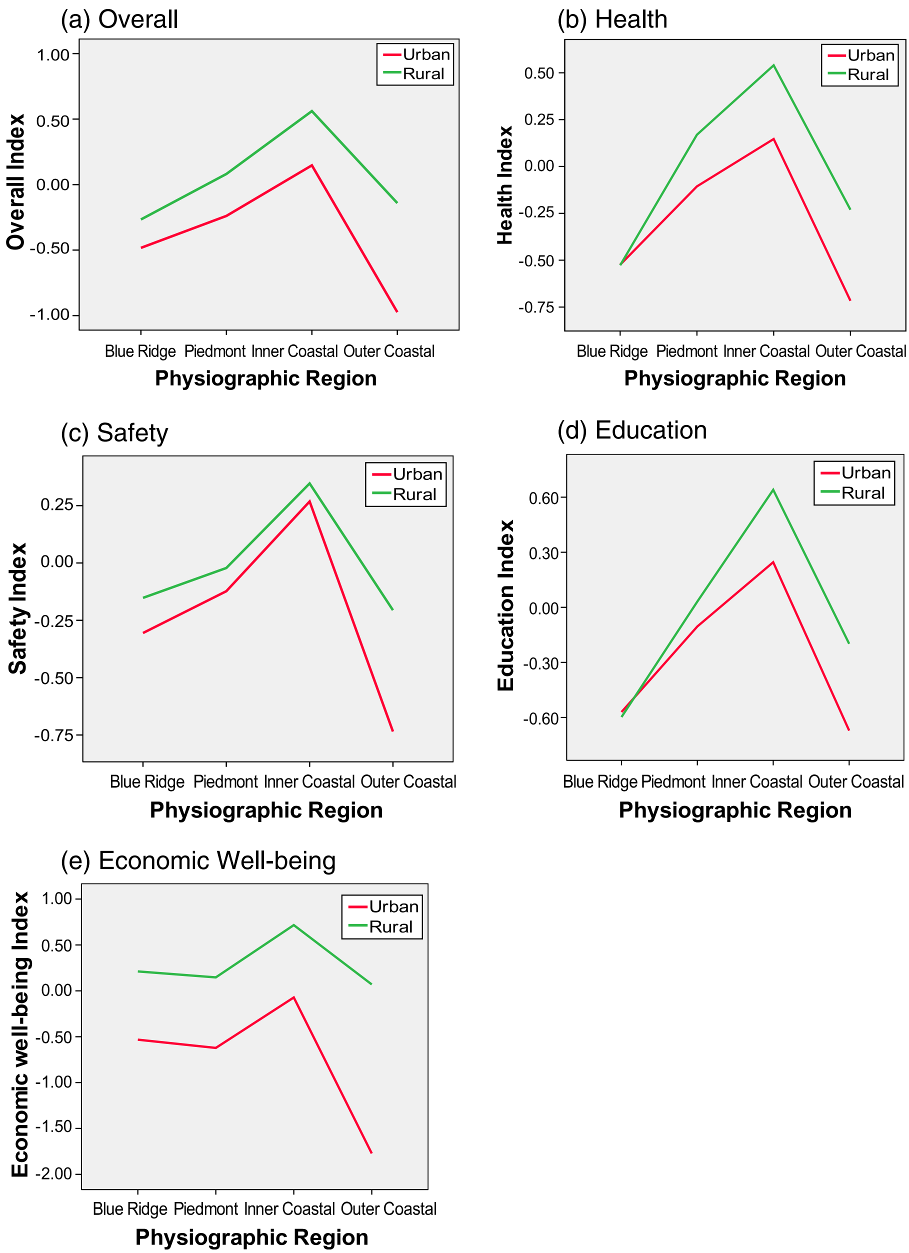


Fig. 3 Urban vs. rural comparison in physiographic regions

with an assumption that "whatever the subject or indicator—per capita income, health care, education, employment opportunity, or transportation—the nonmetropolitan people of the nation have less" (Ginsberg 1998, p. v). According to the findings in the present study, it is not really true in most child well-being domains. Only in economic well-being was there a huge difference between urban and rural

Table 5 Pearson product correlations

	Overall	Health	Safety	Education	Economic Well-being
Overall	1	.79**	.76**	.86**	.85**
Health	.79**	1	.49**	.65**	.50**
Safety	.76**	.49**	1	.50**	.55**
Education	.86**	.65**	.50**	1	.63**
Economic Well-being	.85**	.50**	.55**	.63**	1

*$p<.05$, **$p<.01$, ***$p<.001$

counties, which substantially contributed to a significant difference in overall child well-being (see *t*-test results in Table 2 and a comparison graph in Fig. 1). Even though urban counties were not significantly different from rural counties in most child well-being domains, urban counties provided a little bit better environments for child well-being (i.e., a lower index score) than rural counties as seen in Figs. 1 and 3.

While the findings in the present study can be useful to county officials, state legislative leaders, citizens, and others, our research has limitations. First, data at a local level are very limited unlike data at a state level or at a national level. Our study is not an exception. The selection of indicators depended largely on data availability. Although survey-based data are more reliable than report-based data in which different filtering mechanisms may be involved, we had to use some report-based data (e.g., child abuse rate) because they were only available. Second, a single index has a limitation in itself because it cannot reflect the trends of individual indicators while comparison among counties can be easily conducted by using it (Moore et al. 2008). Third, changes in child well-being may be important but cannot be measured by cross-sectional studies like this research. While the present study provides a good comparison among NC counties at a certain time point, only longitudinal studies can identify a trend in which we can see how much improvement has been made.

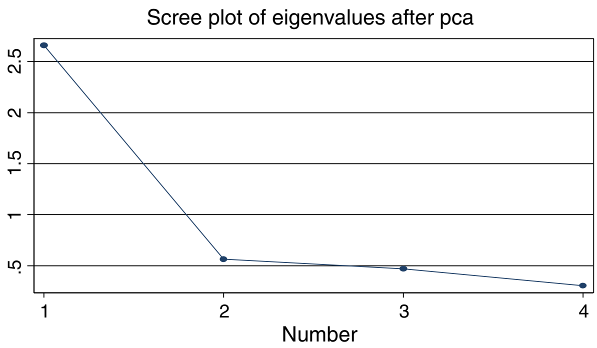
Appendix 1. Principal Component Analysis Results for Component Domains

a. Principal components/correlation

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	2.6612	2.09537	0.6653	0.6653
Comp2	.5658	.09731	0.1415	0.8068
Comp3	.4685	.16408	0.1171	0.9239
Comp4	.3044		0.0761	1

Number of observation—100

b. Scree plot



c. Principal components (eigenvector)

Variable	Comp1	Comp2	Comp3	Comp4	Unexplained
Health	0.4965	−0.535	0.4924	0.4742	0
Safety	0.4709	0.7202	0.4779	−0.1767	0
Education	0.5256	−0.3707	−0.2292	−0.7306	0
Economic W[a]	0.5055	0.24	−0.6904	0.4584	0

[a]Economic Well-being

Appendix 2. Comparison Between Urban and Rural Counties (*t*-test)

(a) *t*-test results

Index		Levene's Test for Equality of Variances		*T*-Test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence interval	
									Lower	Upper
Overall	Equal[a]	.773	.381	−2.43	98.00	0.02	−0.29	0.12	−0.53	−0.05
	Unequal[b]			−2.48	88.97	0.02	−0.29	0.12	−0.53	−0.06
Health	Equal	.766	.384	−1.18	98.00	0.24	−0.16	0.13	−0.42	0.11
	Unequal			−1.22	92.47	0.23	−0.16	0.13	−0.41	0.10
Safety	Equal	.118	.732	−0.63	98.00	0.53	−0.08	0.13	−0.34	0.18
	Unequal			−0.64	90.57	0.52	−0.08	0.13	−0.33	0.17
Education	Equal	2.283	.134	−0.72	98.00	0.47	−0.11	0.16	−0.43	0.20
	Unequal			−0.76	96.08	0.45	−0.11	0.15	−0.41	0.18
Economic Well-being	Equal	.592	.444	−4.98	98.00	0.00	−0.82	0.16	−1.14	−0.49
	Unequal			−5.05	87.47	0.00	−0.82	0.16	−1.14	−0.50

[a]Equal variances assumed

[b]Equal variances not assumed

(b) Descriptive statistics of urban and rural county indices

Index	Urban/rural	N	Mean	Std. deviation	Min	Max
Overall	Urban	40	−0.18	0.56	−1.14	1.36
	Rural	60	0.11	0.61	−1.15	1.63
Health	Urban	40	−0.09	0.58	−1.13	1.52
	Rural	60	0.06	0.69	−1.46	1.64
Safety	Urban	40	−0.05	0.59	−1.07	1.24
	Rural	60	0.03	0.67	−1.50	2.46
Education	Urban	40	−0.07	0.65	−1.07	1.25
	Rural	60	0.05	0.85	−1.83	2.12
Economic Well-being	Urban	40	−0.49	0.77	−2.04	1.74
	Rural	60	0.33	0.82	−1.82	1.84

Appendix 3. Comparison Among Physiographic Regions (ANOVA)

(a) Test for homogeneity of variances

Index	Levene statistic	df1	df2	Sig.
Overall	1.978	3	96	.122
Health	3.481	3	96	.019
Safety	1.506	3	96	.218
Education	2.015	3	96	.117
Economic Well-being	1.710	3	96	.170

The health index ($p<0.05$) does not have equal variances

(b) Descriptive statistics

		N	Mean	Standard deviation	Std. error	95% Confidence interval for mean		Minimum	Maximum
						Lower bound	Upper bound		
Overall	Blue Ridge	17	−0.32	0.37	0.09	−0.51	−0.12	−1.15	0.34
	Piedmont	41	−0.11	0.52	0.08	−0.27	0.06	−1.14	1.38
	Inner Coastal	30	0.41	0.62	0.11	0.18	0.64	−0.66	1.63
	Outer Coastal	12	−0.21	0.63	0.18	−0.61	0.19	−1.02	0.88
	Total	100	0.00	0.60	0.06	−0.12	0.12	−1.15	1.63
Health	Blue Ridge	17	−0.53	0.39	0.09	−0.73	−0.33	−1.18	0.11
	Piedmont	41	0.01	0.49	0.08	−0.15	0.16	−1.13	1.64

		N	Mean	Standard deviation	Std. error	95% Confidence interval for mean		Minimum	Maximum
						Lower bound	Upper bound		
	Inner Coastal	30	0.40	0.72	0.13	0.13	0.67	−1.01	1.59
	Outer Coastal	12	−0.27	0.62	0.18	−0.67	0.12	−1.46	0.43
	Total	100	0.00	0.65	0.06	−0.13	0.13	−1.46	1.64
Safety	Blue Ridge	17	−0.19	0.51	0.12	−0.45	0.07	−0.86	1.17
	Piedmont	41	−0.08	0.56	0.09	−0.26	0.09	−1.10	1.05
	Inner Coastal	30	0.32	0.73	0.13	0.05	0.59	−0.63	2.46
	Outer Coastal	12	−0.25	0.56	0.16	−0.61	0.11	−1.50	0.41
	Total	100	0.00	0.64	0.06	−0.13	0.13	−1.50	2.46
Education	Blue Ridge	17	−0.59	0.50	0.12	−0.85	−0.33	−1.83	0.26
	Piedmont	41	−0.05	0.65	0.10	−0.25	0.16	−1.16	1.58
	Inner Coastal	30	0.50	0.72	0.13	0.23	0.76	−0.82	2.12
	Outer Coastal	12	−0.24	0.91	0.26	−0.82	0.34	−1.29	1.81
	Total	100	0.00	0.77	0.08	−0.15	0.15	-1.83	2.12
Economic Well-being	Blue Ridge	17	0.04	0.65	0.16	−0.30	0.37	−0.97	1.24
	Piedmont	41	−0.30	0.83	0.13	−0.57	−0.04	−2.04	1.71
	Inner Coastal	30	0.43	0.87	0.16	0.10	0.75	−1.07	1.84
	Outer Coastal	12	−0.08	1.11	0.32	−0.79	0.62	−1.82	1.32
	Total	100	0.00	0.90	0.09	−0.18	0.18	−2.04	1.84

(c) ANOVA results

Index		Sum of squares	df	Mean square	F	Sig.
Overall	Between groups	7.725	3	2.575	8.683	.000
	Within groups	28.470	96	.297		
	Total	36.196	99			
Health[a]	Between groups	10.293	3	3.431	10.466	.000
	Within groups	31.470	96	.328		
	Total	41.763	99			
Safety	Between groups	4.651	3	1.550	4.204	.008
	Within groups	35.406	96	.369		
	Total	40.057	99			
Education	Between groups	14.085	3	4.695	10.010	.000
	Within groups	45.027	96	.469		
	Total	59.112	99			
Economic well-being	Between groups	9.352	3	3.117	4.270	.007
	Within groups	70.084	96	.730		
	Total	79.436	99			

[a]Due to unequal variances in health as seen in part (a), Kruskal-Wallis (K-W) test was conducted. K-W results confirmed that there were significant differences in health among physiographic regions

(d) Post-hoc test results (the Sheffee method used)

Index	(I) Physiographic region	(J) Physiographic region	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
						Lower bound	Upper bound
Overall	Blue Ridge	2	−0.21	0.16	0.61	−0.66	0.24
		3	−0.73	0.17	**0.00**	−1.20	−0.26
		4	−0.11	0.21	0.97	−0.69	0.48
	Piedmont	1	0.21	0.16	0.61	−0.24	0.66
		3	−0.52	0.13	**0.00**	−0.89	−0.14
		4	0.10	0.18	0.95	−0.40	0.61
	Inner Coastal	1	0.73	0.17	**0.00**	0.26	1.20
		2	0.52	0.13	**0.00**	0.14	0.89
		4	0.62	0.19	**0.01**	0.09	1.15
	Outer Coastal	1	0.11	0.21	0.97	−0.48	0.69
		2	−0.10	0.18	0.95	−0.61	0.40
		3	−0.62	0.19	**0.01**	−1.15	−0.09
Health	Blue Ridge	2	−0.53	0.17	**0.02**	−1.00	−0.06
		3	−0.92	0.17	**0.00**	−1.42	−0.43
		4	−0.26	0.22	0.71	−0.87	0.36
	Piedmont	1	0.53	0.17	**0.02**	0.06	1.00
		3	−0.39	0.14	**0.05**	−0.78	0.00
		4	0.28	0.19	0.53	−0.26	0.81
	Inner Coastal	1	0.92	0.17	**0.00**	0.43	1.42
		2	0.39	0.14	**0.05**	0.00	0.78
		4	0.67	0.20	**0.01**	0.11	1.22
	Outer Coastal	1	0.26	0.22	0.71	−0.36	0.87
		2	−0.28	0.19	0.53	−0.81	0.26
		3	−0.67	0.20	**0.01**	−1.22	−0.11
Safety	Blue Ridge	2	−0.11	0.18	0.95	−0.61	0.39
		3	−0.51	0.18	*0.06*	−1.03	0.02
		4	0.06	0.23	0.99	−0.59	0.71
	Piedmont	1	0.11	0.18	0.95	−0.39	0.61
		3	−0.40	0.15	*0.06*	−0.81	0.02
		4	0.17	0.20	0.87	−0.40	0.74
	Inner Coastal	1	0.51	0.18	*0.06*	−0.02	1.03
		2	0.40	0.15	*0.06*	−0.02	0.81
		4	0.57	0.21	*0.06*	−0.02	1.16
	Outer Coastal	1	−0.06	0.23	0.99	−0.71	0.59
		2	−0.17	0.20	0.87	−0.74	0.40
		3	−0.57	0.21	*0.06*	−1.16	0.02
Education	Blue Ridge	2	−0.54	0.20	*0.06*	−1.11	0.02
		3	−1.09	0.21	**0.00**	−1.68	−0.50
		4	−0.35	0.26	0.60	−1.09	0.38
	Piedmont	1	0.54	0.20	*0.06*	−0.02	1.11

Index	(I) Physiographic region	(J) Physiographic region	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
						Lower bound	Upper bound
		3	−0.54	0.16	**0.02**	−1.01	−0.08
		4	0.19	0.22	0.87	−0.45	0.83
	Inner Coastal	1	1.09	0.21	**0.00**	0.50	1.68
		2	0.54	0.16	**0.02**	0.08	1.01
		4	0.73	0.23	**0.02**	0.07	1.40
	Outer Coastal	1	0.35	0.26	0.60	−0.38	1.09
		2	−0.19	0.22	0.87	−0.83	0.45
		3	−0.73	0.23	**0.02**	−1.40	−0.07
Economic Well-being	Blue Ridge	2	0.34	0.25	0.60	−0.36	1.04
		3	−0.39	0.26	0.52	−1.13	0.35
		4	0.12	0.32	0.99	−0.80	1.04
	Piedmont	1	−0.34	0.25	0.60	−1.04	0.36
		3	−0.73	0.21	**0.01**	−1.31	−0.15
		4	−0.22	0.28	0.89	−1.02	0.58
	Inner Coastal	1	0.39	0.26	0.52	−0.35	1.13
		2	0.73	0.21	**0.01**	0.15	1.31
		4	0.51	0.29	0.39	−0.32	1.34
	Outer Coastal	1	−0.12	0.32	0.99	−1.04	0.80
		2	0.22	0.28	0.89	−0.58	1.02
		3	−0.51	0.29	0.39	−1.34	0.32

- 1. Blue Ridge, 2. Piedmont, 3. Inner Coastal, 4. Outer Coastal
- Significant cases are marked in boldface. If cases are not significant but p-vale is less than .10, they are italicized (see the safety domain)

Appendix 4. Overall Index of Child Well-being for North Carolina Counties

County	Z-score	County	Z-score	County	Z-score	County	Z-score	County	Z-score
Watauga	−1.152	New Hanover	−0.468	Brunswick	−0.212	Rockingham	0.095	Wilson	0.479
Wake	−1.143	Pender	−0.466	Craven	−0.201	Mitchell	0.117	Chowan	0.488
Camden	−1.025	Yancey	−0.456	Surry	−0.179	Pasquotank	0.149	Sampson	0.545
Davie	−1.016	Davidson	−0.400	Granville	−0.173	Wilkes	0.174	Nash	0.575
Union	−1.015	Ashe	−0.399	Franklin	−0.170	Perquimans	0.180	Hertford	0.582
Orange	−0.987	Haywood	−0.338	Caldwell	−0.163	Person	0.196	Bladen	0.728
Currituck	−0.974	Hyde	−0.329	Avery	−0.155	Cleveland	0.209	Richmond	0.755
Carteret	−0.881	Stokes	−0.288	Stanly	−0.128	Gaston	0.213	Northampton	0.765
Dare	−0.822	Yadkin	−0.285	Mecklenburg	−0.122	McDowell	0.256	Greene	0.830
Henderson	−0.765	Catawba	−0.278	Harnett	−0.111	Graham	0.277	Bertie	0.882
Chatham	−0.673	Alleghany	−0.276	Guilford	−0.071	Duplin	0.290	Washington	0.884
Cabarrus	−0.668	Onslow	−0.273	Caswell	−0.069	Beaufort	0.301	Anson	0.887

County	Z-score	County	Z-score	County	Z-score	County	Z-score	County	Z-score
Johnston	−0.661	Macon	−0.263	Rowan	−0.061	Hoke	0.303	Columbus	0.929
Moore	−0.660	Jackson	−0.252	Cherokee	−0.035	Swain	0.337	Warren	0.947
Clay	−0.608	Pamlico	−0.251	Lee	−0.001	Wayne	0.337	Lenoir	0.964
Transylvania	−0.597	Madison	−0.250	Alamance	0.018	Montgomery	0.361	Scotland	1.081
Buncombe	−0.579	Tyrrell	−0.248	Jones	0.025	Rutherford	0.380	Edgecombe	1.365
Iredell	−0.566	Burke	−0.239	Gates	0.025	Cumberland	0.399	Vance	1.376
Polk	−0.505	Randolph	−0.238	Forsyth	0.054	Martin	0.408	Halifax	1.539
Alexander	−0.493	Lincoln	−0.236	Durham	0.078	Pitt	0.464	Robeson	1.630

- Overall index consists of four domains such as health, safety, education, and economic well-being
- Counties were ordered from low to high scores, based on their z-scores
- A lower z-score indicates a higher status of overall child well-being because indices of all component domains measured negative constructs

Appendix 5. Health Index of Child Well-being for North Carolina Counties

County	Z-score	County	Z-score	County	Z-score	County	Z-score	County	Z-score
Tyrrell	−1.458	Brunswick	−0.601	Cherokee	−0.154	Guilford	0.135	Perquimans	0.425
Clay	−1.178	Ashe	−0.560	Haywood	−0.152	Surry	0.146	Gates	0.510
Davie	−1.129	Chatham	−0.546	Davidson	−0.115	Durham	0.187	Sampson	0.554
Moore	−1.014	Buncombe	−0.538	Iredell	−0.098	Rutherford	0.188	Person	0.567
Carteret	−1.007	Jones	−0.518	Rockingham	−0.088	Camden	0.214	Nash	0.642
Alleghany	−0.962	Union	−0.486	Wilkes	−0.076	Anson	0.220	Forsyth	0.647
Watauga	−0.950	Macon	−0.468	McDowell	−0.076	Wilson	0.220	Warren	0.658
Yancey	−0.909	Swain	−0.400	Catawba	−0.072	Chowan	0.227	Richmond	0.753
Alexander	−0.904	Onslow	−0.390	Harnett	−0.057	Craven	0.228	Hertford	0.791
Hyde	−0.828	Caswell	−0.358	Northampton	−0.048	Gaston	0.233	Polk	0.792
Henderson	−0.793	Johnston	−0.348	Avery	0.009	Alamance	0.248	Martin	0.816
Transylvania	−0.756	Lee	−0.297	Washington	0.016	Duplin	0.312	Scotland	0.844
Currituck	−0.717	Rowan	−0.254	Mecklenburg	0.033	Pasquotank	0.335	Halifax	1.033
Jackson	−0.671	Burke	−0.246	Graham	0.036	Stanly	0.372	Robeson	1.254
Orange	−0.648	Cabarrus	−0.244	Beaufort	0.055	Lincoln	0.375	Lenoir	1.273
New Hanover	−0.644	Randolph	−0.229	Cleveland	0.064	Cumberland	0.375	Bertie	1.331
Pender	−0.643	Franklin	−0.219	Hoke	0.067	Wayne	0.377	Greene	1.493
Wake	−0.638	Caldwell	−0.194	Pamlico	0.096	Yadkin	0.378	Edgecombe	1.524
Madison	−0.615	Stokes	−0.194	Mitchell	0.112	Bladen	0.387	Columbus	1.589
Dare	−0.611	Granville	−0.192	Montgomery	0.114	Pitt	0.402	Vance	1.638

- Health index consists of four indicators such as infant and children death by illness rate, infant mortality rate, teen pregnancy rate, and low birthweight rate
- Counties were ordered from low to high scores, based on their z-scores
- A lower z-score indicates a higher status of child well-being in that domain because negative constructs of child well-being were measured by most indicators and when positive constructs were measured, we put opposite signs to their z-scores

Appendix 6. Safety Index of Child Well-being for North Carolina Counties

County	Z-score	County	Z-score	County	Z-score	County	Z-score	County	Z-score
Camden	−1.496	Surry	−0.556	Buncombe	−0.214	Tyrrell	0.118	Guilford	0.497
Polk	−1.098	Perquimans	−0.552	Cherokee	−0.210	Pasquotank	0.121	Richmond	0.506
Davie	−1.074	Randolph	−0.523	Iredell	−0.201	Martin	0.135	Rutherford	0.509
Wake	−0.879	Cabarrus	−0.471	Clay	−0.165	Forsyth	0.146	Pitt	0.562
Watauga	−0.862	Davidson	−0.444	Harnett	−0.151	Beaufort	0.205	Columbus	0.604
Caswell	−0.859	Pender	−0.406	Burke	−0.148	Person	0.208	Mecklenburg	0.619
Orange	−0.836	Pamlico	−0.398	Craven	−0.124	Rowan	0.231	Vance	0.653
Ashe	−0.776	Henderson	−0.376	Alleghany	−0.099	Lee	0.245	McDowell	0.655
Currituck	−0.735	Alexander	−0.364	Rockingham	−0.078	Warren	0.266	Wilson	0.682
Yancey	−0.717	Madison	−0.360	Greene	−0.065	Sampson	0.278	Wayne	0.694
Union	−0.709	Stanly	−0.353	Moore	−0.059	New Hanover	0.301	Graham	0.739
Hyde	−0.674	Avery	−0.341	Stokes	−0.052	Montgomery	0.302	Anson	0.985
Chatham	−0.651	Carteret	−0.330	Dare	−0.052	Northampton	0.303	Nash	1.053
Jones	−0.634	Granville	−0.324	Alamance	−0.044	Onslow	0.318	Swain	1.171
Johnston	−0.622	Haywood	−0.272	Duplin	−0.041	Wilkes	0.343	Edgecombe	1.197
Yadkin	−0.621	Caldwell	−0.243	Brunswick	−0.036	Washington	0.388	Cumberland	1.238
Franklin	−0.619	Lincoln	−0.236	Bladen	−0.001	Durham	0.396	Lenoir	1.301
Hertford	−0.594	Hoke	−0.235	Mitchell	0.027	Gaston	0.400	Scotland	1.342
Bertie	−0.576	Gates	−0.228	Jackson	0.034	Chowan	0.406	Halifax	1.380
Macon	−0.561	Transylvania	−0.220	Catawba	0.053	Cleveland	0.492	Robeson	2.460

- Safety index consists of four indicators such as violent crime rate, child abuse & neglect rate, delinquency rate, and homicide rate
- Counties were ordered from low to high scores, based on their z-scores
- A lower z-score indicates a higher status of child well-being in safety because only negative constructs of child well-being were measured

Appendix 7. Education Index of Child Well-being for North Carolina Counties

County	Z-score	County	Z-score	County	Z-score	County	Z-score	County	Z-score
Watauga	−1.826	Buncombe	−0.693	Alexander	−0.208	Alamance	0.147	Lenoir	0.572
Dare	−1.286	Catawba	−0.686	Macon	−0.193	Randolph	0.190	Nash	0.632
Carteret	−1.254	Currituck	−0.671	Mitchell	−0.161	Cumberland	0.214	Franklin	0.649
Polk	−1.161	Yancey	−0.642	Cleveland	−0.149	Swain	0.261	Durham	0.666
Henderson	−1.069	Surry	−0.636	Caldwell	−0.142	Wayne	0.267	Jones	0.746
Union	−1.042	Johnston	−0.606	Hyde	−0.135	Scotland	0.301	Pitt	0.803
Wake	−1.020	Pender	−0.558	Chatham	−0.110	Person	0.312	Edgecombe	0.998
Camden	−1.002	Haywood	−0.556	Brunswick	−0.065	Beaufort	0.326	Sampson	1.009
Iredell	−0.948	New Hanover	−0.548	Rowan	0.002	Gaston	0.342	Bladen	1.040
Burke	−0.932	Craven	−0.526	Forsyth	0.016	Rutherford	0.353	Northampton	1.175
Clay	−0.921	Cabarrus	−0.525	Mecklenburg	0.025	Perquimans	0.372	Anson	1.180
Graham	−0.907	Davidson	−0.502	Madison	0.036	Rockingham	0.396	Robeson	1.216
Transylvania	−0.894	Avery	−0.493	Stanly	0.046	Gates	0.398	Hoke	1.243
Tyrrell	−0.873	Lincoln	−0.479	McDowell	0.052	Richmond	0.421	Greene	1.254
Moore	−0.821	Ashe	−0.462	Jackson	0.056	Granville	0.446	Hertford	1.377

County	Z-score	County	Z-score	County	Z-score	County	Z-score	County	Z-score
Alleghany	−0.807	Stokes	−0.333	Lee	0.066	Duplin	0.509	Bertie	1.432
Cherokee	−0.779	Guilford	−0.310	Martin	0.074	Chowan	0.516	Vance	1.498
Pamlico	−0.770	Yadkin	−0.303	Harnett	0.079	Wilson	0.521	Warren	1.578
Davie	−0.726	Onslow	−0.297	Pasquotank	0.106	Columbus	0.526	Washington	1.813
Orange	−0.718	Wilkes	−0.284	Montgomery	0.125	Caswell	0.531	Halifax	2.117

- Education index consists of four indicators such as high school dropout rate, combined (reading and math) proficient rates for third grade students, combined (reading and math) proficient rates for eight grade students, and SAT score

- Counties were ordered from low to high scores, based on their z-scores

- A lower z-score indicates a higher status of child well-being in education because when positive constructs were measured (i.e., proficient rates and SAT score), we put opposite signs to their z-scores to be consistent with the other negative indicator (i.e., dropout rate)

Appendix 8. Economic Well-being Index of Child Well-being for North Carolina Counties

County	Z-score	County	Z-score	County	Z-score	County	Z-score	County	Z-score
Wake	−2.036	Granville	−0.624	Alamance	−0.279	Swain	0.315	Hertford	0.753
Union	−1.824	Guilford	−0.606	Pender	−0.257	Hyde	0.320	Alleghany	0.765
Camden	−1.816	Lincoln	−0.606	Cumberland	−0.231	Surry	0.329	Chowan	0.801
Currituck	−1.772	Yadkin	−0.594	Rowan	−0.222	Sampson	0.338	Montgomery	0.902
Orange	−1.746	Forsyth	−0.594	Clay	−0.167	Burke	0.368	Columbus	0.996
Cabarrus	−1.432	Gates	−0.579	Brunswick	−0.147	Duplin	0.382	Cherokee	1.001
Chatham	−1.386	Stanly	−0.576	Gaston	−0.122	McDowell	0.393	Anson	1.162
Dare	−1.337	Stokes	−0.573	Caldwell	−0.071	Caswell	0.413	Tyrrell	1.222
Mecklenburg	−1.164	Polk	−0.551	Madison	−0.060	Cleveland	0.427	Graham	1.238
Davie	−1.136	Davidson	−0.538	Nash	−0.025	Yancey	0.445	Warren	1.283
Johnston	−1.070	Transylvania	−0.519	Lee	−0.017	Rutherford	0.472	Washington	1.318
Iredell	−1.017	Alexander	−0.495	Wayne	0.009	Perquimans	0.474	Richmond	1.338
New Hanover	−0.980	Franklin	−0.490	Pasquotank	0.032	Mitchell	0.490	Bertie	1.340
Watauga	−0.971	Jackson	−0.426	Pamlico	0.067	Wilson	0.494	Bladen	1.485
Durham	−0.938	Catawba	−0.408	Pitt	0.087	Jones	0.507	Robeson	1.590
Carteret	−0.931	Randolph	−0.390	Hoke	0.135	Martin	0.609	Halifax	1.627
Buncombe	−0.870	Craven	−0.380	Rockingham	0.151	Beaufort	0.618	Northampton	1.629
Henderson	−0.825	Haywood	−0.374	Macon	0.172	Greene	0.635	Vance	1.714
Moore	−0.746	Harnett	−0.315	Avery	0.203	Lenoir	0.711	Edgecombe	1.741
Onslow	−0.723	Person	−0.304	Ashe	0.204	Wilkes	0.715	Scotland	1.836

- Economic well-being index consists of four indicators such as unemployment rate, free/reduced lunch rate, poverty rate, and median household income

- Counties were ordered from low to high scores, based on their z-scores

- A lower z-score indicates a higher status of child well-being in the economic well-being domain because negative constructs of child well-being were measured by most indicators, and when positive constructs were measured (i.e., median household income), we put opposite signs to their z-scores to be consistent with other negative indicators

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