THE IMPACT OF SPATIAL AND ECONOMIC INEQUALITY ON THE ORAL HEALTH OF CHILDREN IN APPALACHIA

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Abstract

Spatial and economic inequality has the potential to impact the oral health care of children. This study examined the relationship of high and low capacity rural, Appalachian counties in Ohio and the oral health of children in these areas. A survey was conducted by the Bureau of Oral Health Services (BOHS), and the subjects were Ohio third-grade students. Four rural, Appalachian counties were examined in this study; two were considered high capacity and two considered low capacity. Data concerning the inability of children to receive needed dental care and the presence of untreated decay was analyzed. The preceding analyses yielded some significant results. In the 2004-05 and 2009-10 academic years, the percentage of children within Appalachian counties that could not get needed dental care significantly differed by enrollment in Free/Reduced Price Meal Program. During both academic years, the percentage of children enrolled in Free/Reduced Price Meal Program significantly differed by county capacity. During both academic years, enrollment in Free/Reduced Price Meal Program is associated with the presence of untreated decay for both high and low county capacities. In the 2004-05 academic year, the difference between this association level for high and low capacity was determined to be statistically significantly different. In the 2009-10 academic year, the percentage of children that could not get needed dental care significantly differed by county capacity. During both academic years, the percentage of children that had untreated decay significantly differed by county capacity. In conclusion, low economic standing and low county capacity within rural Appalachia appears to negatively impact both ability for children...
to get needed dental care and the presence of untreated decay. The findings of this study warrant further exploration of contributing factors.
Introduction

Social inequality is an important subject because of its implications for people. Max Weber claimed that social inequality impacts people’s life chances, but in addition it also has affects on their families and society as a whole (1978). In the past, sociologists tended to not give much attention to the role of geographic location in understanding social structure and inequality (Lichter & Campbell, 2005). However, there are various and interlocking dimensions of inequality that impact and influence each other creating chain reactions, including location. Recently, this factor has increasingly been recognized as a component of social status in that it affects available resources. Most of this research however has focused on urban locations (Tickamyer, Henderson, & Tadlock, 2007). Because urban and rural areas differ in social structure, it is important to devote adequate attention to both locales. Appalachia is an ideal rural region to examine as one can study several forms of inequality simultaneously (Lichter & Campbell, 2005). That is, there are economic, educational, structural, and resource differences present within and between the Appalachian region. For example, poverty is more concentrated in some Appalachian counties than others (Lichter & Campbell, 2005).

We know some of the ways in which social inequality affects people, including education, employment, inadequate food and housing and, at the most basic level, health (Amato & Zuo, 1992; Duncan, 1999; Seccombe, 2007). Research findings make it clear that health is not only related to individual social status, but also appears to be related to spatial inequality, the association of where people live and their
economic status (Amato & Zuo, 1992). Research further shows that the Patient Protection and Affordable Care Act (PPACA) focuses on rural regions (Mueller, 2010). But it is necessary to determine the particular needs of those facing rural inequality, and Appalachia serves as an ideal model to accomplish this because of the many precursors to poor health (low income, limited education, geographic isolation) that exist within this region (Behringer & Friedell, 2006). Research finds urban poor report a higher level of health than the rural poor and demonstrates that poverty is not a homogeneous experience (Amato & Zuo, 1992).

Research indicates that poor childhood socioeconomic conditions have a negative effect on the physical well-being of children (Amato & Zuo, 1992). Because this particular age group is dependent on others, and they cannot alter their situations by themselves, they carry the heaviest burden of social and spatial inequality. The effects of poverty on children can be far-reaching and devastating within a number of areas, including health. Seccombe confirms, “Poor children suffer from a variety of ailments at higher rates than do more affluent children” (2007, p. 54). Indeed, their health is particularly at risk, as their bodies and minds need adequate nourishment and care to thrive (Seccombe, 2007). Overall, children in urban poverty are perceived to be in better health than children in rural poverty (Amato & Zuo, 1992).

One component of health that is often overlooked is oral health, and there are severe consequences of unmet dental care needs. Access to dental care varies greatly between urban and rural areas, and this disparity is intensified by poverty (Oral Health and Access to Dental Care for Ohioans, 2010). The interlocking and chain reaction
nature of poverty in this aspect is further intensified by the fact that oral health is in direct relation to overall health. Poor oral health can lead to such problems as diabetes, diseases, and conditions of the heart and lungs (Oral Health and Access to Dental Care for Ohioans, 2010). These health problems can lead to a loss of time at school for children who are already suffering from the achievement gap that places them educationally behind their more advantaged peers (Teach for America, 2011), and at work for parents, furthering their impoverished situation. The number one unmet health care need for children is dental care and children residing in Appalachian counties are more likely to go untreated (Oral Health and Access to Dental Care for Ohioans, 2010). Despite all this information, we still do not have a clear answer to how “rurality” impacts oral health care for children and the possible policy solutions available.

RESEARCH QUESTION AND APPROACH

Given the interlocking nature of rural poverty, in which every problem magnifies the impact of the others, the oral health of children has the potential to create a problem, which could in turn intensify another. To better understand the oral health of children in rural poverty, and make significant contributions to the current health care reform initiative and its impact on families enduring economic hardships in rural communities, it is necessary to complete a substantial research project.

The focus of this study is an examination of the effect of geographic and economic inequality on oral health care for children. In particular, this research involved secondary data analysis to determine children’s access to quality oral health
care in four Appalachian counties. In order to evaluate whether, and if so to what extent, geographic and economic inequality affects oral health care quality and access, the counties in the study encompassed four rural counties, two of which are of high capacity with high social and economic indicators and two are low capacity with low social and economic indicators. The determination of county capacities came from a welfare reform study completed by Tickamyer et al. (2007). Once the four counties of this study were determined, secondary data on variables related to the access and quality of oral care for children in this region were evaluated.

The data for analysis of oral health care quality and access came from the Ohio Department of Health (ODH). Due to the multiple variables that will be taken into account, several statistical analyses were completed to determine the significance of location and economic standing in oral health care quality and access. This analysis will provide insight into the components involved in the oral health of children in rural poverty.

In addition to the analysis of ODH data, a policy recommendation component was completed. An analysis of the current health care reform policy, the PPACA, was carried out to examine the factors potentially impacting oral health care for children in impoverished rural areas. This research addressed the limitations of the health care reform policy by offering sound recommendations for future policy reforms to effect oral health care for children.
SIGNIFICANCE

Due to the nature of poverty, the oral health of children carries the possibility of creating a problem, which could in turn intensify another one, especially in an area such as Appalachia where many resources are lacking. To complete an evaluation of the oral health of children in Appalachia, and make significant contributions to the health care reform initiative and its impact on families enduring economic hardships in rural communities, it is necessary to analyze substantial research data. Studying the geographic, economic, and health components associated with inequality separately is important, because understanding the parts is critical to furthering our understanding how those parts fit together to create the current and future system. While most current studies do not differentiate between the specific oral health issues in urban and rural populations, studies must be designed to examine the often overlooked poor rural Appalachian communities as there is a lack of research concerning health care in this area (Behringer & Friedell, 2006). This work will advance our understanding of the significance of oral health as a part of the interlocking nature of poverty and inform the creation of current and future health care policies. Overall, this work has the potential to serve as an impetus for policy makers to create the comprehensive policies needed to battle poverty and its health care consequences.
Literature Review

This literature review explores the four dominant themes of the research questions: social inequality, spatial inequality, and impact on well-being and oral health care. While oral health care is the social issue being examined in this particular research project, the scope of this literature review is expanded to include research that examines the dominant themes of the research questions, regardless of the specific social issue.

SOCIAL INEQUALITY

Our society is marked by inequality, with some people having more resources than others. This unequal distribution of valued resources such as wealth, schooling, and health care is known as social stratification and it is defined by a hierarchy in which society ranks categories of people (Thorbecke & Charumilind, 2002). The patterned inequality of social stratification indicates that the unequal distribution of resources occurs on a wide-scale basis and regularly along the lines of these hierarchical categories. Indeed, social stratification is a characteristic of society and is not just due to individual talent and abilities when it comes to the distribution of resources, including income, education, health, and power. Access to these resources for people depends heavily on the categories in which they fall such as race/ethnicity, gender, class, and status (Thorbecke & Charumilind, 2002). The determination of what categories or individuals are socially advantaged is based in part on these certain, identifiable characteristics and also on how society values or devalues such characteristics (Thorbecke & Charumilind, 2002). If we know whether a group or an
individual possesses or does not possess certain traits, then we are able to predict
where this group or individual falls in the social hierarchy. This is an important area
of concern because it affects people’s lives and can be manifested in various ways in society.

Because of patterned inequality, social stratification affects people’s life
chances, or opportunities that individuals have to engage in certain activities, and the
opportunities that they have to accomplish certain goals simply because of where they
are located in the social hierarchy (Thorbecke & Charumilind, 2002). For example,
intelligent children born into wealthy families will have opportunities for schooling
and activities that intelligent children born into impoverished families may not have.
The determination of such life chances provides some people with advantages over
others, which can lead to conflict and friction throughout society (Thorbecke &
Charumilind, 2002). This point of view was taken by Karl Marx, who criticized
capitalist societies for defending the belief that wealth, power, and prestige belonged
in the hands of a few (Marx & Engels, 1848). Marx concluded that social institutions,
such as the government and the economy, combine to support such elite, allowing
social stratification to exist and remain (Marx & Engels, 1848). This philosophy had a
significant influence on sociological thinking in terms of inequality.

Max Weber was one sociologist who was influenced by Marx’s philosophy.
Weber agreed with Marx that a capitalist society is class-based and that social
stratification causes conflict and friction, however Marx’s dichotomous class
distinction of the haves and have-nots was too limiting for Weber (Marx & Engels,
Weber believed that social inequality is much broader than economics and involves multiple dimensions of stratification, including class, status, and power (1978). One of the dimensions, class, is determined mainly by economic standing or wealth, and Weber did not think of classes as well-defined categories, but rather as a continuum ranging from high to low (1978). Weber did not view prestige and power as simple reflections of economic standing but treated them as distinct dimensions of structural stratification. Weber noted that the three dimensions he outlined were often not very consistent with one another in modern society (1978). For example, a local government official may exercise great power but have a low economic class position. Weber characterized inequality in modern society as a multidimensional ranking rather than a hierarchy of rigidly defined classes (1978). In line with Weber’s model, social scientists today use the term socioeconomic status (SES) to refer to a ranking based on a combination of various dimensions of social inequality, such as education, income, type of occupation, place of residence, ethnicity, and religion (Gould, 2002).

It is especially important to examine SES during at the present time as inequality has increased recently in the United States (Seccombe, 2007). Although many people think of the United States as a middle-class society, this may not necessarily be the case (National Opinion Research Center, 2005). In reality, wealth and its opportunities remain in the hands of a few while the rest struggle with the hardships of poverty and making ends meet. Not only do the wealthy have most of the money, but they also receive the best and most schooling, enjoy higher levels of health, and consume the most goods and services (Thorbecke & Charumilind, 2002).
Such privilege contrasts sharply with the poverty of millions of people who have to decide between paying next month’s rent or a doctor’s bill when their child becomes ill (Seccombe, 2007). This social stratification can be determined by a number of variables, each of which can cause someone to be advantaged or disadvantaged compared to others in society. It is not necessarily the impact of any one variable in the U.S. that leads to stratification, but a combination of related factors that determines how one succeeds in society.

**SPATIAL INEQUALITY**

One of the factors that can lead to inequality includes geographic location. Spatial inequality, or geographic inequality, is the association between where people live and their status, which is the social position one holds. In the past, sociologists have ignored the role of place in their study of inequality (Lobao, Hooks, & Tickamyer, 2007). Still, spatial inequality is a dimension of overall inequality and it has added significance when geographic divisions align with social and economic tensions to undermine the stability of that region in terms of economics, politics, education, and health (Lobao et al., 2007). These resources and their associated status are often consequences of where one lives as certain levels of and opportunities for wealth, political power, education, and health accompany certain geographic locations. Once groups of people are allocated these certain levels of and opportunities for such resources, these resources turn out to also determine where one is able to live by not necessarily providing residents the means to leave. The lack of choice that can be present in one’s geographic location shows the interlocking nature of inequality, and
the significant role this particular matter of location can have as a dimension of inequality. Therefore, it is necessary to examine the literature on spatial inequality to learn what we know and do not know about the causes of spatial inequality, so we are able to determine solutions to its concerning consequences.

The goal of Lobao, Hooks, and Tickamyer (2007) was to bring focus to the significance place has on social inequality. In order to bring focus of space into social inequality research, Lobao et al. suggest distinguishing between place-in-society and society-in-place approaches. Place-in-society is concerned with what a specific place reveals about broader societal processes, and society-in-place concentrates on how societal processes are carried out across places (Lobao et al., 2007). Leicht and Jenkins (2007) contribute to the society-in-place approach by examining spatial inequality through political sociology. Leicht and Jenkins argue that subnational or lower levels of government, such as the state and county, now have a significant part in public policy and poverty due to the recent trend of “new federalism,” where specific policy areas are becoming more and more regionalized (2007, p.78). State and county levels of government have largely become responsible for making and implementing social welfare and economic development policies in ways that are specific to their region (Leicht & Jenkins, 2007). Due to this trend, spatial inequality has become more regional in nature because the poor are less protected by a centralized, federal government and the lower levels of government vary in capacity and ideology when it comes to carrying out social and economic policies (Leicht & Jenkins, 2007). Leicht and Jenkins focus on one of the actors and institutions
responsible for allocating inequalities, the state. As political sociologists, they emphasized using the state and county level of government to examine questions related to subfields of inequality affected by place, such as education and health. Sociologists need to give more attention to how programs and policies affect regional well-being.

Tickamyer et al. (2007) narrow this critical evaluation of the spatial distribution of social inequality, by focusing on the effect of place on welfare reform. Tickamyer et al. argue and present evidence that welfare reform differs between rural and urban regions (2007). They explain that rural areas lack the necessities, including employment opportunities, social services, human and social capital, and infrastructure to facilitate progress for successful welfare reform, whereby recipients move into the labor market (2007). Tickamyer et al. take this a step further by examining the variation within a rural area, Appalachia in particular (2007). Additionally, they outline the large differences in the pertinent resources from locale to locale within the area, such as jobs, human and social capital, and infrastructure, to determine the local capacity to implement and carry out welfare programs (2007). The principles and facts presented by Tickamyer et al. (2007) can be applied to an extent to other social programs, such as education and health care.

As recognized by Tickamyer et al. (2007), Appalachia is an ideal area to examine the influence of place on inequality. The Appalachian region now includes 406 counties in 13 states in the eastern United States (New York, Pennsylvania, Ohio, West Virginia, Maryland, Virginia, Kentucky, Tennessee, North Carolina, South
Appalachia is commonly recognized as a highly rural, under-developed, and impoverished region and, in fact, has lagged behind the rest of the nation on a number of significant indicators, including education, health care, and income (Lichter & Campbell, 2005). The isolated location of many areas within Appalachia contributes to the rural, under-developed nature of much of the region. However, the region is not homogeneous with respect to socioeconomic status or rurality. While many counties in Appalachia have had significantly lower levels of educational attainment, lower per capita incomes, higher rates of poverty, and reduced access to health care resources compared to counties outside the region, there are also significant social and economic differences within Appalachia (Lichter & Campbell, 2005). These differences are evident when comparing and contrasting the rural communities within Appalachia and the metropolitan areas in the region that typically have more stronger economies, higher per capita incomes, and greater access to health care than non-metropolitan areas in the region (Lichter & Campbell, 2005).

**HEALTH CARE**

Amato and Zuo acknowledge the effect that economic inequality can have on personal well-being (1992). Although narrowly focusing on poverty instead of inequality as a whole, Amato and Zuo argue most studies have concentrated on urban poverty rather than rural poverty (1992). Additionally, Amato and Zuo recognize the consequences of poverty on individual health. Their research finds that urban poor report a higher level of health than the rural poor thus demonstrating that poverty is
not a homogeneous experience (Amato & Zuo, 1992). Although not discussed in the article, the findings have policy implications in providing appropriate and distinct care to rural areas. Amato and Zuo also do not offer details concerning the health consequences of childhood poverty.

While poverty affects an entire family, undoubtedly children carry the heaviest burden. Millions of impoverished children in the United States live in rural areas (Shobe & Boyd, 2003). When compared with children from more affluent families, poor children are more likely to have low academic achievement, to drop out of school, and to have health, behavioral, and emotional problems (Moore, Redd, Burkhauser, Mbwana, & Collins, 2009). A research brief produced by Child Trends in 2009 draws on Census data and finds that poor children are more likely to be of low birth weight, die in the first month of life and experience food insecurity which “includes not having enough to eat, having a diet that is inadequate, and having parents who worry about being able to afford the amount and type of food that a household needs” (Moore et al., 2009, p. 5). Additionally, poor children experience higher rates of accidents and injuries than children who are not living in poverty.

While the research relates childhood poverty to substandard nutritional status, it also reports that poverty has an impact on poor motor skills, as well as high levels of obesity, asthma, and anemia (Moore et al., 2009). The brief relates health problems associated with poverty during early childhood to developmental problems in later life, including problems in the achievement, cognitive, language, social-emotional, and physical domains (Moore et al., 2009). Moreover, the research moves beyond
childhood and explains that adolescents living in poverty are more likely to get involved in risky and health-compromising behaviors, such as smoking or engaging in early sexual activity (Moore et al., 2009). The brief notes, “There are many possible pathways by which poverty can affect health” (Moore et al., 2009, p. 6).

One pathway that is of concern in the Appalachian region is accessibility to health care, which is a social capital problem (Blakeney, 2006). Traditionally in the U.S., social capital, such as health care, is a private provision, meaning an individual’s health insurance depends on their income and economic standing (Blakeney, 2006). This causes interrelatedness between health care and employment in specific regions. As we know from previous research, the economy and employment opportunities in Appalachia are of concern as they lead to poor health care (Blakeney, 2006). In addition to the private provision of health care through employers being an issue in Appalachia, there is an issue with the public provision of care in this region.

Medicaid is a federal, public provision of health care that is administered at the state-level, making political culture within a region an important factor (Blakeney, 2006). Appalachian states such as Kentucky and West Virginia are in need of improved access to health care. However, due to the political culture of these states, their Medicaid benefits are ironically ungenerous. As Leicht and Jenkins (2007) pointed out, political culture, or ideology, differ from place to place. The traditional political cultures in Kentucky and West Virginia place value on the government maintaining social order rather than redistributing resources (Mead, 2004). This
makes it difficult for such states to agree on generous Medicaid benefits despite their levels of need.

In an attempt to combat the issue of access to care, the Appalachian region has received federal funding to establish and maintain community health centers (Blakeney, 2006). These are nonprofit centers created to provide care for the uninsured and underserved populations of an area. Community health centers often employ general practitioners and nurses instead of the specialized doctors that are all too often unavailable in Appalachia (Blakeney, 2006). Recruitment of such specialized medical professionals is another area of concern for Appalachian health care. One of the contributing factors to this issue is the education that is available for medical professionals in the region. The lack of training for medical professions throughout the region makes it difficult for professionals to gain specific knowledge of the region and its people (Blakeney, 2006). These professionals receive training in the medical field but not the cultural and economic issues of the regions that need them the most. Rather than simply transferring the training they received in other areas to Appalachia, medical professionals in Appalachia need adapt to the region and be aware of the region’s language and political and economic system in order to provide effective care to their unique patients (Blakeney, 2006). Uninformed medical professionals may misconstrue the lack of resources and experience people in Appalachian have with the medical field as not trying hard enough to take care of themselves. In order to improve health care in Appalachia, it must be realized that urban solutions, such as profit-motivated health services, and insurance programs
modeled after managed care organizations (Kentucky Appalachian Task Force, 1995), are not the best when it comes to addressing rural problems.

**ORAL HEALTH CARE**

One component of health care that is often overlooked is oral health, and there are severe consequences of unmet dental care needs. Access to dental care varies greatly between urban and rural areas, and this disparity is intensified by poverty (Oral Health and Access to Dental Care for Ohioans, 2010). The interlocking and chain reaction nature of poverty in this aspect is further intensified by the fact that oral health is in direct relation to overall health. Poor oral health can lead to such problems as diabetes, diseases, and conditions of the heart and lungs (Oral Health and Access to Dental Care for Ohioans, 2010). These health problems can lead to a loss of time at school for children who are already suffering from the achievement gap that places them educationally behind their more advantageous peers (Teach for America, 2011), as well as loss of time at work for parents, furthering the impoverished situation of the family. The number one unmet health care need for children is dental care, and children residing in Appalachian counties are more likely to go untreated (Oral Health and Access to Dental Care for Ohioans, 2010). Despite all this information, we still do not have a clear answer as to how and why children of rural Appalachia are negatively impacted regarding oral health care and the possible policy solutions.

Oral health problems and trends that arise and appear in Appalachia have been documented and reveal some disturbing realities. Dental disease, such as tooth decay and untreated cavities, remains a persistent problem in Appalachian counties,
particularly among children (Make Your Smile Count, 2007). It is important to acknowledge the oral health problems experienced by Appalachian children if policies and programs are to be created to improve the future prospects in terms of success for the children of the region. Children in Appalachian counties are far more likely to suffer from tooth decay than children living in other areas (Make Your Smile Count, 2007). In fact, children of Ohio Appalachian counties experience tooth decay at a 50 percent higher rate than children in other areas of Ohio (Oral Health Isn’t Optional, 2011). This demonstrates the inequality that exists between Appalachian and non-Appalachian areas that remains unnoticed by the public and policy. Additionally, tooth decay all too often goes without proper care and results in untreated cavities. Children from Appalachia have significantly more untreated cavities compared to children of other areas (Make Your Smile Count, 2007). In Ohio, children in Appalachian counties have a disproportionately higher prevalence of untreated cavities at 27 percent compared 17 to 18 percent in other Ohio counties and the national standing at 21 percent (Oral Health Isn’t Optional, 2011). This difference in the rate of untreated cavities in Appalachian Ohio compared to the national objective shows that this cannot only be a state concern, but a national one as well. This grave disparity shows that the Appalachia area needs national support to combat this issue. The oral health of all children must be made a national priority in order to combat this serious issue as Appalachian counties are not just lagging behind in treatment compared to the non-Appalachian counties in their respective states, but also behind the rest of the nation (Oral Health Isn’t Optional, 2011).
Another example of the lack of proper care being delivered and available to Appalachian children is the presence of early or urgent dental needs. Due to high levels of untreated dental issues, children in Appalachian counties are more likely to require an early or urgent visit to the dentist (Make Your Smile Count, 2007). Once again, children in Appalachian counties of Ohio have higher rates of dire dental needs at 27 percent compared to the 16 to 18 percent of children in other regions of Ohio (Oral Health Isn’t Optional, 2011). The lack of routine dental care being delivered to this population is not improving compared to other Ohio counties and is leading to serious dental concerns that remain untreated by medical professionals (Oral Health Isn’t Optional, 2011).

The dental care that is being provided to Appalachian children is reactive in nature and not the proactive care that is truly needed. This is exemplified by the prevalence of dental sealants among children living in Appalachian counties. Children in Appalachian regions are much more likely to have dental sealants placed on their teeth to prevent tooth decay and cavities (Make Your Smile Count, 2007). In Ohio, 58 percent of third graders in Appalachia have one or more dental sealants compared to the overall 50 percent of Ohio third graders and the other Ohio counties (41 percent of rural, non-Appalachian counties; 51 percent in metropolitan counties; and 52 percent for suburban counties) (Oral Health Isn’t Optional, 2011). Often times these dental sealants are made available to children through public programs that provide the procedure at the child’s school (Make Your Smile Count, 2007). The programs service second and sixth grade students because they are most likely to have incoming
molars at these ages. Additionally, these programs target schools with 40 percent or more students eligible for the Free and Reduced Price Meal Program. Such programs operate in 50 of Ohio’s 88 counties, most of which are Appalachian (Oral Health Isn’t Optional, 2011). Although six Appalachian counties in Ohio do not have a sealant program in place, these programs are still quite prevalent in Appalachia as children from these counties are at a higher risk for tooth decay and do not have access to regular dental care (Oral Health Isn’t Optional, 2011). The increase of these programs coincides with a decrease in untreated decay. These dental sealant programs are serving as an alternative to accessible, regular dental care in the Appalachian region. Despite fewer children experiencing cavities as these programs have increased, ODH reminds us that “disparities in the oral health of Ohio’s children continue to exist depending on where they live, their families’ income and whether they have dental insurance” (Oral Health Isn’t Optional, 2011, p. 5). While these programs are a step in the right direction, they do not get at the root of why tooth decay and cavities are so problematic in Appalachia.

Lack of treatment for oral diseases, such as cavities, is not the only aspect of dental care being unmet in Appalachia. There are also significant disparities in orthodontic care that affect people in this region. Martin, McNeil, Crout, Ngan, Weyant, Heady, and Marazita (2008) find that, while adolescents in Appalachia are similar to the general population of adolescents nationally in terms of orthodontic treatment history and the need of orthodontic care, their parents were considerably worse off in such orthodontic care and status measures – including the degree of
dentulism, or tooth loss, history of orthodontic treatment, unmet need, and demand for care. This disparity between these Appalachian adolescents and their parents may be because Medicaid coverage in many states only includes orthodontic care for minors, but not adults (El-Gheriani, Ehrmantrout, Oesterle, Berg, & Wilkerson, 2007). This suggests that once these adolescents are adults, they could face these same issues as their parents. Although the orthodontic status of adolescents in Appalachia is promising, the status of their parents suggests possible future problems for adolescents in the region. Martin et al. find that adolescents in the Appalachian region, like their parents, have a lower recognition of need for treatment compared to the rest of the population (2008), which suggests the possibility that they will encounter future problems similar to those faced by their parents. Considering that the need for orthodontic care among parents in Appalachia has the potential of being repeated by their children as they grow up, and the disturbing childhood dental disease trends already present, the current and future oral health Appalachian children is a concern that must be addressed. In order to appropriately address the extent and severity of common oral diseases and the concerning irregularity of care in the Appalachian region, the reasons behind the oral health status and care disparities between and within this region and elsewhere must be understood.

Good oral health is an essential component to good overall health, but there are many Americans that have unmet health care needs. The Institute of Medicine explains, “In 2008, 4.6 million children – 1 out of every 16 children in the United States – did not receive needed dental care because their families could not afford it”
(Improving Access to Oral Health Care, 2011). While the majority of U.S. children routinely obtain routine oral health care, this routine care eludes children that are a part of vulnerable and underserved populations, including Appalachian residents. Access to oral health care is limited by a variety of social, cultural, economic, structural, and geographic factors (Improving Access to Oral Health Care, 2011). This lack of access contributes to the significant oral health disparities between children in Appalachia and elsewhere as well as within the region.

Geography is a major factor in the lack of access to oral health care in Appalachia. In Ohio, the problem does not lie in the number of dentists, but rather, the geographic location of dental offices and the willingness of dentists to treat low-income patients (Oral Health Isn’t Optional, 2011). This suggests that access to oral health care is an interrelated component to poverty and a reflection of a region’s employment and economic prospects. Sixty-nine of Ohio’s 88 counties (78 percent) are below the state primary care dentist to population ratio of one dentist to 2,093 persons (Oral Health Isn’t Optional, 2011). The Ohio counties with the worst ratios are mostly in the Appalachian region of the state. Twenty-five of the 30 counties within the area (over 83 percent) have a ratio of one dentist to every 3,001 or more persons (Oral Health Isn’t Optional, 2011). A concerted effort must be made to recruit dentists and entice them to the Appalachian area. This is especially obvious when you compare non-Appalachian, metropolitan counties to Appalachian counties in Ohio. In Cuyahoga County, a non-Appalachian, metropolitan county, there is one dentist for every 1,473 persons. However, in Hocking County, which is an Appalachian county
there is one dentist for every 9,637 person, and Noble County, which is also an Appalachian county, does not currently have a dentist (Oral Health Isn’t Optional, 2011). When discussing dentists in Appalachia, the dentists’ willingness to treat low-income patients must also be considered.

In Ohio, an alternative to traditional dental offices for low-income patients is safety net dental clinics which are funded by ODH and provide care to all patients regardless of their ability to pay (Oral Health Isn’t Optional, 2011). However, most of Ohio’s safety net dental clinics are located in non-Appalachian, metropolitan counties where dentist to population ratios are the lowest (Oral Health Isn’t Optional, 2011). This suggests that there is an unwillingness of dental health practitioners to treat low-income patients and locate to rural areas, such as Appalachia. The logistical issues, such as low reimbursement rates and administrative challenges, that dentists experience with this program result in relatively few dentists willing to participate, and most of the dentists willing to participate are not located in the Appalachian region (Oral Health Isn’t Optional, 2011). In fact, only 28 percent of safety net dental clinics are in Appalachian and rural counties (Oral Health Isn’t Optional, 2011). The location of these safety net dental clinics means long travel times and other associated expenses, such as absence from work and costs of travel, that make it difficult for people from Appalachian areas to get dental care.

Aside from geographic and economic factors that limit oral health care access, there are also social and cultural barriers to good oral health that affect Appalachian children. The lower oral health quality in Appalachia is made cyclical in nature by the
lack of education and experience residents have with medical treatment. Martin et al. (2008) find that parents and children in the region have a lower recognition of need for treatment. This suggests the possibility of future oral health problems for these children as they follow the cyclical pattern of their parents, who lack the funds and the knowledge necessary to make the appropriate decisions for their children in terms of oral health care. The geographic, economic, structural, social, and cultural barriers to oral health care outlined above call for area-specific solutions, which means not only comparing the Appalachian region to other areas but also comparing areas within the Appalachian region.

The purpose of this research is to examine the effect of geographic and economic inequality on oral health care for children. In particular, this research will involve secondary data analysis to determine children’s access to quality oral health care in four Appalachian counties. In order to evaluate whether, and if so to what extent, geographic and economic inequality affects oral health care quality and access, the counties in the study encompass four rural, Appalachian counties, two of which will be of high capacity (higher social and economic indicators) and two will be low capacity (lower social and economic indicators). In the following section, the methods used to evaluate the access to oral health care and oral health status for children in these areas will be discussed.
Methods

Given the interlocking nature of rural poverty, in which every problem magnifies the impact of the others, the oral health of children has the potential to create a problem, which could in turn intensify another. To better understand the oral health of children in rural poverty, and make significant contributions to the current health care reform initiative and its impact on families enduring economic hardships in rural communities, it was necessary to complete a substantial research project. The focus of this study was to examine the effect of geographic and economic inequality on oral health care for children.

This research involved secondary data analysis to determine children’s access to quality oral health care in four Appalachian counties. In order to evaluate whether, and if so to what extent, geographic and economic inequality affects oral health care quality and access, the counties in the study encompassed four rural counties, two of which are of high capacity (higher social and economic indicators) and two are low capacity (lower social and economic indicators). The determination of the capacity level of each of these counties came from a study completed by Tickamyer et al. (2007). Once the four counties of this study were determined, secondary data on variables related to the access of oral care and the oral health status for children in this region were evaluated.

The data for analysis of oral health care quality and access came from ODH. Correlations and Chi-square tests for independence were completed to determine the significance of location and economic standing in oral health care quality and access.
This analysis provided insight into the components involved in the oral health of children in rural poverty.

SURVEY

This research presents the secondary data analysis findings from statewide surveys conducted by the Bureau of Oral Health Services (BOHS). The purpose for data collection was to provide a population-based assessment on oral health status and access to dental care for children. Since 1987, the BOHS has conducted statewide oral health surveys of Ohio school children in third-grade approximately every five years. The surveys analyzed in this research were conducted during the 2004-05 and 2009-10 academic years. De-identified datasets for this research were obtained via written request to the BOHS.

Data collection was completed with a stratified, random sample of Ohio third-grade students using both a questionnaire and an open-mouth screening. Data from the open-mouth screening were quantified for the data set, and data from both the questionnaire and the screening were analyzed here. Data content categories included demographic data, socioeconomic data, health care utilization, payment, morbidity (tooth decay), health insurance, access to care, and health status. Copies of the questionnaires are included in Appendices A and B. The surveys provided information on the amount of dental disease among children in third-grade via the open-mouth screening by checking for untreated cavities, a history of tooth decay (i.e., fillings, cavities, extractions), and the presence of dental sealants. These survey items were measured using a dichotomous variable for whether or not these conditions were
present for each child (1 = Present; 0 = Not present). The surveys also measured the children’s access to dental care via the questionnaire answered by the child’s parents, which included inquiries regarding the length of time since the last dental visit, whether dental care is needed but cannot be obtained, payment method for dental care, and toothaches during the previous six months. These survey items each had multiple choices available as answers, which were then each assigned a number code when the data was compiled. For the purpose of this research, the following variables were chosen for analysis:

- untreated cavities (1 = Present; 0 = Not present);
- whether dental care is needed but cannot be obtained (1 = Parent reported child could not get needed dental care; 2 = Parent did not report child could not get needed dental care; 3 = Parent did not know/remember if child could not get needed dental care);
- and enrollment in the Free/Reduced Price Meal Program, which was obtained from the school for each child that participated (0 = Not enrolled; 1 = Enrolled).

Data on these indicators was collected at the individual level. The questionnaire portion is completed by the child’s parent(s), and the open-mouth screening is completed at school by professionals with parental consent. The survey recorded the geographic unit of county and county type, which included Appalachian, rural, metropolitan, and suburban. County designations and their included counties are included in Appendix C of this report.
COUNTY SELECTION

For the purpose of this research, the survey data was organized by county and county type. Previous research indicates that Appalachian children have poorer quality of oral health compared to children from other areas (Make Your Smile Count, 2007). In order to determine the extent to which this disparity is caused by geography and economics, four counties that are all considered Appalachian but differ in regards to social and economic indicators, such as levels of poverty and unemployment, and degrees of urbanization, isolation, and access to human resources, and social and investment capital were examined. The counties analyzed encompassed four rural, Appalachian counties: two of which (Athens and Washington) are of high capacity (higher social and economic indicators); and two (Meigs and Vinton) are of low capacity (lower social and economic indicators). The determination of the capacity level of each of these counties came from a study completed by Tickamyer et al. (2007).

Although all four of these Appalachian Ohio counties come from a region of “historically high levels of poverty and unemployment that is largely rural, remote, the product of deindustrialization, lacking in investment and capital necessary for economic development, and with relatively little access to state and federal policy makers and circles” (Tickamyer et al., 2007, p. 8), the region is not as homogeneous as it appears. In order to develop sound solutions to issues such as inadequate oral health care, the contextual factors that are specific to particular areas must be taken into account. Indeed, there are significant differences between the counties in the
Appalachian region when it comes to social and human capital, employment opportunities, and local capacity to implement and administer public programs (Tickamyer et al., 2007). By examining these differences in the context of oral health care, this study reiterates the heterogeneity of the Appalachian region and the importance of the aforementioned factors in regards to life chances. Tickamyer et al. selected four counties in the Appalachian Ohio region that were representative of the high levels of poverty and unemployment across the area, but with varying degrees of urbanization, isolation, access to human resources, and available social and investment capital to utilize (2007). The examination of these four counties in this study of oral health care helped to determine how much of an impact spatial and economic inequality has on access and quality of care. The four counties used by Tickamyer et al. and here “range from a nonmetro, nonadjacent, completely rural population county to one that is officially part of a small metro area but nevertheless retains its small town and rural character” (2007, p. 8).

Relative rurality was determined by Tickamyer et al. using Beale codes, a rural-urban continuum based on “a classification scheme that distinguishes metropolitan counties by size and nonmetropolitan counties by degree of urbanization and proximity to metro areas.” The use of Beale codes allows for a reliable and uniformed method of comparing the selected counties on the basis of rurality. Beale codes vary from 1 to 9 with 1 representing central counties of metro areas with a population of 1 million or more and 9 designating completely rural counties containing no urban areas with a population of 2,500 or more, and not adjacent to a
Lewis 31

metro area. Tickamyer et al. (2007) explain the classifications of the four Appalachian counties included in their study and here, “one small county that comes under the smallest metro designation (Washington, Beale code = 3), a formerly nonmetropolitan county that by Census reclassification in 2000 is now considered “micropolitan” (Athens = 4 on the Beale code) and two nonmetro counties that include the most rural designation (Vinton = 9), and one that is slightly less remote (Meigs = 6)” (p.8). This county selection gives a well-rounded examination differing degrees of rurality spread throughout the Beale code continuum.

Tickamyer et al. (2007) present county characteristics for these four counties in comparison with the state, which is included in Appendix D of this document. The data show that all four counties are substantially worse off than the state average concerning median household and per capita income, percentage of residents in poverty, unemployment rate, percentage of female headed households with children under 18 in poverty, percentage of residents with less than a high school degree, and percentage of the population in the labor force. However, there are also large differences between the counties. This trend is reflective of the Appalachian region, and provides insight of the inequality between this region and others as well as the inequality within the region. Tickamyer et al. interpret this information, “The two more urban counties tend to have higher economic indicators (although not uniformly) than the two completely rural counties. The latter also have less human capital and generally are more isolated economically and socially” (2007, p. 9). It is also important to note the dentist to population ratio in these counties. The ratios in Athens
(1 dentist for every 3,317 people) and Washington (1:2,442) are much better off than those in Meigs (1:7,613) and Vinton (1:6,614) (Oral Health Isn’t Optional, 2011). Using statistical analysis, this study determined how such characteristics of the selected counties impact oral health care by examining two high capacity counties (Athens and Washington) and two (low capacity counties (Meigs and Vinton).

STATISTICAL ANALYSIS

Data were tabulated and analyses were computed using the Statistical Program for Social Sciences (SPSS, 2009, version 18.0, Chicago, Illinois). Survey cases were weighted in order to obtain correct variance estimates due to the sampling technique used in the survey. Correlation analysis was used to describe the strength and direction of the linear relationships between the presence of untreated decay and enrollment in the Free/Reduced Rice Meal Program. Data were split by county capacity, and bivariate Pearson product-moment correlation coefficients ($r$) were calculated. In order to test the statistical significance of the difference between the correlation coefficients for the high and low capacity counties, $r$ values were converted into $z$ values. Chi-square tests for independence were used to assess the relationship between three sets of variables: county capacity and children not getting needed dental care; county capacity and the presence of untreated decay; enrollment in Free/Reduced Price Meal Program and children not getting needed dental care (for this particular test, data were split by county type – i.e., Appalachian, metropolitan, rural, and suburban. For all procedures, a $p < 0.05$ was used for statistical significance.*
Overall, this study examined the relationship of high and low capacity rural, Appalachian counties in Ohio and the oral health of children in these areas. A survey was conducted by the BOHS, and the participants were Ohio third-graders. Four rural, Appalachian counties were examined in this study; two were considered high capacity and two considered low capacity. Data concerning the inability of children to receive needed dental care and the presence of untreated decay were analyzed, and the results are discussed below.
Findings

The following presents the results of multiple analyses used to determine the effect of spatial and economic inequality on the oral health care of children in Appalachia. Firstly, the relationship between enrollment in Free/Reduced Price Meal Program, which served as an indicator of economic status, and the inability of children within all Ohio Appalachian counties to get needed dental care was examined to determine the significance of economic inequality on oral health care access within this type of county. This was then narrowed by examining the relationship between high and low county capacity and enrollment in Free/Reduced Price Meal Program to verify which county capacity is more likely to be of lower economic status. Secondly, the relationship between economic status and current oral health quality was investigated using enrollment in Free/Reduced Price Meal Program and presence of untreated decay. These results were then further analyzed to compare this relationship between high and low county capacities. Finally, the relationships between county capacity, and inability to get needed dental care and presence of untreated decay, were examined to determine the significance of geographic location on oral health care access and current quality.

SURVEY DATA

Tables 1 and 2 provide information about the geographical characteristics of the survey respondents by academic year.
Table 1: Actual and Weighted Number of Survey Cases from Appalachian Counties by Academic Year

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>Actual Number of Cases</th>
<th>Weighted Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-05</td>
<td>3,372</td>
<td>16,262</td>
</tr>
<tr>
<td>2009-10</td>
<td>4,501</td>
<td>16,567</td>
</tr>
</tbody>
</table>

Table 1 displays the actual and weighted number of survey cases from Appalachian counties by academic year. With the weight applied, there is not a large difference between the number of respondents from the two academic years. This is important as the weight was applied for all the forthcoming findings.

Table 2: Actual and Weighted Number of Survey Cases by High and Low Capacity Counties by Academic Year

<table>
<thead>
<tr>
<th>County Capacity</th>
<th>County</th>
<th>Actual</th>
<th>Total Actual</th>
<th>Weighted</th>
<th>Total Weighted</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Athens</td>
<td>66</td>
<td>244</td>
<td>177</td>
<td>340</td>
</tr>
<tr>
<td></td>
<td>Washington</td>
<td>111</td>
<td>96</td>
<td>177</td>
<td>340</td>
</tr>
<tr>
<td>Low</td>
<td>Meigs</td>
<td>133</td>
<td>140</td>
<td>180</td>
<td>234</td>
</tr>
<tr>
<td></td>
<td>Vinton</td>
<td>47</td>
<td>94</td>
<td>175</td>
<td>164</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>357</td>
<td>574</td>
<td>1,619</td>
<td>1,722</td>
</tr>
</tbody>
</table>

Table 2 displays the actual and weighted number of cases by county and county capacity for both academic years. With the weight applied, there is a very large difference between the number of cases in high and low capacity counties which are representative of the populations within each county capacity. As can be expected in the low capacity counties, these areas have a smaller population than the high capacity counties. This trend does not vary between the two academic years. Still, the number of cases with the weight applied, which is the number of cases used for the analyses, provides a substantial amount of data to use in statistical analyses.
A Chi-square test for independence was used to assess the relationship between enrollment in Free/Reduced Price Meal Program and the inability of children to get needed dental care within the grouping of Appalachian county type. For the 2004-05 academic year, a total of 15,991 cases were taken into account, with 8,455 (52.9%) not enrolled in Free/Reduced Price Meal Program and 7,536 (47.1%) enrolled. For the 2009-10 academic year, a total of 16,094 cases were taken into account, with 7,477 (46.5%) not enrolled in Free/Reduced Price Meal Program and 8,617 (53.5%) enrolled. The frequency of these children that could not get needed dental care is displayed below.

Table 3: Enrollment in Free/Reduced Price Meal Program within Appalachian Counties and Inability to Get needed Dental Care (2004-05 and 2009-10)

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>Not Enrolled</th>
<th>Enrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-05</td>
<td>609 (7.2%)*</td>
<td>1,514 (20.1%)*</td>
</tr>
<tr>
<td>2009-10</td>
<td>467 (6.2%)*</td>
<td>1,461 (17.0%)*</td>
</tr>
</tbody>
</table>

Note: Significant at the $p<0.05$ level.*

The inability for children in Appalachian counties to get needed dental care by enrollment in Free/Reduced Price Meal Program for both academic years is summarized in Table 3 above. In the 2004-05 academic year, the percentage of children within Appalachian counties that could not get needed dental care significantly differed by enrollment in Free/Reduced Price Meal Program, $\chi^2 (2, N=15,991) = 678.981, p < 0.05.$* Of those children that were enrolled, 20.1% could not get needed dental care compared to the 7.2% that were not enrolled and unable to get care. Similar results are present in the 2009-10 academic year as the percentage of children within Appalachian counties that could not get needed dental care
significantly differed by enrollment in Free/Reduced Price Meal Program, \( \chi^2 (2, N=16,094) = 468.663, p < 0.05.* \) Of those children that were enrolled, 17.0% could not get needed dental care compared to the 6.2% that were not enrolled and unable to get care. For both academic years, the rate of children that could not get needed dental care more than doubles with the enrollment in Free/Reduced Price Meal Program. These results indicate that within Appalachian counties, lower economic status (represented by enrollment in Free/Reduced Price Meal Program) negatively impacts the ability of children within the region to get needed dental care.

With this in mind, it is useful to examine the number of children enrolled in Free/Reduced Price Meal Program by county capacity. A Chi-square test for independence was used to assess the relationship between enrollment in Free/Reduced Price Meal Program and county capacity. For the 2004-05 academic year, a total of 1,619 cases were taken into account, with 1,246 (77.0%) from the high capacity counties and 373 (23.0%) from the low capacity counties. For the 2009-10 academic year, a total of 1,722 cases were taken into account, with 1,257 (73.0%) from the high capacity counties and 465 (27.0%) from the low capacity counties. The frequency of these children that are enrolled in Free/Reduced Price Meal Program is displayed below.
Table 4: *Children Enrolled in Free/Reduced Price Meal Program by County Capacity (2004-05 and 2009-10)*

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>High Capacity</th>
<th>Low Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-05</td>
<td>596 (47.8%)*</td>
<td>204 (54.7%)*</td>
</tr>
<tr>
<td>2009-10</td>
<td>584 (46.5%)*</td>
<td>283 (60.9%)*</td>
</tr>
</tbody>
</table>

*Note: Significant at the p<0.05 level.*

The number of children enrolled in Free/Reduced Price Meal Program by county capacity for both academic years is summarized in Table 4 above. In the 2004-05 academic year, the percentage of children enrolled in Free/Reduced Price Meal Program significantly differed by county capacity, $\chi^2 (1, N=1,619) = 5.131, p = 0.023.$* Of those children that were from a low county capacity, 54.7% were enrolled in Free/Reduced Price Meal Program compared to the 47.8% that were from a high capacity county and enrolled. Similar results are present in the 2009-10 academic year as the percentage of children enrolled in Free/Reduced Price Meal Program significantly differed by county capacity, $\chi^2 (1, N=1,722) = 27.584, p < 0.05.$* Of those children that were from a low county capacity, 60.9% were enrolled in Free/Reduced Price Meal Program compared to the 46.5% that were from a high capacity county and enrolled. For both academic years, the rate of children enrolled in Free/Reduced Price Meal Program is greater in the low capacity counties, and this disparity is even more noticeable in the 2009-10 academic year. These results tell us that residing in a lower capacity county appears to negatively impact economic status (represented by enrollment in Free/Reduced Price Meal Program).

Knowing this, it is useful to determine the relationship between enrollment in Free/Reduced Price Meal Program and the presence of untreated decay by county capacity. This relationship was investigated using Pearson product-moment
correlation coefficient for both academic years. For the 2004-05 academic year, 1,246 cases were taken into account from the high capacity counties and 373 from the low capacity counties.

Table 5: Correlation between Enrollment in Free/Reduced Price Meal Program and Presence of Untreated Decay by County Capacity (2004-05)

<table>
<thead>
<tr>
<th>Presence of Untreated Decay</th>
<th>County Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free/Reduced Price Meal Program</td>
<td>.152** High</td>
</tr>
<tr>
<td></td>
<td>.241** Low</td>
</tr>
</tbody>
</table>

Note: Significant at the \( p < 0.01 \) level.**

The correlation between enrollment in Free/Reduced Price Meal Program and the presence of untreated decay amongst these children during the 2004-05 academic year is summarized in Table 5 above. For the high capacity counties, there was a small (Cohen, 1988), positive correlation between the two variables, \( r = .152, n = 1,246, p < 0.01 \).** Similar results are present for the low capacity counties as there was a small (Cohen, 1988), positive correlation between the two variables, \( r = .241, n = 373, p < 0.01 \).** This means that, for both county capacities, enrollment in Free/Reduced Price Meal Program is associated with the presence of untreated decay. The difference between the correlation coefficients for high and low capacity was determined to be statistically significantly different, \( z_{obs} = -4.80 \) (this value is not between -1.96 and +1.96 (Pallant, 2004)). Therefore, we can conclude that there is a statistically significant difference in the strength of the correlation between enrollment in Free/Reduced Price Meal Program and the presence of untreated decay for high and low capacity counties. Low economic standing (represented by enrollment in
Free/Reduced Price Meal Program) explains significantly more of the variance in the presence of untreated decay for low capacity counties, than for high capacity counties.

Table 6: *Correlation between Enrollment in Free/Reduced Price Meal Program and Presence of Untreated Decay by County Capacity (2009-10)*

<table>
<thead>
<tr>
<th>Presence of Untreated Decay</th>
<th>Free/Reduced Price Meal Program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Low</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Presence of Untreated Decay</th>
<th>County Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.136**</td>
<td>High</td>
</tr>
<tr>
<td>.221**</td>
<td>Low</td>
</tr>
</tbody>
</table>

*Note: Significant at the p<0.01 level.*

The correlation between enrollment in Free/Reduced Price Meal Program and the presence of untreated decay amongst these children during the 2009-10 academic year is summarized in Table 6 above. For the 2009-10 academic year, 1,257 cases were taken into account from the high capacity counties and 464 from the low capacity counties. For the high capacity counties, there was a small (Cohen, 1988), positive correlation between the two variables, \( r = .136, n = 1,257, p < 0.01. \)** Similar results are present for the low capacity counties as there was a small (Cohen, 1988), positive correlation between the two variables, \( r = .221, n = 464, p < 0.01. \)** This means that, for both county capacities, enrollment in Free/Reduced Price Meal Program is associated with the presence of untreated decay. The difference between the correlation coefficients for high and low capacity was determined to not be statistically significantly different, \( z_{obs} = -1.62 \) (this value is between -1.96 and +1.96 (Pallant, 2004)).

To determine if there is a statistically significant difference between high and low capacity counties concerning the inability to get needed dental care and the presence of untreated decay, Chi-square tests for independence were conducted and
results analyzed. Beginning with the inability to get dental care during the 2004-05 academic year, a total of 1,593 cases were taken into account, with 1,224 (76.8%) from the high capacity counties and 369 (23.2%) from the low capacity counties. For the 2009-10 academic year, a total of 1,666 cases were taken into account, with 1,213 (72.8%) from the high capacity counties and 453 (27.2%) from the low capacity counties. The frequency of these children that could not get needed dental care is displayed below.

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>High Capacity</th>
<th>Low Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-05</td>
<td>152 (12.4%)</td>
<td>61 (16.5%)</td>
</tr>
<tr>
<td>2009-10</td>
<td>73 (6.0%)*</td>
<td>52 (11.5%)*</td>
</tr>
</tbody>
</table>

*Note: Significant at the $p<0.05$ level.*

The number of children unable to get needed dental care by county capacity for both academic years is summarized in Table 7 above. In the 2004-05 academic year, the percentage of children that could not get needed dental care did not significantly differ by county capacity, $\chi^2 (2, N=1,593) = 4.155, p = 0.125$. Of those children that were from a low county capacity, 16.5% could not get needed dental care compared to the not too different 12.4% that were from a high capacity county and unable to get care. However, in the 2009-10 academic year the percentage of children that could not get needed dental care significantly differed by county capacity, $\chi^2 (2, N=1,666) = 31.641, p < 0.05,*$ Of those children that were from a low county capacity, 11.5% could not get needed dental care compared to the 6.0% that were from a high capacity county and unable to get care. For both academic years, the rate of children that could
not get needed dental care is greater in the low capacity counties, and this disparity is statistically significant in the 2009-10 academic year. These results tell us that, during the 2009-10 academic year, residing in a lower capacity county appears to negatively impact ability to get needed dental care.

Similar trends are discovered when examining the presence of untreated decay. A Chi-square test for independence was used to assess the relationship between the presence of untreated decay and county capacity. For the 2004-05 academic year, a total of 1,619 cases were taken into account, with 1,246 (77.0%) from the high capacity counties and 373 (23.0%) from the low capacity counties. For the 2009-10 academic year, a total of 1,721 cases were taken into account, with 1,257 (73.0%) from the high capacity counties and 464 (27.0%) from the low capacity counties. The frequency of these children that had untreated decay is displayed below.

Table 8: *Children within County Capacity that had Untreated Decay (2004-05 and 2009-10)*

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>High Capacity</th>
<th>Low Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-05</td>
<td>352 (28.3%)*</td>
<td>158 (42.4%)*</td>
</tr>
<tr>
<td>2009-10</td>
<td>428 (34.0%)**</td>
<td>198 (42.7%)**</td>
</tr>
</tbody>
</table>

*Note: Significant at the p<0.05 level.* Significant at the p=0.001 level.**

The number of children that had untreated decay by county capacity for both academic years is summarized in Table 8 above. In the 2004-05 academic year, the percentage of children that had untreated decay significantly differed by county capacity, \( \chi^2 (1, N=1,619) = 25.832, p < 0.05.* \) Of those children that were from a low county capacity, 42.4% had untreated decay compared to the 28.3% that were from a high capacity county and had untreated decay. Similar results are present in the 2009-
10 academic year as the percentage of children that had untreated decay significantly differed by county capacity, $\chi^2 (1, N=1,721) = 10.519, p = 0.001$. Of those children that were from a low county capacity, 42.7% had untreated decay compared to the 34.0% that were from a high capacity county and had untreated decay. For both academic years, the rate of children that had untreated decay is greater in the low capacity counties. These results tell us that, during both of these academic years, residing in a lower capacity county appears to negatively impact the presence of untreated decay.

**NOTABLE FINDINGS**

The preceding analyses yielded some significant results. In the 2004-05 and 2009-10 academic years, the percentage of children within Appalachian counties that could not get needed dental care significantly differed by enrollment in Free/Reduced Price Meal Program. During both academic years, the percentage of children enrolled in Free/Reduced Price Meal Program significantly differed by county capacity. During both academic years, enrollment in Free/Reduced Price Meal Program is associated with the presence of untreated decay for both high and low county capacities. In the 2004-05 academic year, the difference between this association level for high and low capacity was determined to be statistically significant. In the 2009-10 academic year, the percentage of children that could not get needed dental care significantly differed by county capacity. During both academic years, the percentage of children that had untreated decay significantly differed by county capacity. The impact of these results is discussed in the following section.
Discussion

The purpose of this research was to educate an audience on the relationship of spatial and economic inequality to the oral health of children. This was accomplished by determining the relationship of high and low capacity rural, Appalachian counties in Ohio and the oral health of children living in these areas. The study results suggest that low economic standing and residing in a low capacity county, which often accompany one another, negatively impact children’s access to, and current status of, oral health.

The relationship between enrollment in Free/Reduced Price Meal Program, which served as an indicator of economic status, and the inability of children within all Ohio Appalachian counties to get needed dental care was examined to determine the significance of economic inequality on children’s oral health care access within this type of county. During both the 2004-05 and 2009-10 academic years, the percentage of children within Appalachian counties that could not get needed dental care significantly differed by enrollment in Free/Reduced Price Meal Program. These results tell us that, within Appalachian counties, lower economic status negatively impacts the ability of children within this region to get needed dental care. This supports the finding made by Moore et al. (2009) that poor children are more likely to have health problems when compared with children of higher economic status. Moreover, these results focus in on one region to examine this social inequality phenomenon on a more micro-scale in the area of oral health. These results are important because they affirm that the populations within the Appalachian region do
not face all the same social issues and warrant more detailed investigation of the populations within the Appalachian region.

To support this even further, the relationship between high and low county capacity and enrollment in Free/Reduced Price Meal Program was examined to verify which populations and areas within Appalachia need to be examined more closely. During both academic periods, the percentage of children enrolled in Free/Reduced Price Meal Program significantly differed by county capacity. These results tell us that residing in a lower capacity county appears to negatively impact economic status. This supports the county capacity designations given to Meigs and Vinton by Tickamyer et al. (2007). When looking at these results in conjunction with the finding that lower economic status within Appalachian counties negatively impacts the ability of the children within the region to get needed dental care, we can infer that there is a greater percentage of poorer children in low capacity counties that cannot get needed dental care than there are in higher capacity counties. This is important because it indicates that Appalachia is not a homogenous region and directs us to the populations within Appalachia that need to be assisted in the area of oral health.

The assertion that poor children are more likely to have oral health issues when compared with children of higher economic status (Make Your Smile Count, 2007; Oral Health Isn’t Optional, 2011) is confirmed by examining the relationship between economic status and current oral health status for both county capacities using enrollment in Free/Reduced Price Meal Program and presence of untreated decay. For both the 2004-05 and 2009-10 academic years, enrollment in Free/Reduced Price Meal
Program is associated with the presence of untreated decay for both high and low capacity counties. These results reveal even more when this association is examined on the basis of county capacity. In the 2004-05 academic year, low economic standing is a greater factor in explaining the presence of untreated decay for children in low capacity counties than for those in high capacity counties. This suggests that poor children in high capacity counties are better able to receive needed treatment than the poor children in low capacity counties. Low economic standing as a greater indicator of the oral health status for children in low capacity counties confirms that the geographic location of dental offices willing to treat low-income patients is a problem in Ohio (Oral Health Isn’t Optional, 2011). The results of this study show that this is also a problem in Appalachia that requires informed efforts to be remedied. Oral health treatment that can be accessed by those of lower economic standing needs to be made more available in low capacity counties, such as Meigs and Vinton.

The need to make oral health care more accessible to this population is confirmed by examining the relationships between county capacity and inability to get needed dental care, and county capacity and presence of untreated decay. These variables were examined to determine the significance of geographic location on oral health care access and current status within the Appalachian region. In the 2009-10 academic year, the percentage of children that could not get needed dental care significantly differed by county capacity. This result reveals that residing in a lower capacity county appears to negatively impact the ability to get needed dental care. Furthermore, during both the 2004-05 and 2009-10 academic years, the percentage of
children that had untreated decay significantly differed by county capacity. The greater prevalence of untreated decay and inability to get needed dental care for children in low capacity counties confirms that geography is a factor in obtaining dental care within Appalachia that needs to be addressed.

The results of this study support that Appalachia is not a homogenous region, as it is often portrayed, and that area-specific solutions must be considered to deal with the issue of children’s oral health. These solutions must address both spatial and economic inequality within Appalachia. Geographic location and economic standing, which often go hand in hand, affect the amount of dental disease Appalachian children have and the ability for them to get needed dental care. Programs and health reform need to concentrate on low capacity counties, such as Meigs and Vinton, and the poor population within these areas. The findings of this study provide a clear direction and focus for health care reform and programs.

LIMITATIONS AND FUTURE RESEARCH

Despite the important implications of this study, it is not without limitations. This research was completed by analyzing secondary data and was limited to the public data that was accessible. If this research involved primary data, additional questions would have been included to uncover more information regarding economic status, geographic location, and past experiences concerning dental care. The use of secondary data also limited this research in terms of the surveying techniques implemented. The surveying techniques used to gather the data analyzed in this study are subject to at least two limitations. First, the surveys were restricted to third grade
students in public schools, and do not take into account students who attend private schools. Including private school students in the surveys would imaginably allow for more of the population of higher economic standing to be taken into account. Second, assessing the presence/history of decay and sealants can be difficult in a noninvasive screening examination that was used in the open-mouth screening portion of this survey. Therefore, the results might underestimate the prevalence of both untreated and treated decay and sealants. Despite these limitations, the surveys still provided a large amount of data that were easily accessible and reliable.

Important findings were made that encourage further data collection, both quantitative and qualitative in nature, on oral health in the Appalachian region. Future research should identify characteristics of children in low capacity counties that contribute to the high prevalence of tooth decay, and test and evaluate programs to reduce the incidence of tooth decay in this population. Qualitative research should be conducted to determine more specific characteristics of the children in such areas as Meigs and Vinton that experience a high prevalence of tooth decay. This will reveal more of the background and casual factors of this concerning phenomenon and will allow for ground-up policy recommendations. Also in the future, evaluations should be completed to determine if health care reform and programs have made a difference in low capacity areas in comparison to high capacity areas. It is important to identify what is working and what is not if there is ever to be a difference made in health care for vulnerable populations.
POLICY RECOMMENDATIONS

The results of this study support some important health care policy recommendations. Health care reform policy needs to reduce financial barriers to dental access by improving and expanding health care coverage. Policy needs to create a dental program that will attract and retain more dentists to underserved areas, like low capacity counties. This can be achieved by enhancing publicly financed programs to increase the reimbursement rates for participating dental professionals. This program should also improve the oral health of more low-income populations, especially those in low capacity areas, by lowering economic eligibility requirements thus making more people eligible for care. This can be improved upon by having public programs across and within regions adopt standard approaches to coverage.

Health care policy also needs to improve the capacity of the oral health care delivery system. This can be accomplished by increasing the number and quality of dentists who provide services to vulnerable populations. For this to happen, there needs to be financial incentives for private practice dentists to locate to low capacity areas, including loan repayment or scholarships, and tax incentives. In addition, health care policy should inform professional education by increasing the cultural competency of the dental care workforce. This will allow professionals in low capacity areas to understand the barriers faced by their patients. An understanding of patients’ barriers would also be assisted by developing a more diverse workforce.
within the dental care field, which could include attracting members of low capacity areas into this field.

Health care policy could further tap into the potential within low capacity areas by recognizing the power of community action. It would be beneficial for health care policy to support community partnerships and actions to improve dental care access and enhance the oral health infrastructure at the community level. Coalitions and agencies on the local level need to be supported in order to foster a pathway to dental care for vulnerable populations, like children of low capacity areas, and build upon existing programs. This requires that health care policy acknowledge area-specific characteristics. Implementation of such a provision would necessitate a communicative relationship between local, state, and federal forces.

Finally, health care policy needs to increase public awareness of oral health and dental care access issues. Policy should raise awareness of issues, such as those raised by this research, to consumers/patients, policy-makers, and health professionals through community outreach programs, non-governmental organizations (NGOs), and enhancing the educational curriculum for health professionals. Again by utilizing community entities, policy can improve the public’s knowledge and understanding of the significance of oral health. By enhancing policy-makers’ awareness of access and quality issues, they will be able to create effective policies to improve oral health.

Health care policy should support the expansion of research in oral health and use the findings to develop disease prevention programs. The issues of oral health care access
and quality will never be resolved if steps are not taken to learn as much possible about the factors at work, such as spatial and economic inequality.

CONCLUSION

Despite advancements in oral health treatment for children, such as dental sealant programs, there are still countless numbers of Ohio children that suffer from poor oral health. As we have seen, geographically isolated and low-income populations are particularly at risk. As an integral part of general health and well-being, improving oral health is critical to enhancing the status of the health of children in Ohio and the nation. With this in mind, policy-makers, health care professionals, and community entities must put forth the effort and collaborate to change oral health through the implementation of effective prevention measures and treatment plans, an increase in the diversity and capacity of the oral health care delivery system, and the establishment and supporting of partnerships and collaborations to improve access and the quality of oral health care to vulnerable populations.
References


SPSS for Windows, Rel. 18.0.0. 2009. Chicago: SPSS Inc.


Appendix A: 2004-05 Survey Instrument

2004-2005 MAKE YOUR SMILE COUNT SCHOOL SURVEY
Ohio Department of Health

Please complete this form, fold it and place in the envelope provided. Seal the envelope and return it to your child’s teacher tomorrow. Your answers will remain private and will not be shared. Thank you.

Child’s Last Name: ___________________  Child’s First Name: ___________________  Teacher’s Name: ___________________  Room: ___________________

☐ Yes, I give permission for my child to have his/her teeth checked.
☐ No, I do not give permission

☐ Yes, I give permission for my child to have his/her height and weight checked.
☐ No, I do not give permission

Signature of Parent or Guardian: ___________________  Date: ___________________

Home Phone Number: ___________________  Work Phone Number: ___________________

Child’s Birthdate: (month/day/year) ___________________

Child’s Gender: ☐ Male  ☐ Female

Is your child Hispanic? ☐ Yes  ☐ No

☐ Yes  ☐ Other  ☐ Native Hawaiian or other Pacific Islander  ☐ American Indian or Alaska Native  ☐ Black or African American  ☐ Asian  ☐ Unknown  ☐ White

Please answer the questions below to help us learn more about access to dental care in your area. Your answers will remain private and will not be shared. If you do not wish to answer the questions, you may still give permission for your child to have his or her teeth checked.

Please fill in the bubbles completely (right way: ●  wrong way: ✗, ×, ◐) Thank you!

1. During the past 6 months, did your child have a toothache more than once when biting or chewing? (Please check one)
   ○ Yes  ○ No  ○ Don’t know/don’t remember

2. How long has it been since your child last visited a dentist? Include all types of dentists such as orthodontists, oral surgeons and all other dental specialists as well as dental hygienists. (Please check one)
   ○ 1 year or less  ○ More than 1 year but less than 3 years  ○ 3 years or more  ○ Never has been

3. During the past 12 months, was there a time when your child needed dental care but couldn’t get it at that time? (Please check one)
   ○ Yes  (Go to Question 4)  ○ No  (Go to Question 5)  ○ Don’t know/don’t remember  (Go to Question 5)

4. What was the main reason you couldn’t get dental care for your child? (Please check one)
   ○ Couldn’t afford it  ○ Dentist didn’t accept Medicaid OR insurance  ○ No dental insurance OR Medicaid  ○ Appointment hours not convenient  ○ No way to get to dentist  ○ Other ___________________

5. How do you pay for your child’s dental care? (Please check the one way that most of your child’s dental care is paid for)
   ○ Family or self-pay  ○ Medicaid, medical card, Medicaid HMO, Healthy Start  ○ Other dental insurance  ○ Don’t know/don’t remember

6. Is your child eligible for the free/reduced price meal program at school? (Please check one)
   ○ Yes  ○ No  ○ Don’t know/don’t remember

7. Has your child ever had plastic coatings called dental sealants put on his/her teeth at school?  ○ Yes  ○ No  ○ Not sure

8. How many glasses of milk does your child drink in a day? □ 0  □ 1  □ 2  □ 3  □ 4  □ 5 or more

OHIO DEPARTMENT OF HEALTH SCREENER’S USE ONLY
☐ Child Not Screened  ☐ No Consent

Untreated caries  Caries experience  Sealants  Treatment Urgency  Height  Weight
□ 0  □ 1  □ 0  □ 1  □ 0  □ 1  □ 0  □ 1  □ 0  □ 1  □ 2

Thank you again for participating!
Appendix B: 2009-10 Survey Instrument

2009-2010 MAKE YOUR SMILE COUNT SCHOOL SURVEY
_________________________ Ohio Department of Health _______________

<table>
<thead>
<tr>
<th>Child’s Last Name:</th>
<th>Child’s First Name:</th>
<th>Teacher’s Name:</th>
<th>Room:</th>
</tr>
</thead>
</table>

☐ Yes, I give permission for my child to have his/her teeth checked.
☐ No, I do not give permission for my child to have his/her teeth checked.

☐ Yes, I give permission for my child to have his/her height and weight measured.
☐ No, I do not give permission for my child to have his/her height and weight measured.

Signature of Parent or Guardian: ____________________________ 

Today’s Date: ____________________________ 

Home Phone Number: ____________________________ 
Work Phone Number: ____________________________ 

(_____ ) (_____ )

Please answer the following questions. Your answers will remain private and will not be shared. If you do not wish to answer the questions, you may still give permission for your child to have his or her teeth checked. Thank you.

<table>
<thead>
<tr>
<th>Child’s Age: Child’s Birthdate:</th>
<th>Child’s Sex:</th>
<th>Please fill in circles like this…………</th>
<th>Not like this …….</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Is your child Hispanic?</th>
<th>Child’s Race: Please choose all that apply.</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Yes</td>
<td>☐ White</td>
</tr>
<tr>
<td>☐ No</td>
<td>☐ Asian</td>
</tr>
<tr>
<td></td>
<td>☐ Native Hawaiian or other Pacific Islander</td>
</tr>
<tr>
<td></td>
<td>☐ Other</td>
</tr>
</tbody>
</table>

1. Has your child had a toothache in the last six months?
   ☐ Yes ☐ No ☐ Don’t know/don’t remember
2. How long has it been since your child last visited a dentist? Include all types of dentists such as orthodontists, oral surgeons and all other dental specialists as well as dental hygienists.

- [ ] 1 year or less
- [ ] More than 1 year but less than 3 years
- [ ] 3 years or more
- [ ] Never has been
- [ ] Don’t know/don’t remember

3. During the past 12 months, was there a time when your child needed dental care but couldn’t get it at that time?

- [ ] Yes (go to question 4)
- [ ] No (go to question 5)
- [ ] Don’t know/don’t remember (go to question 5)

4. If you could not get dental care for your child, why not? (Please choose one)

- [ ] Couldn’t afford it
- [ ] No dental insurance or Medicaid
- [ ] Dentist didn’t accept Medicaid or insurance
- [ ] Appointment hours not convenient
- [ ] Wait for appointment too long
- [ ] No way to get to dentist
- [ ] Don’t know/don’t remember
- [ ] Other _____

5. How do you pay for your child’s dental care? (Please choose the one way that most of your child’s dental care is paid for)

- [ ] Family or self-pay
- [ ] Medicaid, medical card, Medicaid HMO, Healthy Start
- [ ] Other dental insurance
- [ ] Don’t know/don’t remember

6. Does your child get free or reduced-cost lunches at school?

- [ ] Yes
- [ ] No
- [ ] Don’t know/don’t remember

7. On an average day, about how many servings of pop, soda or other sweetened beverages does your child drink (not counting diet beverages)? This includes those with added sugar, such as Sunny Delight, Hawaiian Punch, Gatorade and energy drinks (please choose one).

- [ ] 0
- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5

Now that you have completed this form, fold it and place in the envelope provided. Seal the envelope and return it to your child’s teacher tomorrow. Thank you for participating!
Appendix C: Counties Grouped by County Type  
(Source: Ohio Department of Health)

<table>
<thead>
<tr>
<th>Appalachian</th>
<th>Rural/Non-Appalachian</th>
<th>Metropolitan</th>
<th>Suburban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adams</td>
<td>Ashland</td>
<td>Allen</td>
<td>Auglaize</td>
</tr>
<tr>
<td>Athens</td>
<td>Ashtabula</td>
<td>Butler</td>
<td>Clark</td>
</tr>
<tr>
<td>Belmont</td>
<td>Champaign</td>
<td>Cuyahoga</td>
<td>Delaware</td>
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<td>Franklin</td>
<td>Fairfield</td>
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<td>Hamilton</td>
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<td>Geauga</td>
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<td>Lucas</td>
<td>Greene</td>
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<td>Mercer</td>
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<td>Wood</td>
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<tr>
<td>Meigs</td>
<td>Morrow</td>
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<td>Ottawa</td>
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<td>Paulding</td>
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<td>Wayne</td>
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<tr>
<td>Wyandot</td>
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## Appendix D: Social and Economic Characteristics of Appalachian Ohio Study Counties

<table>
<thead>
<tr>
<th>Beale Code</th>
<th>Washington</th>
<th>Athens</th>
<th>Meigs</th>
<th>Vinton</th>
<th>Ohio</th>
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</thead>
<tbody>
<tr>
<td>3</td>
<td>1999/00-2004/05/06</td>
<td>1999/00-2004/05/06</td>
<td>1999/00-2004/05/06</td>
<td>1999/00-2004/05/06</td>
<td>1999/00-2004/05/06</td>
</tr>
<tr>
<td>Population</td>
<td>63,251</td>
<td>63,223</td>
<td>61,860</td>
<td>23,072</td>
<td>23,992</td>
</tr>
<tr>
<td>Median household income ($)</td>
<td>33,426</td>
<td>36,257*</td>
<td>28,955</td>
<td>26,795*</td>
<td>25,223</td>
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<tr>
<td>Per capita income ($)</td>
<td>22,735</td>
<td>26,370</td>
<td>17,075</td>
<td>21,926</td>
<td>19,763</td>
</tr>
<tr>
<td>% of persons in poverty</td>
<td>12.3</td>
<td>12.2*</td>
<td>19.1</td>
<td>20.2</td>
<td>20.4</td>
</tr>
<tr>
<td>Unemployment Rate (%)</td>
<td>4.6</td>
<td>.5*</td>
<td>11.1</td>
<td>5.4*</td>
<td>10.0</td>
</tr>
<tr>
<td>% of female headed households with children under 18 in poverty</td>
<td>44.6</td>
<td>na</td>
<td>47.0</td>
<td>na</td>
<td>55.2</td>
</tr>
<tr>
<td>% with less than high school degree</td>
<td>11.6</td>
<td>na</td>
<td>12.8</td>
<td>na</td>
<td>18.6</td>
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<tr>
<td>% of population in the labor force</td>
<td>61.6</td>
<td>na</td>
<td>56.9</td>
<td>na</td>
<td>54.6</td>
</tr>
</tbody>
</table>

* from [http://quickfacts.census.gov/qfd/states/39000.html](http://quickfacts.census.gov/qfd/states/39000.html)
* from [http://www.ohio.gov/research/files/SO/Athens.pdf](http://www.ohio.gov/research/files/SO/Athens.pdf)
* from [http://www.ohio.gov/research/files/SO/Meigs.pdf](http://www.ohio.gov/research/files/SO/Meigs.pdf)