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Social Determinants of Health and Variability in Weight Trends of Children of Low Income Families Living in New Mexico

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**Social Determinants of Health and Variability in Weight Trends of Children of Low
Income Families Living in New Mexico**

BY

MOLLY MORRISON

**BACHELOR OF SCIENCE
NUTRITION AND DIETETICS**

THESIS

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Social Determinants of Health and Variability in Weight Trends of Children of Low Income Families Living in New Mexico

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ABSTRACT

When evaluating the prevalence of obesity rates throughout New Mexico (NM), it appears these rates have reached a plateau. A recent study conducted by the NM Department of Health (DOH) found that NM was among 19 other states that have had a first time decrease in child obesity rates among low income families. However, when examined deeper, when looking at geographical areas throughout NM, hidden geography of weight disparities become apparent. Although obesity rates may have decreased in some areas, they have increased in others. The purpose of this study is to effectively evaluate variability in weight trends between geographical areas throughout NM and to evaluate the relationship between obesity rates and specific socioeconomic determinants.

This study utilized two mapped datasets, created at two distinct times, that were conjoined to form a trend map as well as a swipe map that allows for visual exploration of child weight trends from 2013 to 2015. Pearson correlation evaluated the relationship between socioeconomic variables and obesity rates. Statistical significance of changes in obesity rates in geographical areas was determined using two standard deviations above

and below each estimate to obtain a 95% confidence interval for the coefficient estimate.

A significant relationship was found between one socioeconomic variable (proportion of grandchildren living with grandparents without parent present) and a significant increase in obesity rates was seen in over 10 geographical areas throughout NM. All WIC management, early childhood groups, obesity prevention groups and researchers can utilize suggested findings of this study to effectively focus healthcare in areas where obesity rates have increased and improve quality of care in these communities. Results of this study can provide a pathway for the improvement of WIC program management and development, social conditions/environments and continuity of care.

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Chapter 1

Introduction

Childhood obesity remains a serious problem throughout the United States and is associated with negative health outcomes that can continue into adulthood. Obesity can increase the risk of developing type 2 diabetes, cardiovascular disease, hypertension, sleep apnea, liver disease, kidney disease, arthritis and certain types of cancers.¹ Children who are overweight at the age of five years are more likely than healthy weight children to be obese at the age of fourteen and have a 70% chance of remaining overweight or obese as an adult.² Social determinants of health, which can be defined as conditions where children live, grow and play can influence health outcomes and weight disparities. Neighborhood environmental factors and social determinants of health such as demographics, (including educational attainment level, employment status, income level, and marital status), family composition, food insecurity, poor nutritional knowledge, perceived neighborhood safety, inadequate access to healthy food and poor access to health care can significantly affect the nutritional status of children and contribute to the prevalence of child obesity rates.³

Obesity has been found to disproportionately affect children from low income families, which may contribute to socioeconomic disparities across a life span.⁴ Research has shown that children from low income families are at a higher risk of being overweight or obese than children from families with higher incomes. Furthermore, children from low income families are more likely to become obese by the age of five compared to their higher income counterparts.⁵ A recent study published by Rogers, et al.

found that among multiple school districts, for every 1% increase in low income status, there was a 1.17% increase in rates of overweight/obese students.⁶

The literature regarding obesogenic environments, which are defined as environments that are characterized by structural and social factors in one's community that lead to high rates of obesity, have examined neighborhood socioeconomic status (SES), physical activity environment, food environment and social environment (crime, violence, abuse etc.) as contributing factors.⁷ Research shows that children living in low income neighborhoods have a 20-60% higher chance of being overweight or obese than children living in higher socioeconomic status and in healthier built environments.⁷ Low income families who live in low SES neighborhoods tend to consume higher amounts of unhealthy foods and have decreased access to healthful foods. Low-income neighborhoods where supermarkets are scarce, can lead to consumption of foods with little to no nutritive value. Low income neighborhoods are also less likely to have parks and facilities in which children and adolescents are able to be physically active. Furthermore, perceived neighborhood safety can contribute to decreased outdoor physical activity among children and adolescents.⁸

One study found that a large percentage of childhood obesity can be explained by the influence that neighborhood and environmental factors have on young children.⁹ This suggests that modifying environmental risk factors at an early age can be influential in reducing childhood obesity. Children living in certain areas of New Mexico (NM) may be at an increased risk for developing obesity due to limited availability to healthcare and education systems, unsafe neighborhood conditions and physical environment, family composition, perceived neighborhood safety, racial segregation, food insecurity and

inaccessibility of nutritious food.⁹ In 2017, more than one in four (27.9%) kindergarten students in NM were overweight or obese. Among third graders, one in three (34.2%) were overweight or obese.¹⁰

When evaluating the prevalence of obesity rates throughout NM in 2015, it appeared that these rates may have reached a plateau. A study conducted by the NM Center for Disease Control (NM CDC) found that in 2015, NM was among 19 other states that had a first time decrease in childhood obesity rates among low income families. Data collected from 2010 to 2016 indicate that child obesity prevalence rates may be stabilizing. Rates for third graders have decreased since 2010, going from 22.6% in 2010 to 19.4% in 2016.¹¹ However, when examined deeper, by looking at various geographical areas of NM, hidden geography of weight disparities becomes more apparent at community and neighborhood levels. Though obesity rates may have decreased in some geographical areas, obesity may have increased in others.

For the purposes of this study, these geographical areas are termed “small areas” (SA), which refer to 108 geographic areas across NM with population sizes that are large enough to evaluate the rate of disease and range in population size from 9,000-30,000. NM SA’s is a project created by the NM Department of Health (NM DOH), to meet the intense demand for health status information at the community levels and to adequately display health disparities in New Mexico.¹²

The purpose of this socioecological study was to effectively evaluate variability in trends of child obesity rates between 2013 and 2015 utilizing geospatial techniques. This exploratory analysis led to the development of an interactive mapping tool created to evaluate these trends in obesity rates in various SA’s. This mapping tool can act as a

resource that public health professionals can utilize to evaluate weight trends, socioeconomic factors and locate WIC clinics in their geographical area. This research also evaluated the relationship between various socioeconomic/sociodemographic variables and child obesity rates. The socioeconomic/sociodemographic variables analyzed for significance include proportion of families living at the same residences for one or more years, mean proportion of the population who were foreign born, proportion of parents of children under age 18 who were unemployed and proportion of households with children in which the grandparents were responsible and no parent was present. Though the relationship between SES and child obesity in NM has been thoroughly researched and is frequently being updated, effectively being able to map, geocode and explore SA's in NM in order to evaluate trends in obesity and healthy weight status of children, and then examine if obesity rates correlate with other socioeconomic/sociodemographic variables is an area that has been minimally studied.

Registered Dietitians , Women, Infants and Children (WIC) staff, NM obesity prevention groups, public health researchers, epidemiologists as well as other healthcare professionals will be able to utilize the data collected and the interactive maps created, as well as suggested findings/ conclusions of this study to assist low income populations living in various SA's of NM in which obesity rates have increased, in order to effectively focus healthcare in these areas, develop interventions and improve quality of care when working with these populations. Furthermore, this exploratory analysis can provide a pathway for the improvement of WIC program management and development, social conditions/environments and continuity of care. Public health researchers can begin to explore disparities in healthy weight status and what measures can be taken to

improve obesity rates in SA's of NM. This study focuses on the improvement of current practices through the use of the created mapping tools and utilization of existing knowledge to change policies and improve quality of care in the future.

Research Question

What variability is present in weight trends of toddler and children, ages two to four, at two distinct times, March 3rd, 2013 and December 31st, 2015 and what is the relationship between these weight trends and socioeconomic variables utilizing two NM WIC mapped datasets, both composed of anthropometric data of toddlers and children enrolled in the New Mexico WIC program?

Hypothesis:

Variability of weight trends will be present in various SA's and there will be an association between neighborhood risk factors and obesity trends of toddlers and children, ages two to four, utilizing two NM WIC mapped datasets, March 3rd, 2013 and December 31st, 2015, both composed of anthropometric data of toddlers and children enrolled in the New Mexico WIC program.

Chapter 2

Methodology

Subjects and Methods

This study was a secondary database analysis of children enrolled in NM WIC at two distinct times in 2013 and 2015. Variability in childhood obesity rates throughout NM was analyzed for significance. This study also evaluated the relationship between socioeconomic variables and childhood obesity rates.

Participants

Toddlers and children ages two to four years who were enrolled in the NM WIC program on March 3rd, 2013 and December 31st 2015 were included in the analysis. Although ethnicity and gender were not included in the analysis, a study conducted by the United States Department of Agriculture Food and Nutrition Service (USDA FNS) in 2015 found that approximately 77% of children enrolled in the NM WIC Program were Hispanic and 23% were non-Hispanic. All children included in this analysis were children of low-income families enrolled in the NM WIC program on March 3rd, 2013 and December 31st, 2015, under the age of five years (defined as < 185% of the federal poverty line), located in the 108 SA's of NM.¹³

Children were excluded if they were not enrolled in the NM WIC program on March 3rd, 2013 and December 31st, 2015, over the age of five years or any infant under the age of two years and any child missing significant information from the dataset, including their address, qualifying their data as unusable.

Screening

This data was collected by the NM WIC program and the NM DOH Epidemiologists.

Data Collection

Data was requested by the Manager of the Maternal and Child Health Epidemiology Program for the NM DOH from the NM WIC Program. Once the data was requested, the request was approved by the NM WIC Program and this data was then provided to the NM DOH. The data requested included BMI data, sociodemographic factors (age, marital status, education, medium income), nutrition risk factors (diabetes mellitus type 2, hypertension, prematurity, nutrient deficiency) and presence of conditions in the biological mother (gestational diabetes mellitus, history of preeclampsia, and hypertension) of all pregnant women, post-partum women, breastfeeding women, infants and children ages one to five that were enrolled in WIC in 2013.

There were 60,000 WIC clients enrolled at the time of the 2013 time period and the home address of the clients were geocoded. Geocoding refers to the process of converting geographic coordinates to a description of a location. Client addresses were converted into geographic coordinates (latitude and longitude) which were then placed as markers on a map. For de-identification and privacy purposes, names or protected health information (PHI) were not provided to the DOH from the NM WIC program, all client information was coded with new client ID numbers. Each new client ID number contained an address and all WIC client information (anthropometric data, gender, age, nutrition risk etc.). Each address was identified, using two different mapping systems and geographical coordinates of each address were uploaded onto a spreadsheet.

This data was then uploaded onto an interactive mapping web site, (<http://nmcdc.maps.arcgis.com/home/index.html>) that allows for visual exploration of data through ArcGis maps, which is incorporated into this mapping website. ArcGis contains an atlas of the world, comprised of authoritative maps that allows maps to be visually represented in a variety of formats, to effectively depict a story and visual exploration of the data provided.¹⁴ A detailed, interactive map was created with the BMI data, socioeconomic factors and nutrition risk factors for all 60,000 WIC clients enrolled in 2013. This map is available for public view on NM Community Data Collaborative (NMCDC), a site which allows for collaborative map making, as well as the exploration of other maps. (<http://nmcdc.maps.arcgis.com/home/index.html>). This site contains over four dozen maps and galleries, 100 different indicators and 150 feature services.¹⁴ From this large dataset, BMI data on all toddlers and children ages 2 to 4 years (n = 20,700), were extracted to create a sub data set.

Data obtained from 2015 provided the same variables as those in 2013, including anthropometric data, sociodemographic factors and nutrition risk factors of all WIC clients enrolled on December 31st, 2015. This information was geocoded in the same manner to that of the 2013 data. Once again, BMI data of all toddlers and children, ages 2 to 4 years (n = 18,571) were extracted from the large dataset. This data (which included all BMI weight categories: underweight, normal weight, overweight, obese and morbidly obese), was then merged and aggregated with the 2013 data via Excel spreadsheet and SAS JMP (https://www.jmp.com/en_us/home.html). Once the 2013 and 2015 anthropometric data was merged, variability of trends in obesity rates

between 2013 and 2015, per SA, were examined and evaluated and the relationship between various socioeconomic variables and these weight trends were observed.

After the data was aggregated, it was uploaded onto the ArcGis maps, NMCDC mapping system and two different maps were created. The first map created was a trend map, which is a map that displays trends of obesity rates from 2013 to 2015 throughout areas of NM as well as various sociodemographic variables explained in the “map overview” section. Through the creation of this map, changes in obesity rates, per SA, from 2013-2015 were tested for statistical significance and obesity rates could then be analyzed in relation to specific socioeconomic variables. The second map created was a swipe map, which allows two maps to be visually compared at the same time. The swipe map provides a side to side comparison of obesity prevalence per small area in 2013 versus 2015.

Map Overview

The trend map includes all weight categories of toddlers and children ages 2-4, enrolled in NM WIC in 2013 and 2015, as well as data extracted from the NM indicator Based Information System (NM IBIS), the public health data resource from the NMCDC used for obtaining health data in NM. The data that was obtained from NM IBIS included: Proportion of mothers who completed high school, mothers who were single, median household income, percent of children living with grandparents as well as percent of the population that were foreign born. This data was added to the trend map. This map has multiple functions including the option of having layers that can be clicked on or off and a drop-down menu for each layer that was created, and which can be viewed by clicking on each SA. For example, if the layer titled “Comparison of WIC

enrollment and toddler overweight status, SA, 2015 minus 2013,” is clicked on, then the drop down will show SA name, the proportion of toddler’s overweight in 2013, the proportion of toddlers in 2015, the difference between the changes on overweight status as well as the percent change in that geographic area which is shown in Figures 1 and 2.

Figure 1

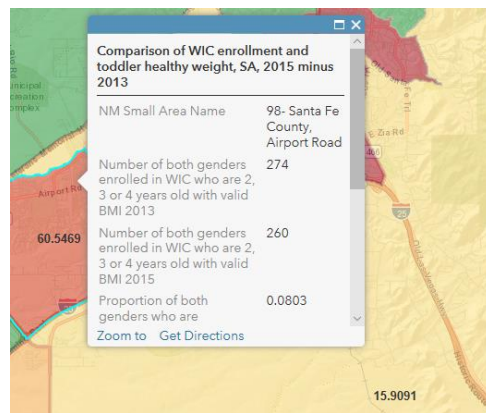
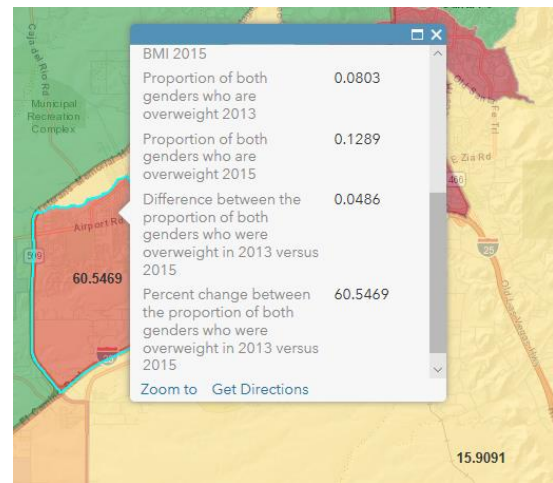


Figure 2



A layer was included with each weight category that displays the most extreme changes in obesity rates, per geographical area. The map is color coded and customized for optimal, convenient exploration of changes in weight status between 2013 and 2015, per SA, as well as changes in socioeconomic status. Extreme cases of obesity are displayed in red and for most extreme decrease in obesity rates, are displayed in green which are displayed in Figures 3 and 4.

Figure 3

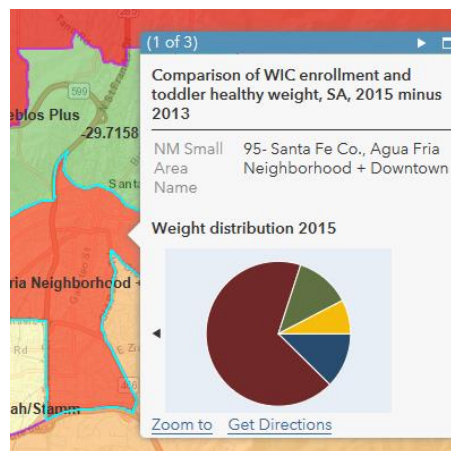
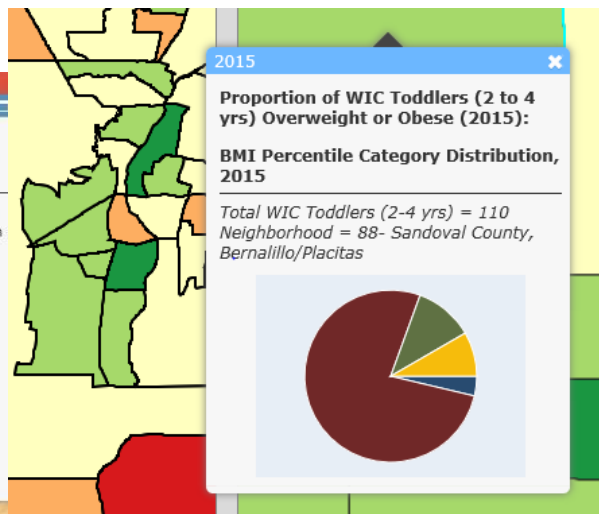


Figure 4



The swipe map allows for a side by side comparison of changes in obesity rates between 2013 and 2015 which is displayed in Figure 5. All 108 SA's were included on the map and a drop down option was created for each geographic area showing the percent, percent difference as well as a pie chart visually portraying the weight categories (underweight, healthy weight, overweight, obese, or morbidly obese) and the percent of toddlers and children, ages 2-4 in those geographical areas who fall into those specific categories.

Figure 5

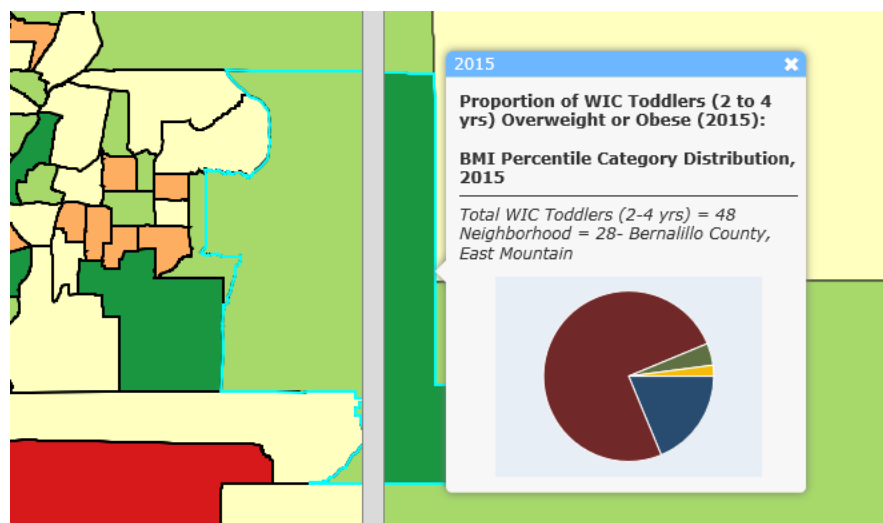
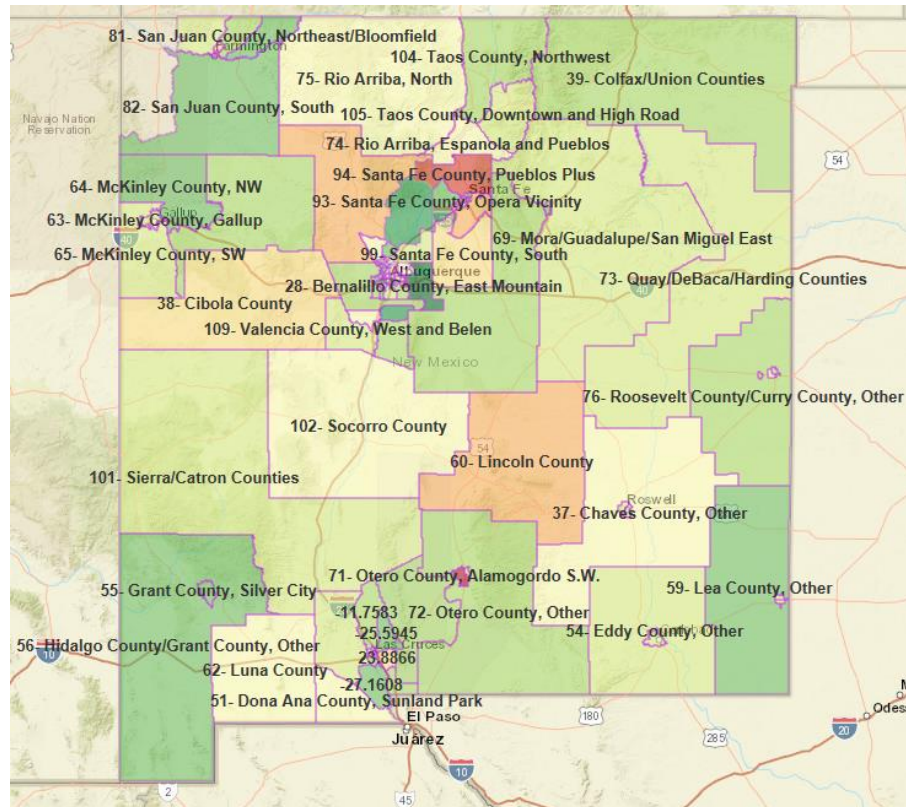


Figure 6 is a depiction of all 108 SA's throughout NM. Each of all the SA's is able to be examined individually chosen in the mapping database

Figure 6



Data Analysis

The data was analyzed using the SAS JMP statistical software as well as ArcGIS maps. Descriptive statistics were analyzed and changes in community rates of healthy weight status were tested for significance. Statistical significance was determined using two standard deviations above and below each estimate to obtain a 95% confidence interval for the coefficient estimate. Geospatial analysis allowed for comparison of obesity rates across SA's and correlations to other community factors/socioeconomic variables (proportion of families living in the same residence for more than a year,

percent of children living with grandparents, percent of the population that were foreign born vs US citizens and proportion of parents of children under the age of 18 who are unemployed), which was analyzed for strength and association using multiple linear regression and Pearson Product-Moment Correlation. A regression was run on the predictors and regression statistics and predictors table were all analyzed. Table 1 provides information regarding the selected characteristics of community level data.

Table 1 – Selected characteristics of community level data

Variable	Variable definition	Mean	Std. Dev	Min	Max
BMI >85th percentile	Proportion of both genders who are overweight or obese	0.22	0.07	0.06	0.43
MFH1YR	Proportion of families living at the same residences for one or more years	0.85	0.065	0.59	0.98
MPFBC	Mean proportion of population who is foreign born	0.03	0.02	0.001	0.10
PCPU	Proportion of parents of children under 18 who are unemployed	0.09	0.04	0.03	0.29
PGPRC	Proportion of households with children under 18 in which the grandparent is responsible (householder), no parent present, 2011-2015	0.03	0.03	0.00	0.18

Changes in weight (underweight, healthy weight, overweight and obese) per SA from 2013 to 2015, were then analyzed for significance. This was done by calculating

summary statistics of each BMI difference (2015-2013) column which predicted mean standard error. Significance of each change in variable was determined by evaluating if its corresponding coefficient estimate was significantly different than zero by measuring two standard deviations above and below each estimate. These changes were categorized as either a significant increase or a significant decrease in weight status per SA and the greatest increases as well as the largest decreases per BMI category were evaluated.

Table 2 shows statewide population totals for each category in the 2013 as well as in 2015 datasets (i.e. total number of clients enrolled, number of both genders who were overweight, etc.). A difference column was then created, to determine the percent change in each category from 2013 to 2015.

Table 2 - COMPARISON of WIC ENROLLMENT AND TODDLER HEALTHY WEIGHT, SMALL AREAS, 2015 MINUS 2013				
DEFINITION	STATEWIDE SA Totals		DIFFERENCES (FORMULA)	
	2013	2015	2015-2013	Percent Change
Count of Unique Client Identifiers	63,762	53,794	-9,968	-15.63
Total number of enrolled WIC Families in the database (unique <Family Group ID> count)	40,982	35,565	-5,417	-13.22
Total number of Families in small area (ACS 5-YR 11-15 B 17022)	501,798	495,031	-6,767	-1.35
Families in small area with any children under 5 and income under 1.85 fpl (ACS 5-YR 11-15 B 17022)	53,083	53,871	788	1.48
Enrolled WIC Families as a percent of Families in small area with any children under 5 and income under 1.85 fpl	77.20	66.02	-11	-14.49
Percent of enrolled Mothers who completed High School	62.73	20.10	-42.64	-67.97
Percent of enrolled Mothers who are not married	66.35	67.34	1	1.49
Number of both genders who are underweight	1335	1231	-104	-7.79
Number of both genders who are healthy weight	14,435	12,963	-1,472	-10.20
Number of both genders who are overweight	2,656	2,231	-425	-16.00
Number of both genders who are overweight or obese	4,958	4,189	-769	-15.51
Number of both genders who are obese	2,302	1,958	-344	-14.94
Number of both genders who are extremely obese	1,716	1,555	-161	-9.38
Proportion of both genders who are underweight	0.07	0.07	0.0006	0.92
Proportion of both genders who are healthy weight	0.69	0.70	0.0037	0.54
Proportion of both genders who are overweight	0.13	0.12	-0.0076	-5.97
Proportion of both genders who are overweight or obese	0.24	0.23	-0.0145	-6.03
Proportion of both genders who are obese	0.11	0.11	-0.0068	-6.09
Proportion of both genders who are extremely obese	0.08	0.08	-0.0004	-0.44

Chapter 3

Results

On March 3rd 2013, 20,700 toddlers and children, ages 2-4 were enrolled in NM WIC. Of these toddlers, 11.1% (n=2,277) of those toddlers and children were obese and 23.9% (n=4,947) were overweight or obese. Variation of obesity rates by SA ranged from 10% to 58%. On December 31st 2015, 18,571 toddlers and children ages 2-4 were enrolled in NM WIC. Out of these 2-4 year olds, 10.5% (n= 1,949) were obese and 22.6% (n=4,197) were overweight or obese. Variation of obesity by SA ranged from 3.8% to 42%. Though the overall overweight and obese rates of toddlers and children appeared to decrease from 2013 to 2015, when evaluating per SA, these overweight and obese rates actually increased in several areas throughout NM.

Areas in which there was a significant increase in overweight and obesity rates are depicted in red on the visual maps created. Areas in which there was a significant decrease in overweight and obesity rates are depicted in green on the visual mapping tool. A 95% increase in the rate of children that were overweight was found in Bernalillo County, East Gateway and a 62% increase was seen in Espanola. In the Auga Fria neighborhood located in Santa Fe, NM an 88% increase in the rate of overweight children was observed. In Southwest Alamogordo, an 82% increase in overweight or obesity rates was found. A 69% increase in the rate of overweight or obese toddlers and children was seen in Los Alamos County and 57% increase was observed in Farmington, NM. In Northwest Taos County, an 89% increase in obesity rates of

children was found. Despite multiple communities showing an increased rate of children that were overweight and obese rates throughout NM, a decrease in the rate of children that were overweight and obese was seen in multiple areas as well. In Santa Fe county, Opera vicinity, there was a 77% decrease in the rate of overweight children. A 63% decrease in the rate of overweight or obese children was found in the East Mountains area and a 64% decrease was seen in the NE Heights area (Paseo Del Norte and Ventura area). A 77% decrease was seen in Sandoval County, Rio Rancho. Overall, there was a 44% increase in the rate of overweight and obese children in 47 SA's and a 56% decrease in 61 SA's. There was a 51% percent increase in the rate of severely obese children in 55 SA's and a 49% decrease in 53 SA's. By predicting which variables were considered non-zero, it was found that all above listed SA's with increases in overweight and obesity rates were indeed significant (tables 3, 4, 5).

Table 3 – Significant increases in rate of children that were overweight

SA number	SA Name	Percent Change	Mean Overweight Significance
3	Bernalillo County, East Gateway	96%	INCREASE, SIGNIFICANT
95	Santa Fe Co., Agua Fria Neighborhood + Downtown	89%	INCREASE, SIGNIFICANT
89	Sandoval County, Corrales	63%	INCREASE, SIGNIFICANT
74	Rio Arriba, Espanola and Pueblos	62%	INCREASE, SIGNIFICANT
98	Santa Fe County, Airport Road	61%	INCREASE, SIGNIFICANT
69	Mora/Guadalupe/San Miguel East	58%	INCREASE, SIGNIFICANT
60	Lincoln County	49%	INCREASE, SIGNIFICANT
91	Sandoval County Other West	47%	INCREASE, SIGNIFICANT
78	San Juan County, Farmington Southeast	44%	INCREASE, SIGNIFICANT

Table 4 – Significant increases in children that were overweight or obese

SA Number	SA Name	Percent Change	Mean Overweight or Obese Significance
71	Otero County, Alamogordo S.W.	82%	INCREASE, SIGNIFICANT
94	Santa Fe County, Pueblos Plus	75%	INCREASE, SIGNIFICANT
61	Los Alamos County	69%	INCREASE, SIGNIFICANT
78	San Juan County, Farmington Southeast	57%	INCREASE, SIGNIFICANT
95	Santa Fe Co., Agua Fria Neighborhood + Downtown	52%	INCREASE, SIGNIFICANT
96	Santa Fe County, Agua Fria Village	49%	INCREASE, SIGNIFICANT
91	Sandoval County Other West	44%	INCREASE, SIGNIFICANT
92	Santa Fe County, East Foothills + Eldorado	39%	INCREASE, SIGNIFICANT
26	Bernalillo County, Paseo Louisiana	36%	INCREASE, SIGNIFICANT

Table 5 – Significant decreases in children that were overweight or obese

SA number	SA Name	Percent Change	Mean Overweight or Obese Significance
27	Bernalillo County, Paseo Ventura	-65%	DECREASE, SIGNIFICANT
28	Bernalillo County, East Mountain	-63%	DECREASE, SIGNIFICANT
25	Bernalillo County, Comanche Juan Tabo	-59%	DECREASE, SIGNIFICANT
5	Bernalillo County, Lomas Girard	-57%	DECREASE, SIGNIFICANT
15	Bernalillo County, Central Coors	-50%	DECREASE, SIGNIFICANT
107	Valencia County, NE	-46%	DECREASE, SIGNIFICANT
90	Sandoval County Other East	-44%	DECREASE, SIGNIFICANT

30	Bernalillo County, Montano Coors	-42%	DECREASE, SIGNIFICANT
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Though there were several SA's in which obesity rates increased, there were also several SA's in which the proportion of underweight children increased from 2013 to 2015. In Santa Fe County, Bellamah, a 98% increase in rate of underweight children was observed. Dona Ana County, Las Alturas a had 96% increase in the rate of underweight children was seen and in Colfax and Union Counties, had a 92% increase. These results, as well other areas in which there was a significant increase in percent of children that were underweight are displayed in Table 6. Further research is needed to determine potential reasons for the increase in underweight children in these areas of New Mexico.

Table 6 – Significant Increases in rate of children that were underweight

SA Number	SA NAME	Percent Change	Mean Underweight Significance
97	Santa Fe County, Bellamah/Stamm	98%	INCREASE, SIGNIFICANT
46	Dona Ana County, Las Alturas	96%	INCREASE, SIGNIFICANT
39	Colfax/Union Counties	92%	INCREASE, SIGNIFICANT
103	Torrance County	85%	INCREASE, SIGNIFICANT
16	Bernalillo County, So. Ninetyeight	79%	INCREASE, SIGNIFICANT
11	Bernalillo County, Arenal Unser	70%	INCREASE, SIGNIFICANT
70	Otero County, Alamogordo N.E.	64%	INCREASE, SIGNIFICANT
51	Dona Ana County, Sunland Park	62%	INCREASE, SIGNIFICANT
15	Bernalillo County, Central Coors	61%	INCREASE, SIGNIFICANT

Multiple linear regression and Pearson Product-Moment correlation were conducted to determine if proportion of foreign-born citizens ($M=0.03$, $SD = 0.02$), proportion of households with children in which the grandparents are responsible and no

parent is present ($M = 0.03$, $SD = 0.03$), proportion of parents who are unemployed ($M = 0.09$, $SD = 0.04$) and proportion of families living at the same residence for more than one year ($M = 0.85$, $SD = 0.07$) correlate with obesity rates of toddlers and children ($M = 0.23$, $SD = 0.10$), ages 2-5 years. These analyses were done at an aggregate level, as individual data for each child was not available. Results should not be interpreted as applying to an individual child. This would be referred to as the ecological fallacy and is done when an inference is made about data on an individual level based on aggregate/group level data.

When using Pearson Product-Moment Correlation Coefficient, a significant positive correlation ($p = <.0001$, $r = 0.4$) was found between obesity rates of toddlers and children of low-income families and grandchildren raised by grandparents. As obesity rates increased, so did the proportion of grandchildren who were raised by grandparents at an aggregate level. A variability of 19% ($R^2 = 0.19$) in obesity rates can be explained by the proportion of grandparents who were responsible for grandchildren and no parent was present.

A significant positive correlation ($p < 0.001$, $r = 0.3$) was found between proportion of parents who were unemployed and obesity rates of children. In various SA's, the proportion of parents who were unemployed was more likely to be higher in neighborhoods where obesity rates of children were higher. There was a weak, non-significant relationship between proportion of families living at the same residence for more than one year and obesity rates of children ($p > .05$, $r = 0.15$). The relationship between proportion of foreign-born citizens and obesity rates of children in 2015 was

also found to be non-significant and a weak, negative association was observed ($p > .05$, $r = -0.73$).

When applying multiple regression analysis and controlling for other socioeconomic variables, factors that did not significantly impact obesity rates at a community level included foreign born citizens, families living at same residence, and proportion of parents who are unemployed. A significant association ($p = <0.05$) was found between childhood obesity rates and proportion of grandchildren living with grandparents when controlling for other socioeconomic variables. For every one [unit] increase in proportion of grandparents responsible for grandchildren, childhood obesity rates increased by 1.246 [units]. When comparing the standardized coefficient to Cohen's standards, proportion of grandparents responsible for grandchildren had a relatively small effect on childhood obesity rates.

Table 6 provides the standard error, 95% confidence intervals and standard coefficients of each predictor at an aggregate level. When evaluating R^2 in the Table, 20.10% of variance of child obesity rates can be explained by the combined influence of the proportions of foreign-born citizens, households with children in which the grandparents are responsible and when no parent is present, parents who were unemployed and proportion of families living at the same residence for more than one year.

Table 7 – Predictors Table

	Coeff.	Standard Error	t Stat	p Value	95% Lower	95% Upper	Stand. Coeff
Intercept	0.155	0.136	1.144	0.2555	-0.114	0.425	
MFH1YR	0.0186	0.154	0.121	0.9042	-0.288	0.325	0.0116

MPFBC	-0.474	0.517	-0.915	0.3621	-1.500	0.553	-0.0830
PGPRC	1.246	0.428	2.910	0.0044**	0.397	2.095	0.346
PCPU	0.290	0.283	1.024	0.3080	-0.272	0.852	0.112

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

Table 8 – Regression Statistics

Regression Statistics

R ²	20.10%
Adjusted R ²	17.00%
Mean	0.231
Standard Error	0.0966
Coefficient of Variance	41.83

Chapter 4

Discussion

Throughout New Mexico, large fluctuations in childhood obesity rates were found between 2013 and 2015. Visual exploration of these changes through the creation of these mapping tools allows for further evaluation of weight fluctuations in all SA's throughout NM. The trend map created provides multiple variables that can be selected and examined per SA. The contents in this map include NM WIC clinics, NM EBT retailers, anthropometric data of all BMI categories, food deserts, SES variables, percent low income families as well as other variables. Public Health professionals can utilize these mapping tools to examine their specific geographical area and individually evaluate changes from 2013 to 2015 in that location. When hovering over that area, a drop down of information is presented, providing useful detailed information on the variables chosen. For example, when evaluating percent of children under five years of age living in poverty in a specific geographical area, a drop down appears that provides name of geographical area, percent total households with SNAP benefits, percent families in that area living in poverty and percent children under five years in poverty. As discussed previously, multiple variables can be chosen at once and can be essentially layered per SA.

These maps can be a vital tool for WIC management groups, researchers and early childhood prevention groups to focus healthcare resources and improve quality of

care in various communities. Practical changes in policy for patient care, access to WIC clinics and eligibility renewal can be developed. Potential barriers in SA's based on visual exploration are able to be examined and feasible solutions for improvement can begin to be evaluated. These maps can guide interventions for modifying social factors to positively impact healthy weight status by examining social environments per SA. Furthermore, effectively being able to pinpoint percent of low-income families per SA and percentage that is enrolled in WIC and SNAP, can encourage and promote outreach to families not enrolled to determine if they would qualify for these programs. This in turn can increase the percent of families that can access these programs, allowing for improved health outcomes, increased access to nutritious foods and the opportunity for nutrition education.

This study was an exploratory analysis utilizing geospatial techniques to evaluate trends in childhood obesity rates throughout NM. When examining the association between obesity rates and socioeconomic variables, results were interpreted with caution, as this study utilizes aggregated data evaluating 108 SA's, and not individual level data which would allow for analysis of each child enrolled in WIC. However, this study is not meant to prove that a relationship exists between these variables and weight status, as this relationship has been evaluated through numerous studies using more appropriate study designs, but instead assist in improving current practices through the use of the created mapping tools and to utilize existing knowledge to change policies and improve quality of care.

When controlling for other variables, the relationship between proportion of families living in same residence for one or more years and obesity rates was found to be

non-significant. Despite this finding, other studies have observed a relationship between constant relocation and negative health effects. This variable was chosen to be evaluated as the relationship between residential relocation and obesity rates in NM has been minimally researched. Residential instability (constant relocation from one residence to another) affects numerous children and adolescents through the United States.¹⁵ One study found that 17% of children and adolescents two to 18 years of age did not live in the same residence across a two year time period and across five years, children of the age of five and older did not continue to live in the same house.¹⁶ Constant relocation can pose negative health consequences including cognitive difficulties and behavioral problems. Families that are constantly moving also report overall poorer health and use emergency services more often.¹⁶

One study found that people who moved frequently tended to become less physically active, leading to weight gain, especially when they moved to non-urban areas.¹⁷ In another study, the impact of mobility on weight was likely attributed to changes in neighborhood surroundings, including inadequate access to parks and unsafe streets.¹⁷ Immigrants/foreign born citizens may have to move to low-income neighborhoods with limited social supports due to discrimination in the housing market, language barriers, job instability and financial problems.¹⁸ When evaluating the relationship between foreign born citizens and obesity rates while controlling for other variables, this relationship was found to be not significant. However, this data is at an aggregate level and exploration of individual data may provide different results.

The relationship between proportion of households with children in which the grandparents are responsible and no parent is present and obesity rates was found to be

significant ($p < .005$). This is in accordance with previous research. In NM, from 2011 to 2015, approximately 29,212 children lived in the home of a grandparent. For 9,011 of those children, the parent is not present in the home. Children living with extended family or in a single parent home environment may lead to changes in healthy weight status.¹⁹ One study found that the average obesity rate for children growing up in a traditional two parent family structure was 17%. In contrast, children growing up in “nontraditional” living arrangements had notably higher obesity rates, with rates of 29% for children living with adult relatives and 23% for children raised by single mothers.²⁰

When evaluating rates of unemployment and obesity rates, and controlling for other factors, the relationship was found to be non-significant. However, when evaluating other studies, a relationship has been found to exist. A recent poll found that Americans who have been out of work for greater than a year are much more likely to be obese. It was found that obesity rates rose from 22.8% for those unemployed for two weeks or less to 32.7% for those unemployed for 52 weeks or more. It is suspected that Americans who have been unemployed for long periods of time may engage in a pattern of unhealthy eating behaviors potentially caused by restricted income, psychosocial stress and altered daily routine. Due to financial difficulties, unemployed Americans are less likely to be able to purchase healthful foods and may have increased consumption of unhealthful foods.²¹ With multiple environmental factors/sociodemographic factors contributing to the prevalence of child obesity, it emphasizes the continued need and importance to improve program development and management. This can allow for improved neighborhood environments and conditions, accessible healthful food options, recreational and educational opportunities among low income families living in NM.

Strengths

This study examines aggregated communities versus evaluating individual children enrolled in WIC, which reduces possible concerns about confidentiality using individual level data. Furthermore, utilizing aggregated data allowed for the analysis of BMI status and socioeconomic variables at an aggregate level per geographical area versus examining each individual child enrolled in WIC. This study included a relatively large sample size in 2013 (n =20,000) and in 2015 (n=18,571). This study utilized geospatial techniques to build a mapping tool that evaluates trends of obesity rates and allows for examination of social environments. Utilization of these mapping tools can assist in improving current practices and can use existing knowledge to change policies and improve quality of care.

Limitations

This study examines aggregate childhood obesity rates throughout geographical areas of NM at a community level, not at an individual level. Though this acted as a strength, it also acted as a limitation, as it posed problems regarding accuracy of statistical analysis and interpreting results. Caution had to be taken when analyzing results to ensure the ecological fallacy was not violated. Unfortunately, individual level of all toddlers and children enrolled in WIC was not available, as all data was originally geocoded and aggregated per geographical area. However, this study was not about the BMI status and socioeconomic variables of individual toddlers and children, but about these factors at an aggregate level per geographical area. Another limitation to this study was that this population was not a random sample but a sample of only low-

income children. When analyzing this sample against various socioeconomic variables, caution must be taken, as it not a general representation of the overall population.

Conclusion

This study evaluated the prevalence of overweight and obesity at an aggregate level to evaluate variability in trends throughout various geographical areas of NM as well as evaluated the relationship between socioeconomic variables and obesity rates. The study, as well as other similar studies suggest that social determinants, the complex circumstances in which children and families are born and live, can significantly impact healthy weight status. This study demonstrates that although overall obesity rates decreased throughout NM, there were several geographical areas in which there was significant changes in healthy weight status. Further exploration of obesity interventions and appropriate resources in these areas as well as living conditions and food access is vital to improve the health status of toddlers and children. Adjusting care to social environments, improving social conditions, continuity of care and improving program management are some of the vital interventions needed to improve nutritional status of toddlers and children. The mapping tools created can act as a vital tool for various public healthcare professionals when working to improve healthy weight status and environmental conditions in geographical areas throughout out NM.

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