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The Relationship between Overweight and Obesity and Acculturation of 12- to 19-Year-Old Mexican American Children

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Walden University
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Abstract

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By

Elsa Ramirez Brisson, M.P.H., R.D.

MPH, University of Minnesota, 1994

BS, University of Maryland, 1980

Dissertation Submitted in Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

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Abstract

Mexican Americans, one of the fastest growing segments of the population, have been identified as having above-average rates of obesity. Yet, among this group, obesity rates seem to differ by immigrant status: recent immigrants, immigrants who have lived in the United States more than 15 years, and U.S.-born Mexican Americans. Guided by the acculturation phenomenon and the social ecological model, the current study assessed all 1,732 Mexican American children 12- 19 years old who participated in the National Health and Nutrition Examination Survey between 2003 and 2008 to determine the association between body mass index (BMI) and language, years living in the United States, citizenship, birth country, household income and size, and school attendance. Analysis of variance and linear regression were used for statistical analysis. All of these variables were significantly associated with BMI in both the bivariate and linear regression analysis, although the R-squared value was small at .138, indicating that additional factors not included in this study also influence BMI. Measuring obesity and the correlated acculturation variables with currently available data sets will provide insight in the planning and administering effective interventions for Mexican American children 12-19 years of age and promote the global social change goal of healthy weights for all children.

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Dedication

I dedicate this work to Alexis David Brisson, Irene Elsa Ramirez de Marquez,

Miguel Angel Ramirez, III and Marie Garcia, who touched my life profoundly in

their short lives. In honor of their memories, I did not abandon this project during

periods of great readjustment and new life directions.

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Chapter 1: Introduction to the Study

Introduction to BMI and Acculturation

Obesity in adults and children is a growing concern in the United States. Hispanic children in the United States have higher than average weight to height ratio, body mass index (BMI), and waist circumference measures than do non-Hispanic children (Li, Ford, Mokada, & Cook, 2006; Popkin, 2007; Schaefer, Salazar, Bruhn, Shavian, , Bushy, & Van Loan, 2009). Despite public health interventions in schools and communities to reduce obesity, the rate rose steadily from 1970 to 2003 (Gordon-Larsen, Harris, Ward, & Popkin, 2003). From those estimates, the rate of overweight or obesity in children and adolescents nationally did not increase more than half a percentage point from 2003-2007 (CDC, 2010; Ogden et al., 2006). Instead, obesity rates varied among different ethnic groups. Current estimates show that Mexican American adolescent boys and non-Hispanic Black adolescent girls have the highest rates, at 21.1% and 27.7%. These estimates show an average obesity rate for all children at 17.1% (McDowell, Fryer, Ogden, & Flegal, 2008).

Several studies link food choices, economic status, and length of time in the United States and their influence on overweight measures (Akresh, 2007; Goel, McCarthy, & Phillips, 2004; Van Hook & Balestreri, 2007). Childhood is a time of rapid growth and development (Popkin & Undry, 1998). The ages 12 to 19 years are marked by significant biological and social changes in a child (Waters, Cross, & Runions, 2009). Amidst of these changes, physical activity

levels also change during this period of development, and relationships have been found between physical activity and weight (National Survey of Children's Health [NSCH] from 2003-04 and published in 2008). The child's patterns of physical activity and weight have also been associated with the parent's physical activity patterns. The NSCH, as reported by Lutfiyya, Garcia, Dankwa, Young, and Lipsky (2008), used a random digit dial survey of 62,796 school-aged children and found more than one-third of all the children and 44% of the Hispanic children were above the 85th percentile for weight and height. The children above the 95th percentile in this study were 40% or more likely to be low income, not participate in physical activity, and not receive regular health care checks. Boys had higher rates of obesity in all groups. Studies such as this one support research about the effect of social environment and acculturation on obesity. Children learn about culture and cultural values from their family's interpretation of them; therefore, discussions about acculturation and social ecology add to the information gathered for health behaviors and values in families (Crouter, Davis, Updegraff, Delgado, Fortner, 2006; Kilty & de Haymes, 2000).

The theories found in public health literature that describe how culture and social change occur in the community are: acculturation phenomenon (Berry, Phinney, Sam, & Vedder, 2006), transactional model (Waters et al., 2009) and ecological perspective (Mc Leroy, Bibeau, Steckler, & Glanz, 1988). *Transactional* or *ecological perspective* and *social ecological model* (SEM) have been used to describe the same phenomenon (Berry, 1999).

The acculturation phenomenon focuses on family behaviors and values and is measured most often by language, media preferences, foods, country of birth, and length of stay in the new location (Abraido-Lanza, Chao, & Florez, 2005; Berry, et al., 2006; Caprio et al., 2008; Escobar-Chavez & Anderson, 2008). SEM includes the focus found in acculturation phenomenon, in addition to how the individual and family fit into the larger community. Language is one of the most commonly used measures to determine acculturation. It has been noted that individuals living in communities with few immigrants will learn the new language faster and adopt more local customs (DuBard, 2003). The ecological perspective by McLeroy, Bibeau, Steckler, & Glanz, (1988) an ecological perspective and their five levels of influence below are the reference for this study:

- Intrapersonal factors, the person's knowledge and experience;
- Interpersonal factors, family and formal/informal networks;
- Institutional factors, organizations and their rules and regulations;
- Community factors, relationships among institutions and networks within defined boundaries; and
- Public policy: local, state, and nationals laws and policies. (p. 355)

These models are presented visually in Figure 1 using interacting circles encompassing individual, immediate family members, and all the other interactions they could have throughout the day that may impact personal and

group goals (McLeroy et al., 1988). A more in-depth discussion is found in

chapter 2.
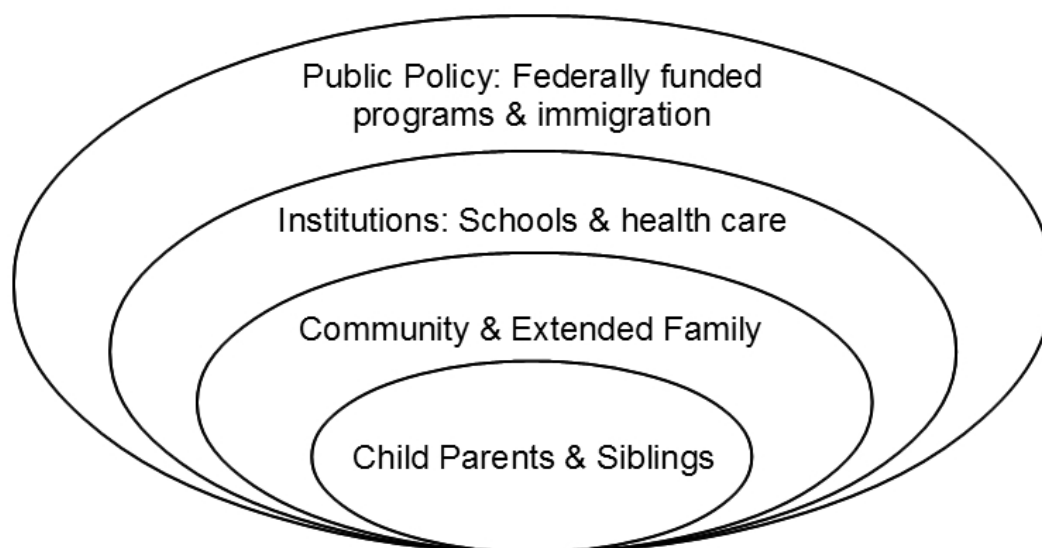
Figure 1. Adaptation of the social ecological model relationships. *Note.* Adapted from the
following authors: Figure 1. . A Social-Ecological Model for nutrition evaluation:
spheres of influence, p. S5. From McLeroy KR, Bibeau D, Steckler A, Glanz K.
An ecological perspective on health promotion programs. *Health Education
Quarterly.* 1988;15:351–377, by Gregson, J., Foester, S. B., Orr, R., Jones, L.,
Benedict, J., Clarke, B., Hersey, J., Lewis, J., & Zotz, K. (2001). System,
Environmental, and Policy Changes: Using the Social-Ecological Model as a
Framework for Evaluating Nutrition Education and Social Marketing Programs
with Low-Income Audiences. *Journal of Nutrition Education. 3,* S4-S15.

Problem Statement

Mexican American children between 12 and 19 years of age are gaining

weight at a higher rate than are children of other ethnicities (Cisneros et al., 2005;

Schaefer et al., 2009). In addition to the differences in weight gain rates by ethnicity, other factors have been identified as contributing factors on weight gain. Research has found that poverty, low physical activity, family dynamics, food consumption behaviors, and greater acceptance of obesity are some of the more common environmental and demographic factors are associated with increasing weight in the population (Akresh, 2003; Schaefer et al., 2009; Scharoun-Lee, Kaufman, Popkin, & Gorden-Larsen, 2009; Van Hook & Balestreri, 2007). However, in Mexico there is little research on the impact of societal factors on BMI. Moreover, government-led population surveys on health are rare because of their expense.

In the United States, income determines social context or class, and the government has a well established system for categorizing income. In the United States, education is slightly more significant in predicting high BMI in midlife, along with income (Kaiser, 2009). Less than a high school education and living in a low income census track has indicated higher BMI in adult women (Wang & Beydoun, 2007; Wolin, Colanglo, Chiu, & Gapstur, (2009); Yeh, Viladrich, Bruning, & Reye, 2008). Education of parents has been predictive of obesity in adolescents with income not being predictive for Mexican American youths (Caprio et al., 2008). This finding was supported from meta-analysis review of four ethnic groups from five national databases that reviewed acculturation patterns and obesity (Wang & Beydoun, 2007).

Obesity has been determined by weight, height, and waist circumference. BMI is calculated by dividing weight by height squared. BMI scores that are greater than 30% represent the cutoff for obesity (Flegal, Ogden, & Carroll, 2004). BMI does not adjust for age or gender. Growth curves are used to evaluate a child's height and weight for age and gender. The CDC growth curves were revised in 2000 using NHANES data and actual body measures. NHANES is a random, national, cross-sectional survey of approximately 5,000 persons annually and will be discussed in more detail in chapter 3 (Kuczmarski et al., 2002; McDowell et al., 2008). Using the CDC growth charts if a child is at risk of overweight at or above the 85th percentile, overweight at the 95th percentile, and obese at more than the 97th percentile. The data in NHANES have the information needed to plot a child's growth curve, and the BMI calculations have been done for all ages starting at 2 years. Waist circumference has been evaluated to be an acceptable measure to determine high body fat (Gomez-Diaz et al., 2005; Li et al., 2006). Abdominal fat has been linked to higher risk for chronic diseases such as diabetes (Cisneros-Tapia et al., 2005). BMI measures, along with waist circumference measures, are a more sensitive indicator of obesity (Cisneros-Tapia et al., 2005; Gomez-Diaz et al., 2005; Li et al., 2006). These measures used together help distinguish abdominal fat from short stocky stature since there is much variation in heights and body frame among persons of Mexican heritage (Pena Reyes, Cárdenas Barahona, Cahuich, Barragán, & Malina, 2002; Zuniga, Fritch, Villa, & Soto, 2003).

Theoretical Constructs

Acculturation and BMI

Acculturation is the study of cultural and social change (Berry, 1999). It is complex, multidirectional, and influenced by the community of origin and community of destination (Berry, 2003). Each new wave of immigrants is not the same as those before them because of the dynamic nature of culture and each person's reason to migrate. Acculturation is also occurring within the family unit through changes and adaptations of marital roles, parenting styles, child-parent discipline, and expectations (Chun & Akutsu, 2003). Each member of a family or household interacted with more than one social, geographical, or political network (Berry, 1999, 2001). The child's temperament and self-efficacy influence how these network interactions provide experience for the future (Thurber, Scanlin, Scheuler, & Henderson, 2007). Acculturation is measured using some or all of the following variables: language, birth country, citizenship, income, school attendance, and duration of citizenship in the United States (Denton, 2005; Nesdale & Mak, 2000; Oria, Sawyer, & Rapporteurs, 2007).

Acculturation phenomenon and the ecological perspective were selected as the theories for this study (Berry et al., 2001; Schumann, 2006). Language was used because it is easy to collect (DuBard & Gizilce, 2008).Language has been used as the proxy measures in NHANES since 1980 with the questions proposed by Cuellar, Maldonado, and Arnold (1995) and Hazuda, Stern, and Haffner (1988) in the Acculturation Rating Scale for Mexican Americans II (ARSMA II).

These questions were designed for a cardiovascular risk study in San Antonio Texas in 1980, and they are found in the NHANES survey (Gorden-Larsen et al., 2003). NHANES population and survey design should moderate regional differences in the acquiring and retaining the Spanish language in Mexican American adolescents. Acculturation has been described as a linear progression and for some, it may still be linear (Abraido-Lanza, Armbrister, Florez, & Aquire, 2006). Acculturation may be more multidirectional and that individuals acculturate at different rates in different aspects of life such as education, values, foods, etc., depending on the community, income, education, and family (Romero, Lopez, Turner, Asarian , & Daud, 2000). Lara, Gamboa, Kahramanian, Morales, and Hayes Bautista (2005) discussed the "U" shaped curve of acculturation, adopting United States customs and then rediscovering one's ethnic heritage or becoming less acculturated. Language use by children has not been used to measure acculturation in children. Schumann (2006) studied how language acquisition is related more to employment, environment, and motivation than the mechanics of learning a language, and found limitations in the use of language to enumerate acculturation rates in quantitative studies.

Berry et al. (2006) studied 7,997 adolescents from 26 ethnic groups in 13 countries. The small numbers of individuals from each group were justified as they tried to identify characteristics of immigrant youth. The researchers focused on urban centers with concentrations of immigrants, asking how the youth acculturated and how well they did so. Several questionnaires were completed

that determined psychological and sociocultural adaptation among adolescents. The information was grouped by acculturation attitudes that Berry (1999) had described previously: assimilation, integration, separation, and marginalization. Poor psychological adaptation was measured by behavioral and personality disorders, and poor sociocultural adaptation was measured by depression and anxiety. Language use and friend selection were important determinants for the categories. Ethnic referred to identification with heritage and nation of ancestry. This body of information also described gender differences. Boys scored better in psychological adaptation and girls in sociocultural adaptation. Adolescents in this study integrated at a much higher rate, 36%, including both cultures, and 22% had a high ethnic profile which lines ups with separation attitude. Diffuse profile described more than 20% and in this model, they would be in the marginalization attitude. They retained language, yet felt ambivalent or negative about ethnic association, and they did not participate in the larger society. Ethnic identity was not a liability especially for those who had a positive opinion about heritage, language, history, religion, and a good experience in the new location. The neighborhood's configuration influenced the rate of integration. Faster integration occurred in areas where there were fewer immigrants than in areas with large immigrant neighborhoods. The sample was recruited from schools. Schools were where the language of the new country was learned and where immigrants contacted others outside of their group. Religion had a positive effect on retaining

culture especially among Muslims. Adolescents without a religious affiliation were found in higher numbers in the marginal and diffuse groups.

Schumann (2006), working during this same period, focused on language acquisition and noted that the type of community around the non-English-speaking person determined how quickly language was learned. This study emphasized how the environment may have a stronger influence on acculturation than the individual or family influences.

The following graphical presentation of how individuals may have moved between acculturation attitudes is found in Figure 2. As illustrated in this figure, sources of bias and discrimination that are real, perceived, or feared are intertwined with economic status, education, appearance, and food choices. Models simplified what occurred in real-life situations. Potvin, Gendron, Bilodeau, and Chabot (2005) described the lack of theories grounding public health research. Their premise was a conflict between the established structure of public health programs and the commitment to objective, science-based research. Public health was founded on the scientific, medical model once the communicable infectious diseases in the population were controlled. Chronic diseases required a new approach. Prevention programs evolved based on social theory.
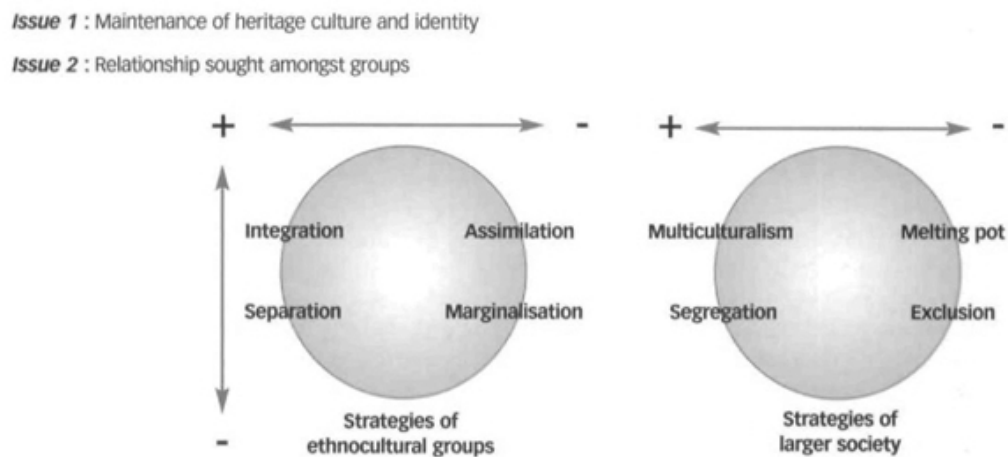
Figure 2. Acculturation attitudes.

Note. Adapted from Figure 2, *Varieties of intercultural strategies in immigrant groups and in receiving society* in "A psychology of immigration" by J. W. Berry, *Journal of Social Issues, 57*(3), p. 618. Copyright 2001 by the Association of Canadian Studies. Reprinted with permission.

Social Ecological Model and BMI

The social ecological model describes individual behaviors as influenced by the network of relationships from personal, family, extended family, community, institutions, local, state, and national, plus the policies and laws that affect everyday life (McLeroy et al., 1988). High BMI has been linked to low-income individuals living in communities without access to a variety of seasonal foods and health care (Boumtjea, Huang, Lee, & Lin, 2005). Health programs and research in schools have used this model, along with a very successful program in Texas, the Coordinated Approach to Child Health (CATCH), which focused on grade schools and has documented a reduction of BMI in students (Kelder,

Wootan, & Story, 2006). CATCH was a model program that was used as a

reference when the national school health policies were adopted in 2005 that

proposed a strong curriculum and parent components in schools nationwide

(CDC, 2009). SEM is used extensively by programs funded by the CDC such as

Steps to a Healthier U.S. (STEPS) and the Department of Adolescent and School

Health (CDC, 2009). Each community with STEPS funding develops different

approaches to increase activity and decrease obesity in their population. The

findings are not generalizable to all communities, a limitation which prompted the

current study's selection of NHANES for analysis.

International environmental effects are also part of this discussion.

Cultural change and adaptation in persons from Mexico and U.S.-born Mexican

Americans may be different because of the proximity of Mexico to the United

States. The two countries and their residents have had a long history of social,

political, and economic interactions. The increasing availability of media and

products on both sides of the border influences the adoption or maintenance of

cultural practices (Chun & Akutsu, 2003; Hunt, Schneider, & Comer, 2004; Lara

et al., 2005).

Analysis of information in NHANES was used for SEMs level 5 activities

such as creating policy, funding for federal programs, and developing tools such

as the growth charts. Variables collected from households provide information

about the individuals, the family, and the community. Figure 3 represents how

SEMs and acculturation theory are similar (Berry, 1999; McLeroy et al., 1988;

Waters et al., 2009).
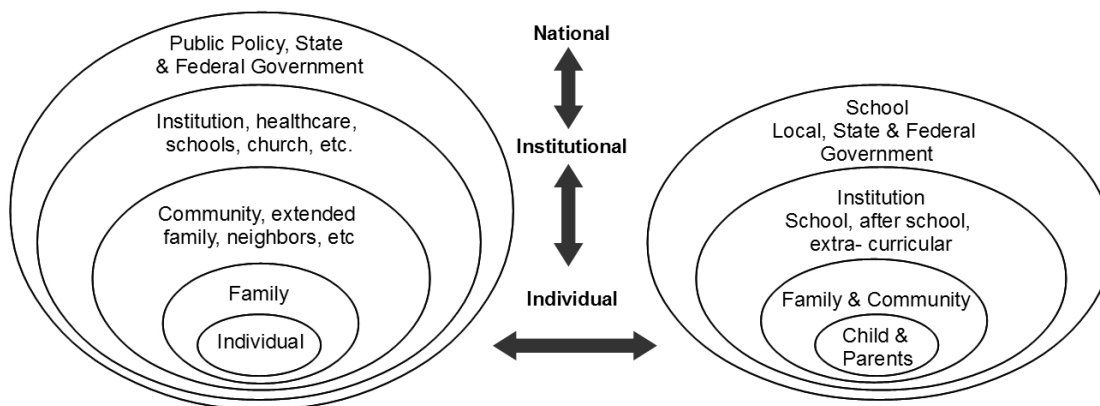
Figure 3. Acculturation ecological model for adolescents. Adapted from the following sources: Figure 1. . A Social-Ecological Model for nutrition evaluation: spheres of influence, p. S5. From McLeroy KR, Bibeau D, Steckler A, Glanz K. An ecological perspective on health promotion programs. *Health Education Quarterly.* 1988;15:351–377, by Gregson, J., Foester, S. B., Orr, R., Jones, L., Benedict, J., Clarke, B., Hersey, J., Lewis, J., & Zotz, K. (2001). System, Environmental, and Policy Changes: Using the Social-Ecological Model as a Framework for Evaluating Nutrition Education and Social Marketing Programs with Low-Income Audiences. *Journal of Nutrition Education. 3,* S4-S15. Permission requested; by Berry, J. W., Phinney, J. S., Sam, D. L., & Vedder, P. (2006). Immigrant youth: Acculturation, identity, and adaption. *Applied Psychology: An International Review, 55*(3), 303-332; and Waters, S.K., Cross, D.S., & Runions, K. (2009) Social and ecological structures supporting adolescent connectedness to school: a theoretical model. Journal of School Health. 79: 516-524.

Methodologies

The NHANES database is a random national survey that has been carefully selected and supervised in this format since 1999. This data set provided internal validity and minimized regional characteristics (CDC, 2006, 2009). National random data samples reduced the effect of regions on findings. Holt (2006) recommended the use of secondary data analysis to study children because it diminished the effect of region on the bias that can confound the results. The data available in the public use files have been weighted to reflect the population of the United States. The statistical tests used were the test of variance, as well as linear and multiple regression analysis. The CDC (2006, 2009) provides a detailed guidebook for the use and handling of data for accuracy in publications. This study is different from others in that the BMI results were not collapsed into obese and non-obese categories. Dawson, Crano, and Burgoon (1996) challenged the collapsing of acculturation measures into single numbers using regression analysis factor analysis from scales proposed by Hazuda (1988) and Cuellar (1995). Using Phi in their analysis, the shorter questionnaire proposed by Cuellar (1995) was determined to be as good as the longer version originally proposed by Hazuda (1988) and used in the ARSMA II. The Phi coefficient method used a 2 X 2 table to determine high and low scores for a variable. The middle and neutral results were deleted and hence did not dilute the effect of high and low scores on the coefficient. The study population was Hispanic parents of Catholic schoolchildren in the Southwestern U.S. The researchers' interest was how to

address HIV and AIDS education and attitudes. A recommendation from this study was the development of more scales that could be used to measure the effect of culture as determined through communication preferences (Dawson et al., 1996). This study was approved by the Institutional Review Board of Walden University # 10-29-10-0250024.

Purpose

This study examined a gap in the research pertaining to Mexican American children, 12-19 years of age and the associations between BMI, acculturation, and social factors using an existing national data set.

Nature of the Study

This quantitative secondary data analysis gathered the information from three, 2-year sets of NHANES public access information. All the complete records of Mexican American children 12 to 19 years of age were used. NHANES uses questions related to the language used at home by individuals 12 years to 150 years of age as the acculturation proxy measure (CDC, 2009). Other factors, such as length of time in the United States, country of birth, education, and parents' income have been found to influence how an individual develops skills, behaviors, values, and culture in adolescence and adulthood (Berry, 2003; Chen & Akutsu, 2003; Waters et al., 2009). For this quantitative secondary analysis of 6 years of NHANES data, six questions provided a systematic testing between pairs of variables and then among variables. Analyzing this large population-based data set identified new associations between variables used to describe

overweight/obesity (body measurements), acculturation (language), and socioeconomic status (demographics). BMI was used as a continuous variable in this study.

Research Questions and Hypotheses

1. Is there an association between the BMI of Mexican American children 12 to 19 years of age and acculturation as measured by the language preferred and used by the child and his or her family?

H_{01a}: There is no association between BMI of Mexican American children between 12 to 19 years of age and acculturation as measured by the language preferred and used by the child and his or her family.

H_{A1a}: There is an association between BMI of Mexican American children between 12 to 19 years of age and acculturation as measured by the language preferred and used by the child and his or her family.

H_{01b}: There is no association between BMI of Mexican American children 12 to 19 years of age and acculturation as measured by the language preferred and used by the family.

H_{A1b}: There is an association between BMI of Mexican American children 12 to 19 years of age and acculturation as measured by the language preferred and used by the family.

2. Is there an independent association between the BMI of Mexican American children 12 to 19 years of age and acculturation as measured by the country of birth, citizenship, and length of stay in the United States?

H_{02a}: There is no independent association between the BMI of Mexican American children 12 to 19 years of age and acculturation as measured by the country of birth.

H_{A2a}: There is an independent association between the BMI of Mexican American children 12 to 19 years of age and acculturation as measured by the country of birth.

H_{02b}: There is no independent association between the BMI of Mexican American children 12 to 19 years of age and acculturation as measured by citizenship.

H_{A2b}: There is an independent association between the BMI of Mexican American children 12 to 19 years of age and acculturation as measured by citizenship.

H_{02c}: There is no independent association between the BMI of Mexican American children 12 to 19 years of age and acculturation as measured by length of stay in the United States.

H_{A2c}: There is an independent association between the BMI of Mexican American children 12 to 19 years of age and acculturation as measured length of stay in the United States.

3. Is there an independent association between the BMI in Mexican American children, 12 to 19 years of age and social ecology and environment as measured by the household and family income, the household size, and school attendance?

H_{03a}: There is no independent association between the BMI of Mexican American children 12 to 19 years of age and social ecology and environment as measured by the household and family income.

H_{A3a}: There is an independent association between the BMI of Mexican American children 12 to 19 years of age and social ecology and environment as measured by the household and family income.

H_{03b}: There is no independent association between the BMI of Mexican American children 12 to 19 years of age and social ecology and environment as measured by household size.

H_{A3b}: There is an independent association between the BMI of Mexican American children 12 to 19 years of age and social ecology and environment as measured by household size.

H_{03c}: There is no independent association between the BMI of Mexican American children 12 to 19 years of age and social ecology and environment as measured by school attendance.

H_{A3c}: There is an independent association between the BMI of Mexican American children 12 to 19 years of age and social ecology and environment as measured by school attendance

4. Is there an overall association between BMI, and the multiple independent variables that are aggregate concepts of acculturation and social ecology and environment—language preference and use, citizenship, birth country, length of stay in the United States, household income; family income,

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household size, and school attendance? Is there an interaction between multiple terms?

H_{04}: There is no overall association with BMI in Mexican American children 12 to 19 years of age and one or more of these variables.

H_{A4}: There is an overall association with the BMI with BMI in Mexican American children 12 to 19 years of age and one or more of these variables.

Operational Definitions

Acculturation: The cultural change process immigrants undergo in a new location. Each author may have a different definition. A variety of social behaviors and socioeconomic status measures are used to assess how minority and majority cultures affect each other. Language use is a measure used in all acculturation definitions. NHANES in describing acculturation among Hispanics uses only language (Berry et al., 2006).

Body mass index (BMI): A ratio calculated from the metric measurements for height and weight. The formula is found in chapter 3. The BMI is the current standard for comparing and reporting health statistics related to weight (CDC, 2006; Kuczmarski et al., 2002).

Generation: The ways in which the numbers are allocated to offspring varied among studies. First generation may pertain to any child of parents born in Mexico and second generation only to the children born in the United States, with one or both parents born in Mexico. Gorden-Larsen, Harris, Ward, & Popkin (2003) found the number of persons in the second generation was too small and

no different than the third generation and collapsed the categories into more than second.

Metabolic syndrome: A set of risk factors in overweight and obese persons that are linked to cardiovascular disease, diabetes and stroke. The five risk factors are waist circumference, altered blood lipid levels such as high triglyceride or low high density lipoproteins, hypertension, impaired glucose sensitivity, and overweight (Cisneros-Tapia et al., 2005: National Heart Lung and Blood Institute, 2010).

Mexican American: Any individual citizen or noncitizen of Mexican heritage who has identified him or herself as Hispanic or Latino with a subgroup of Mexican origin (CDC, 2006).

Proxy: A term used to describe a person providing some or all of the information for another person because of age, language or disability during this survey. The word proxy is also used to describe measures that are considered representative of a group of behavioral or clinical variables (CDC, 2006).

Waist circumference: A measure for central adiposity. The definition used in this study was determined by the Centers for Disease Control and the Mobile Examination Center (MEC) interviewer protocols. Variation from this definition will be mentioned when referring to studies that did not use this method. Combined with BMI measures it is considered a more accurate identification for overweight and obesity risk factors (Li et al., 2006).

Assumptions

The following assumptions guided this research and analysis. First, it was assumed that all children and parents would accurately self-identify with a particular ethnic group, regardless of what other behaviors exist (CDC, 2009), and would understand the questions and provide unbiased responses, without coercion from the stipend they received for participation. An adult family member provided much of the information collected on children and it is assumed they knew how the child would respond. Second, it was assumed that the NHANES would provide valid population statistics on participant BMIs (Kuczmarski et al., 2002). Third, it was assumed that random cross-sectional results, collected under strict protocols nationwide, would provide a generalizable result if the weighting assumptions were correct (CDC, 2009). Fourth, any weight and height changes during preadolescent to late adolescents were assumed to be because of puberty, and would not affect the sample. Last, these behavioral and anthropometric measures were assumed to have a linear relationship.

Limitations

This study was limited in the nature of its design, and in its information source. Because of the study design, family dynamics and values could not be determined, and the use of the NHANES data set precludes the addition of information (CDC, 2006). An uneven distribution of ethnic groups was also a limitation of this study, as ethnic minority participants may have been under

reported. This uneven distribution impacted the results because Hispanic ethnic identification triggers the questions on acculturation in NHANES (CDC, 2009).

The language variable in this data set was also a limitation, because it was collected from questions developed before the increase in both migration and birth rates among Mexican Americans (Berry et al., 2006; Cuellar et al., 1995). Last, the level of proficiency in Spanish or English of the interviewee or individuals in the household translating was not collected. Language proficiency has economic and educational ramifications for the individual and the family members communicating and interacting in the community (DuBard & Gizilce, 2008; Schumann, 2006).

Delimitation

The bounds of this study were the information available in the NHANES public access data files on Mexican American children ages 12 to 19 years of age for the years 2005-2008. Only body measurements, demographic, and acculturation information were used in the analysis.

Significance of the Study

The number of obese individuals in the United States is growing at an alarming rate, a trend which merits more research on the factors that influence weight gain in childhood. Newer information about the association between acculturation and environmental factors and BMI is limited for Mexican American adolescents (Gordon-Larsen et al., 2003; 2004). NHANES public access data set provides an ongoing source of new information within 12 months

after it is collected (CDC, 2009). Analyzing these data for adolescents provides a descriptive evaluation about how BMI increases just prior to adulthood (Scharoun-Lee et al., 2009). Regional studies in the United States and Mexico about high BMI in children all show a gender difference and the boys in these studies have higher BMI measurements (Del-Rio-Navarro et al., 2007).

The use of quality large national databases provided objective information for health planning at all levels. Public health releases have repeatedly warned that the current generation of children will not outlive their parents because of childhood obesity, stemming from the comorbidity between overweight, disease, and shortened longevity (Frohlich, Corin & Potwin, 2001). In the past two decades, adult-onset diabetes (Type 2) in children from 10-19 is occurring more often, a worrisome trend because Mexican Americans have higher than average rates of diabetes. Obesity and a genetic predisposition for diabetes have been linked to the increases in this disease, a consequence in both Mexican Americans and Mexicans. An association between acculturation and diabetes has been shown in adults, and the rate of diabetes is much higher in the United States than it is in Mexico (Cisneros et al., 2005).

Technology and earlier diagnosis of diabetes have reduced complications and prolonged lives over all (Astrup, 2011) unfortunately that is not true for the undiagnosed persons and ethnic minorities are overrepresented in this group (Harris, 1998). Death from cardiovascular disease has also been reduced in the last 40 years, and artificial filtration of the kidneys during renal failure has

increased length of life (Perez-Escamilla & Putnik, 2007). Managing a chronic

disease such as diabetes during childhood is a challenge. All of these

interventions are expensive for insured individuals and not available for the

uninsured. They often bankrupt families and public assistance becomes the

financial source of this care (Cisneros-Tapia et al., 2005: Cunningham, Ruben, &

Narayan, 2008). Length of time in the United States, especially for Mexican

American women, is a risk for increased obesity, surpassing the population

average (Goel et al., 2004). Age specific information in the hands of health care

providers, teachers, and teens could provide objective tools to make small

changes immediately that could impact how weight in adulthood is viewed and

managed (Swallen, Reither, Haas, & Meir, 2005).

Social change will be seen in decreased BMIs among Mexican American

children, regardless of income. All obese children can be stigmatized and may

have lower self-esteem; these can affect their social development and education

(Puhl & Latner, 2007). Obesity has also been linked to increased risks for chronic

diseases in later life, diseases that require more health services to prevent death

and disability (Cisneros-Tapia et al., 2005; Kaiser, 2009). This quantitative

analysis will provide knowledge from more recent interviews about Mexican

American adolescents for prevention and intervention program planning and for

future qualitative research on acculturation and BMI.

Summary

Using secondary data analysis of NHANES public access data from 2003-2008, I employed multiple linear analyses of variables to measure acculturation and environmental effects on BMI in immigrant and nonimmigrant Mexican American children 12 to 19 years of age. Through these analyses, I parsed apart the previously masked associations that have occurred when this group has been studied with other children. The importance of this study stems from the trends among this population: Mexican American children are one of the fastest growing segments of the population (Martin et al., 2010), and they have higher than average rates of obesity (Trevino, 1999).

Chapter 2 provides a discussion of current publications about Mexican American children and the dependent and independent variables. Chapter 3 is a detailed description of the study design and statistical tests planned. Chapter 4 will be a discussion of the results of multiple regression analysis of all variables selected from the NHANES data set for this group, and chapter 5 will provide recommendations from the perspective of a community based public health registered dietitian.

Chapter 2: Literature Review

Health, anthropology, sociology, and psychology fields were reviewed for research on acculturation and obesity (Cunningham et al., 2008). Acculturation research was originally investigated by anthropologists, and by the middle of the last century, this discipline had determined that immigrant experiences were often very similar and at the same time varied (Lorenzo-Hernandez, 1998). The variation was because of the region, social economic status, and social tensions that occurred between residents and immigrants (Henry, Stiles, & Biran, 2005). Hunt et al. (2004) reported that these tensions and problems were universal among people worldwide and during different times in history. Hispanics, Asians, African Americans, and Native Americans were overrepresented in acculturation research and no distinction was made between current immigrants and the ethnic population with a long history in the regions of the United States and Canada (Berry 1999; Dawson et al., 1996; Hunt et al., 2004; Padilla & Perez, 2003). Media and technology have produced worldwide social change, especially for youth. In the past 10 years, access and availability to individuals from all socio economic and educational levels have been observed. More screen time has been linked to increases in BMI and decrease in physical activity (Escobar-Chavez & Anderson, 2008; Hernandez et al., 1999; Yang, Wu, Zhu, & Southwell, 2004).

This review explored acculturation studies (Berry, 1998, 2001; Marin, Sabogal, Marin, Otero-Sabogal, & Perez-Stable, 1987; Nesdale & Mak, 2000) and studies about obesity in adolescents (Gordon-Larsen et al., 2004). A few studies

examined both acculturation and obesity in youth (Kahn, Sobal, & Martorell, 1999; Popkin & Udry, 1998

Strategy for the Review

Key words used to search publications in Medline (Ovid) were as follows: *acculturation, adolescents, Mexican American, Latino, Hispanic, obesity, BMI, growth charts, waist to height,* and *waist to hip*. . Searches were completed using EBSCO host and included the following databases: Academic; CINAHL; Communication and Mass Media Complete; Education Research Complete; ERIC; PsycArticles; SocIndex with Full Text and Fuente Academica Premier. The key words were linked to 24 full text, peer reviewed articles. More peer reviewed studies and reviews were found in references and bibliographies (Lara et al., 2005; Miranda, 2006). A Spanish language database called Sciencio and the journal *Nutricion Hospitaleria,* provided 16 articles and books were selected for closer review. The Mexican research articles paralleled the studies in the United States in the late 1990s, as did the findings about food intakes, and increasing weight and waistlines in children (Flegal et al., 2004; Trioano & Flegal, 1998; Wang & Beydoun, 2007).

Organization of the Review

The structure of this review was organized using the variables as they presented in the research questions listed in chapter 1. The variables are grouped into three major groups: variables that measure acculturation, variables that measure environment and the dependent variable BMI and variables that measure weight

status. The variables for language and gender were found in acculturation and environmental studies. In this discussion, language preference was discussed as a measure of acculturation with more English spoken the more acculturated the individuals. Gender was discussed in the measures of environment because of the socializing effect. Gender in the methods and analysis section was limited to demographic descriptions. There are 11 variables in this study and the literature reviewed included one or more of these variables often mixed with other variables that were either not part of this study or not available in the database.

Childhood Obesity

Introduction

National trends in childhood and adult obesity are tracked and published by the CDC and the National Center for Health Statistics. The most recent publication of results includes the NHANES data from 2007-08; in this study, all children except 2-5 year olds showed an increase in the 95th percentile. The curve for 12-19 year olds is smoother with a slower increase in the rate of obesity since 2000. During the same time, there has been a large increase in the rate of obesity in 6-11 year olds who had previously shown a downward trend in weight increases. These national statistics remove the variations that occur because of region and environmental effects (Ogden & Carroll, 2010). The Healthy People 2010 objectives outline health-related goals that have been set for the United States since 1975 to prevent death and disability because of chronic diseases (USDHHS, 2010). Throughout this period, there have been public health

interventions in schools and communities to reduce obesity. The impact has been very small, if any, on reducing this trend (Gordon-Larsen et al., 2003). Several studies link food choices, economic status, and years living in the United States on overweight measures (Akresh, 2007; Goel et al., 2004; Van Hook & Balestreri, 2007). An obesogenic environment has been positively associated with high BMI in the population (Swinburn, Eggar, & Raza, 1999). The environment in the United States has been associated with higher BMI and other risks for chronic diseases when individuals with similar ethnic/racial characteristics from the United States and Mexico were studied (Kaiser, 2009). A meta-analysis review by Wang and Beydoun (2007) that included four ethnic groups reported results on Mexican Americans from five national databases and supported the concept that more research was needed on individual ethnic groups with the information disaggregated. Along with Berry (1999), this review also described the complex multi-directional patterns that immigrants adopted in a new environment making the review of multiple variables all the more relevant.

Problem

Mexican American children, 12 to 19 years of age, are becoming obese at a faster than average rate (Cisneros et al., 2005: Schaefer et al., 2009). Environmental and demographic factors such as poverty, low physical activity, family dynamics, food consumption behaviors and greater acceptance of obesity were different for this ethnic sub-group (Akresh, 2003: Schaefer et al., 2009: Scharoun-Lee et al., 2009: Van Hook & Balestreri, 2007). This study used

acculturation, demographic measures, and BMI from NHANES data for Mexican American children 12 to 19 years of age to determine which variable or combination of variables are associated with the higher than average BMI found in this group.

Introduction to Weight Measurements

To accurately determine a child's weight for current and future health, the following information is needed: gender, age, height, weight, waist circumference, BMI, and age specific growth charts. A child may appear overweight and be in the healthy weight category for that age. Children's weight status is determined by months of age because of growth and timing of puberty (CDC, 2010). The growth charts use NHANES data and Fels probability to determine this obesity risk factors (CDC, 2010; Guo et al., 2004).

Body Mass Index

Body Mass Index (BMI) was first approved to be used with children during the revision and adoption of the 2000 Growth Charts by the CDC. This approval indicated a use in clinical evaluation as a predictor of obesity at age 35 (Guo, Wu, Chumlea, & Roche, 2004). BMI is calculated the same for children and adults. The numbers are then plotted on the BMI for Age Growth Charts by Gender. Adult BMI, in comparison, is not evaluated by age and gender (CDC, 2010). BMI is calculated using the following formula: BMI = weight in kilograms (kg) divided by height in meter (m) (CDC, 2009).

Waist Circumference

The NSCH, a national, random digit dialing survey of households with children in 2003-04, found that low-income Hispanic children were more likely to be overweight than any other group. In the NSCH Hispanic children had a lower average weight than as   African American children. The reference in the NSCH study was a BMI z score, which was also used in a 2006 national study in Mexico, which used CDC and WHO methods for calculation of BMI and BMI z scores using smoothed curves from empirical percentiles from the 18,528 records (Lutfiyya et al., 2008). The Mexican study determined that there had been a marked increase in overweight and obesity in Mexican children since the last survey. Stunted growth and malnutrition had been replaced with high BMIs. Waist circumference and BMI confirmed that heavy children were at risk for obesity related disorders such as diabetes. Metabolic syndrome was confirmed with the presence of acanthosis nigricans (Del-Rio-Navarro et al., 2007).

Studies did not generally discuss the cultural acceptance of "round, rosy cheeked, chubby babies" worldwide as the ideal baby (Rossignol, 2003). The belief that a "chubby baby" is a healthy baby has not been totally abandoned in the United States. In Mexico, public health outreach efforts had focused on malnutrition and growth failure in children, and there has been success in reducing these conditions. Regional comparison studies of Mexican children have found substantial weight increases, especially among middle and higher-income children in northern regions and urban centers (Peña-Reyes et al., 2002). Increases

in BMI and waist circumference measures have also been noted in children living

in isolated rural communities (Gonzalez-Cossio et al., 2001). The findings and

discussions in these studies do not link the rise in obesity to the previous

campaigns to reduce malnutrition and growth failure. Peña-Reyes et al. (2002)

noted that the increases in body weight are highest in the northern regions, which

are closest to the United States and that the foods from the United States had an

influence on the diet of the border regions. The rise in BMI in border regions

could be attributed to the success of international marketing efforts. Changing the

cultural esthetics that "chubby" children are healthy in both Mexico and the

United States maybe a bigger challenge. This may be part of the isolated rural

increases in BMI.

Introduction to Acculturation Measures

Acculturation is the study of cultural and social change. Cultural influence

from U.S. sources has been lacking in discussions about acculturation. Mexican

immigrants appear to be more familiar with American culture than immigrants

from countries further away from the United States because of binational family

and business relationships and proximity (Kaiser, 2009). In the current study, nine

variables were identified to analyze the following two factors: acculturation and

environment. These factors are important in the discussion of health status among

different populations. Lara et al.'s (2005) review of the literature identified the

following proxy measures in their discussion about acculturation and Latino

health: use of language, media, food, and music. These items have context,

access, and availability (Yeh et al., 2008). In the public health setting, language

has been one of the easiest and most accurate proxy measures to collect (Dubard

& Gizilice, 2008).

Language

Studies about the effects of language are typically qualitative because such

a design allows for an assessment of cross-cultural influences, with a focus on

language. The Mexican-to-Mexican American experience has been unique and

varied and dependant on SES, language, region of origin, settlement location, and

decade (Macias, n.d.; Smith, 2007). For many individuals, especially men,

migration has been a temporary solution to provide economic support to family in

Mexico. In these scenarios, Mexican men migrate to communities where they can

function in Spanish, and where English proficiency is not needed and strong ties

to Mexico are maintained. Migrants in the United States form associations to

support community and political activities in their hometowns in Mexico. These

"transnational" activities provide persons with limited English skills to develop a

voice and later the confidence to participate in the United States in Spanish or

with limited English skills (Macias, n.d.; Smith, 2007).

Language variables in studies have been tied to acculturation

measurements. Two studies examined whether language or duration in the United

States was more predictive of obesity in women. Wolin et al. (2009) studied 388

Hispanic women, 98% of whom were born outside of the United States and 65%

of this group born in Mexico. All the women used Spanish in all aspects of life.

Multivariate analysis adjusted for age, education, smoking, activity, and length of time in the United States found that language was not associated with obesity. A smaller study by Himmelgreen et al. (2004) had the same conclusions. This study used only Puerto Rican women, and found that U.S.-born Hispanics who spoke Spanish had a much higher incidence of obesity than Hispanics in general and should be investigated along with pairing English proficiency and Spanish speaking.

Country of Birth

Another critical variable in acculturation studies is the country of birth as well as generation in the United States. This variable and length of time in a place results in higher acculturation Birth outside of the United States has generally been related to lower acculturation and high acculturation when both parents and children were born in the United States (Bates, Acevedo-Garcia, Alegria, & Krieger (2008). Both the parents' and children's country of birth are used to determine the child's generation. Generation has been determined in each study slightly differently. Popkin and Udry (1998) also found higher BMIs with each generation. The information was from the National Latinos and Asian American Survey, a stratified area probability sample of persons 18 years and older. The height and weight information was self-reported. Regression analysis was used to compare the BMI among first through third generations and a higher BMI was noted in each new generation. In the data analysis age, place of origin or ancestry, gender, and education were controlled. Education affected BMI across all

generations with lower BMI especially in women, yet their BMIs were higher than their parents. Among Latinos, BMI did not vary among countries of origin, as it did in the Asian population (Bates et al.).

Country of birth can influence culture, acculturation, and assimilation in a new country. The economic environment of the country of origin and the immigrants' status in that economy can have an influence on not just income capacity but health outcomes such as BMI. Information from the Early Childhood Longitudinal Survey compared economics in the country of origin and the new country plus the families' SES in a meta-analysis that used national random samples of adults and children. For children born in the United States the parents' birth country was used. The gross domestic product (GDP) per capita and the parents' SES were associated with BMI. Generation was classified as number 1.0 for the first generation for children 12 years and older at immigration and number 1.5 for generation one and a half for children between birth and 11 years of age at immigration. Generation 1.0 children with parents from countries of low GDP that were low-income were likely to have high BMI. Higher weights were also found in the first generation children from high GDP countries. Socio-economic strata were more closely related to high BMI and assimilation than was generation (Van Hook & Balistreri, 2007).

Length of Time in the United States

The 2000 National Health Interview Survey determined length of stay in the United States by asking participants about place of birth and the duration of

their residency in the United States. Although this study generated detailed, descriptive data, it was limited by the self-reported heights and weights for the determination of BMI scores. The gap between new immigrant BMI and U.S. BMI rates became smaller the longer immigrants were in the United States. After 15 years, all except Black immigrants, primarily from Africa, had the same weight distributions (Goel et al., 2004). The NHANES information on Mexican American adults and children reported the same trend of increased BMI, the longer they resided in the United States (McDowell et al., 2008).

Citizenship

In contrast to the well documented link between length of stay in the United States and BMI, citizenship is not the primary variable in studies. In the demographic descriptions *immigrant* and *nonimmigrant* was used most often. Since an immigrant can be a citizen, many of these studies could not be referenced. Citizenship has other problems such as non citizens that are documented and undocumented. There were no studies in the public health/health searches that explored this area. Qualitative studies provide insight into the complex issues that surrounded changing citizenship for immigrants. The process of identifying with one country to another as one's home is a big step in the acculturation phenomenon (Macias, n.d.; Smith, 2007). Having changed citizenship measured high acculturation into the new culture. An ethnographic study by Espitia (n.d.) pointed out the phenomenon that Mexican immigrants delay much longer to apply for U. S. citizenship, including those with legal entry

documents than immigrant from other countries. Fear of failing to learn enough English to pass the citizenship interview was a recurring theme since, living in a Spanish-speaking community, a resident did not have to learn English (Farkas, Duffet, Johnson, Moye, & Vine, 2003; Smith). This pairs citizenship and language into overlapping variables, and language is a strong indicator of acculturation. Motivation to apply for citizenship was generally not shared with the interviewer. Espitia gathered from the interviews that changing citizenship somehow betrayed Mexico. On the other hand, American citizenship made it easier for individuals to assist other family members in gaining preferred status in the immigration process. Many individuals did not know that Mexican citizens could apply for dual citizenship status. At the same time, those that did know they could have both did not choose to apply to keep the Mexican citizenship when this study was done (Farkas et al.). How they felt they were treated was generally no different; some activities such as applying for loans, crossing back into the United States and access to medical insurance and services were possible. Many described it as the lifting of the worry about deportation. Undocumented individuals had difficulty finding suitable housing and work and were not able to afford the extra cost of becoming naturalized citizens because of the fines added to the application process (Huerta-Macias, Gonzalez, & Holman, 2000).

Introduction to Socioeconomic Status Variables

Household Size

The number of persons living in the home or members of one family has been a measure of acculturation and socioeconomic status in the United States and Mexico. As noted in the discussion on country of birth and length of time in the United States these variables have a strong influence on socioeconomic status. Researchers found that household size is associated with BMI and health outcomes (Ayala et al., 2007). Studies concerned with family size were focused on small families with one son or less than three children and predominantly middle and higher income. Sons were of particular interest because Mexican American male children in some studies have higher BMI than the average Mexican American child and Mexican American girls (McDowell et al., 2008) Smaller family size was described as *acculturated* in the United States and as *progressive* in Mexico (Brewis, 2003). Smaller family and household sizes were associated with higher BMI, especially in male children regardless of income (Ayala et al.; Brewis, 2003).

Family and Household Income

Income has been mentioned in studies that focused on birth country, length of stay and household size with it having an effect and not having an effect. Kahn et al.'s (1997) study reviewed the acculturation variables of income, generation, and language preference in NHANES, 1982. The data did not determine an association with BMI in the regression analysis. They attributed it to

a very large numbers of low-income Mexican Americans. Scharound-Lee et al.

(2009) used the ADD data for a secondary data analysis of adolescents and the

various trajectories that SES and obesity have taken. Older adolescents may be

captured in analysis as contributing to their income status, yet those who are

underemployed and remained in school could attain higher socioeconomic status

by postponing marriage, parenthood, and stressors because of low socioeconomic

status. Pregnant teens in the Wave II data set were excluded. *Ever been pregnant*

was estimated to be 25% of the population, and it was included. Pregnancy was an

important factor because the weight increases cause of higher weights in adult

women. Pregnancy would be linked to other variables such as income, household

size, and school attendance. Adolescents who entered the workforce early were at

the highest risk for obesity and most likely not to earn high wages. Parental

education and social networks had a positive effect on current and future

socioeconomic status of their children. Asians had the most educated parents and

the highest scores for life course socioeconomic status. Latent class analysis was

used to develop these five levels from the data: "persistent disadvantage;

disadvantage with autonomy; material advantage; educational advantage and

highest overall advantage". Regression analysis was used to determine the

interaction among the race/ethnicity and obesity characteristics. The information

was self-reported and included high school students. Although the authors found

race/ethnicity not to be an across sample effect, Hispanics and African Americans

were more likely to be in the bottom two tiers of income and they also had the highest rates of obesity.

Education

School attendance is both an acculturation and an environmental measure. In this review it is listed under environment because it is used as a proxy for future income potential. Parent's educational level is also found to affect children's weights with higher BMIs and lower educational attainment. Older adolescents and young adults in school had lower BMI ratios than those that were not in school (Bates et al., 2006; Scharoun-Lee et al., 2009). The National Heath Interview Study (NHIS) is one example where many variables that are part of this study were analyzed. It is included here because education was a factor that changed the negative heath findings related to high acculturation and health outcomes. The health variables in the NHIS study were smoking; alcohol intake, high BMI, and exercise, and the independent variables were age, income, education, ethnicity-Latino, country of birth, and length of residence. The independent variables were used to determine an acculturation rating scale for NHIS. Born in the United States were rated as 1 the highest acculturation on the NHIS acculturation scale. High acculturation rating was related to increased smoking, alcohol intake, BMI, and exercise frequency. The population was 3,100 Latinos, 18 years of age compared to white non-Latinos. Increased BMI and other adverse high risk behaviors were reversed when the highly acculturated individuals in the sample had the most years of education (Abriado-Lanza et al.,

2005). Waters et al. (2009) systematically reviewed the literature on adolescents and their connectedness to school. Connectedness was a concept that included the "brick and mortar" structures and the interpersonal interactions and relationships. Organizational structure was the building, the facilities, equipment, and governance. Interpersonal connectedness included the children, staff, parents, and community. Children who connected with school developed the skills of autonomy, competence, and relatedness. Better health and academic outcomes were the measure. Waters et al., described the whole system as school ecology, which had similarities to Berry's (1999) model and the social ecological model used in public health for program interventions and evaluation. A graphical presentation of how these models overlap was presented in chapter 1, Figure 3.

Gender

Gender is a demographic variable. The Continuous NHANES from 1999 to the present has oversampled the Mexican American population in the United States. All persons from low socioeconomic status across racial and ethnic groups and late adolescent males from low socioeconomic status were at the highest risk for high BMI. High BMI or obesity was found to continue into adulthood (Stovitz, Schwimmer, Martinez, & Story, 2008). McDowell et al. (2008) also found that Mexican American male children were more likely to be above the 95th percentile and that this increased with age.

Kahn et al. (1997) used HHANES and NHANES III survey data. The groups in this study were Mexican Americans, Cubans and Puerto-Ricans.

Acculturation variables were ethnic identification with Hispanic, language, birth country, and generation. Demographic variables included individual and household income, employment, gender, age, and education. Increased BMI and acculturation varied between gender and generation. Employed and married women had lower BMIs. No associations were found between increased education and lower BMI in this study. Cubans had highest incomes and rates of obesity closest to the non-Hispanic population. Puerto Ricans had the lowest incomes and higher rates of obesity, which was related to the income. The Puerto Rican population was also mostly found in large urban centers in the United States. Mexican Americans represented more than 66% of the total Hispanic group and had lower incomes and higher rates of obesity, especially among males.

Summary

The Hispanic Health and Nutrition Examination Survey from 1988 was the source of many articles (Angel & Worobey, 1991). The Continuous NHANES from 1999 to the present has oversampled the Mexican American population in the United States. High BMI in childhood was found to be a high risk in adulthood for obesity and chronic diseases. Late adolescent males and all low-income persons across racial and ethnic groups are at higher risk (Stovitz et al., 2008). A study focused on Mexican American children 12 to 19 years of age on the association of BMI and acculturation variables was not found.

Chapter 3: Research Method

Introduction

Mexican American children in the United States have a higher than average body mass index (BMI) than non-Hispanic children. High BMI, especially in Mexican American children, has been associated with higher rates of metabolic syndrome and diabetes (Jones, 1998; May & Rew, 2010). Several studies link food choices, economic status, and length of time in the United States and their influence on BMI (Akresh, 2003; Himmelgreen et al., 2004; Kaiser, 2009; Khan et al., 1997; Salsbury & Reagan, 2009; Villa-Caballero et al., 2006). This quantitative study investigated the associations among the variables found in the National Health and Examination Survey (NHANES) pertaining to BMI, demographics, and language use in Mexican American children 12 to 19 years of age. NHANES uses questions related to the language used at home by individuals 12 years to 150 years of age for the acculturation proxy measure (CDC, 2009). The upper limit of age is set at 150 years to assure that surveys will always include the oldest old noninstitutionalized person. An understanding of the acculturation and ecological/environmental factors that affect children, such as language, county of birth, age of immigration, years living in the United States, citizenship, socioeconomic status, and gender, will encourage the design and delivery of health education for this ethnic sub-group and age range, which will prevent or reverse obesity. This chapter contains a description of the design of the

NHANES survey, the study design, research questions and hypotheses, and analysis.

NHANES Research Design and Approach

NHANES is a stratified, cross-sectional study of civilian, noninstitutionalized residents from 0-150 years of age in the United States (CDC, 2006). The federal government has undertaken this study since 1964 and it became a continuous survey in 1999. A cross section of the population is selected each year based on a complex sampling plan developed from the 2000 census by county. Each year 5,000 individuals in the United States are selected. The households are selected by randomized blocks within randomly selected census tracts. If the selected dwelling is empty or refuses to participate, the surveyors are instructed to find another household within that city block or nearby dwelling. The study is weighted to compare the results to the United States population. Using a combination of 4 years from two 2-year sets of data creates a randomized national sample and the effects of region are reduced. Mexican Americans and adolescents have been over sampled since 1999 (CDC, 2006). The purpose of this oversampling is to assist the public health services in determining trends in health risk in this group. Mexican Americans are one of the fastest growing segments of the population (CDC, 2006; Martorell, Mendoza, & Castillo, 1989).

Instruments and Descriptions

There were three parts to this survey: (a) an in-home interview survey, (b) a clinical examination, and (c) follow-up on a small sample. Adults willing to

answer questions about the household demographics and themselves were identified as sample persons; they may or may not have been heads of the household. The types of instruments included computer-assisted questionnaires and flash cards. The home interview unfolded into a series of interview questionnaires beginning with the Screener, Module 1, that is used to describe the dwelling; develop a rapport with participants; confirm the address; and capture the names, ages, relations, and gender of all the persons related and not related living in the residence. The public access records were carefully sanitized to maintain confidentiality. Module 1 included the names, locations, and most relationships. Confidentiality and the protection of the households interviewed were a key component of this study. Participant anonymity was insured by the survey protocols, the training of personnel, and the information collection process. Screener, module 2, developed the matrix of relationships in the household. This information was not available in the public access records. Two interviews were conducted at the address: individual questionnaires and a family questionnaire. The sample or reference person had to be 18 years of age or older and able to answer detailed questions about the family. The family interview was composed of six questionnaires and a set of hand flash cards that assisted in answering the demographic and income questions. The topics for these questionnaires were: (a) demographic background or occupation, (b) food security, (c) housing characteristics, (d) income, (e) smoking, and (f) tracking and tracing. Food security was determined by food purchasing ability. The housing

characteristics included the type of house, single family, or mobile home, as well as information about plumbing, water filter use, and pets and pests. Income was selected from flash cards for each person living in the house. Smoking questions included the frequency and quantity of cigarettes smoked as well as the location. Tracking and tracing included detailed references for follow up for individuals who would change their address before all the information had been collected. The sample person interview had 28 topics that included exposure to environmental contaminants, behaviors, perceptions, and background.

The information gathered above was processed from a laptop with the computer-assisted survey instrument, which was abbreviated A-CASI. The question order was programmed to facilitate checking answers that could be in error. Redundant questions provided a check for consistency in the replies from the interviewees. The NHANES interviewer returned for a follow-up visit and at that time all the answers to questions were entered via laptop directly to the NHANES data collection center. The public access files for the interview were found under the demographic section called DEMO_D. The acculturation questions pertaining to the use of language were asked during the demographic interview, and were triggered by answering the ethnicity question as Hispanic. The surveyor also documented the use of language other than English, if someone in the household answered as a proxy for the sample person or if a translator was used. Language use was also collected during the clinical evaluations. Children 16 years of age and older or emancipated teens completed the interviews themselves.

For children 15 years and younger, the study protocol required that the questions be answered by the sample person in the household. Detailed body measurements were taken of everyone from 0-15 years of age and are found in the public access subfolder, in a file labeled BMX_D.

Detailed body measurements were taken of everyone from 0- 15 years of age in the survey during the clinical evaluation. These evaluations were conducted in a specially equipped vehicle called the Mobile Examination Center (MEC) and included anthropometric measurements, clinical observation, and lab tests. The results are found in the public access subfolder, in a file labeled BMX_D.

The data were approved for public distribution and assured the confidentiality of the individuals interviewed. SUDDAN ® software was used for the calculations by the CDC. SPSS software was selected for use because it had a menu driven interface and was able to calculate the weights and variables. NHANES provides a SAS® reader with transfer utility that works with MS Excel® and SAS®.

Reliability and Validity

Triola (2004) described reliability as "the consistency with which results occur and validity refers to how well the data measure what they are supposed to measure" (p. 203). The survey accuracy depends on the recall abilities of the persons interviewed and the variation among the measurements taken by staff. The analytic guidelines recommend that the relative standard error be less than 30% and the degrees of freedom 12 for confidence limits. This survey had a high

percentage of completion, which may be due in part to the stipends provided at the completion of each step (CDC, 2009).

The power of the statistical tests can be increased by ensuring that the sample size is adequate to reduce the Type I and Type II errors. The population size was calculated using 4 years of information. These data included 1,037 Mexican American children ages 12-19 years old. Seventy-two percent were born in the United States, 1% were born in Mexico and were U.S. citizens, and 26% were born in Mexico and were not U.S. citizens. When $\alpha = .05$ for the two-tailed t test, a sample of 265 is required for .90 1-β. False negatives and positives were only a concern with children born in Mexico who are U. S. citizens. The sample sizes for the correlation with an r of .15 are more than double. For an r of .10 with a 1-β of .80-.85 is possible. Therefore, 6 years of NHANES data was used to ensure the sensitivity of this study and it included 1732 records. Four years of data represented a national random sample.

Study Design

A cross-sectional study design was used to examine stated hypotheses. Public access data from the National Health and Nutrition Examination Survey (NHANES) was the source for the information about Mexican American children 12 to 19 years of age and their BMI, demographics, and language use. The research questions determined whether there were associations among the dependent variable BMI and independent variables measuring acculturation and ecology. NHANES used questions related to the language used at home by

individuals 12 years to 15 years of age for the acculturation proxy measure (CDC, 2009). Information from all the Mexican American children 12 to 19 years of age in the sample years 2003-04, 2005-06, and 2007-08 were used. The NHANES data set represented the distribution of the population from census estimates. Each 2-year set of data contained a factor to create the sample weights because this was a combination of 6 years, and the sample weights had to be produced following the directions in the Analytic and Reporting Guidelines for NHANES (2006). Two continuous variables and seven categorical variables with two to seven levels each were selected from the demographic sample and the examination public data set. The dependent variable, BMI, was found in the body measures data set. It was calculated from height and weight measurements that were carefully obtained by trained personnel in the MEC.

The statistical analysis software had the capabilitiy of incorporating the weights prior to running the tests. The three data sets (demographic, acculturation, and body measures) for each year each have specific weighting factors. These data cannot be used in an analysis without the weighting to produce viable conclusions.

Concepts Measured

The concepts measured were acculturation and social ecology. The proxy measures for acculturation in this study were language, country of birth, age of immigration, and years living in the United States (Padilla & Perez, 2003). Studying the associations between language uses, BMI, years living in the United

States, and age may provide a more sensitive measure of how these factors show a trend towards obesity/overweight in childhood and later in adulthood (Miranda, Bilot, Peluso, Berman, & Van Meek, 2006). The proxy measures for social ecology were school attendance, family and household size, and family and household income. These variables focused on the first three levels of the SEM: the individual, family, and institutions. Indirectly, the fifth level was part of this study because of the source of the data. These data were and are used in public health policy development in the United States and Mexico (McLeroy, 1988; Waters et al., 2009). Three of the variables identified could be a proxy measure for either acculturation theory or the SEM theory: country of birth, years living in the United States, and household size.

Process for Data Management

The information for the study was found in the NHANES web site for public use. The data files were opened by the SAS ® reader. In addition to the variables described above, the full sample 2-year individual sample weights, full sample 2-year MEC exam sample weights, Masked Variance Pseudo- PSU and Masked Variance Pseudo Stratum were downloaded into SAS ®. The independent variables were found under the following three sets of data demographics, language, and body measurements: ratio, categorical, and continuous. Each of the statistical analysis described below were completed using the combined information from the 6 years of NHANES.

Description of Variables

Table 1

Data Dictionary

Variables	NHANES source variable	Variable type	Values options for this variable
Dependent variable			
BMI	BMXBMI *	Ratio, continuous	14% – 54%
Independent variables			
Demographics			
Age	RIAGEMDR *	Integral, continuous	1-84 for whole survey >, =12 to 19=, <
Gender	RIAGENDR	Nominal, categorical	Male - 1 Female - 2
Country of birth	DMBORN *	Nominal, categorical	1- U.S, District of Columbia. Puerto Rico,.; 2 -Mexico; 3 - other
Citizenship status	DMDCITZN *	Nominal, categorical	1 – yes by birth or naturalization; 2 – no, not a citizen
Now attending school	DMDSCHOL *	Nominal, categorical	Yes – 1; No – 0
Marital status	DMDMARTL *	Nominal, categorical	1- Married; 5- never married; 77 refused; missing

(table continues)

Variables	NHANES source variable	Variable type	Values options for this variable
Family income	INDFMINC	Nominal, categorical	Codes 1-11; increments $4,999 from 0-$75,000; 11-above $20,000; below $20,000; 77-refused; 99-don't know and missing is a period.
Household income	INDHHINC	Nominal, categorical	Same as Family Income above
Individuals in family	DMDFMSIZ	Integral & nominal, categorical	1-6 indicate number in family; 7- 7 or more; followed by 77, 99 and missing
Individuals in household	DMDHHSIZ	Integral & nominal, categorical	1-6 indicate number in family; 7- 7 or more; followed by 77, 99 and missing
Family PIR	INDFMPIR *	Ratio, categorical	Range 0-4.99; >5
Language			
Sample person interview	SIALANG*	Nominal, categorical	1-English; 2 Spanish
MEC interview	MIALANG*	Nominal, categorical	1-English; 2 Spanish
ACASI interview	AIALANG*	Nominal, categorical	1-English; 2 Spanish

(table continues)

Variables	NHANES source variable	Variable type	Values options for this variable
English usually spoken at home	ACD010A **	Nominal, categorical	1-English; 77-Refused; 99-Don't know
Spanish usually spoken at home	ACD010B **	Nominal, Categorical	8-Spanish or Missing
Other languages usually spoken at home	ACD010C **	Nominal, categorical	9-Other or Missing
Languages usually spoken at home	ACD040 **	Nominal, categorical	1-Only Spanish; 2- More English than Spanish; 3-both the same; 4-Only English; 7-refused; 9-Don't know and Missing
Body measures (Dependent Variable)			
BMI	BMXBMI *	Ratio, continuous	14% – 54%

Note. *DEMO_D file, ** VARQUEX_D file, *** BMX_D file

Research Questions, Hypotheses, and Analysis

The analytic approach to the four research questions was descriptive statistics for all variables using parametric techniques for interval and ratio variables and nonparametric statistics for categorical variables. The dependent variable, BMI, was measured on the ratio scale. The association between BMI and each independent variable was reviewed separately using either the *t* test, regression, or *t* correlation coefficients for ratio and interval variables. Linear

regression analysis was performed on variables that were shown to be

independently associated with BMI in these analyses. The research questions with

associated hypotheses and specific statistical procedures are described below.

BMI and Acculturation Measures

   Research question 1. Is there an association between the BMI of Mexican

American children 12 to 19 years of age and acculturation as measured by the

language preferred and used by the child and his or her family?

   H_{01a}: There is no association between BMI of Mexican American

children between 12 to 19 years of age and acculturation as measured by the

language used by the child and his or her family.

   H_{A1a}: There is an association between BMI of Mexican American

children between 12 to 19 years of age and acculturation as measured by the

language used by the child and his or her family.

   H_{01b}: There is no association between BMI of Mexican American

children 12 to 19 years of age and acculturation as measured by the language

preferred by the family.

   $H_{A1b:}$ There is an association between BMI of Mexican American

children 12 to 19 years of age and acculturation as measured by the language

preferred by the family. Language was the proxy measure for acculturation

in the NHANES survey and this study included two of the seven variables from

the public use data. All the variables were nominal and include two to seven

responses, which are listed in Table 1. These variables were labeled language

preferred by child (MIALANG) and language preferred by family (SIALANG).
The language of the person that provided the answers during the survey could
have had a very strong influence on the language spoken at home, yet the children
could be using other languages both at home and in the community. These
findings could be associated with information related to the environmental factors
with behaviors that affect both acculturation and BMI. Retaining language was
reported more often when there were large immigrant communities, where
business, church, and other activities were transacted in Spanish (Schumann,
2006).

The statistical test proposed for these two sets of variables was a *t*-test
analysis to determine if the mean BMI between the two language groups spoken
(English and Spanish) were statistically different (DeCosta, 2006). Research
Question 2 follows and focused on the other acculturation demographic factors—
country of birth, citizenship, length of stay in the United States, and BMI.

Research question 2. Is there an independent association between the
BMI of Mexican American children 12 to 19 years of age and acculturation as
measured by the country of birth, citizenship, and length of stay?

H_{02a}: There is no independent association between the BMI of Mexican
American children 12 to 19 years of age and acculturation as measured by the
country of birth.

H_{A2a}: There is an independent association between the BMI of Mexican American children 12 to 19 years of age and acculturation as measured by the country of birth.

$H_{0\ 2b}$: There is no independent association between the BMI of Mexican American children 12 to 19 years of age and acculturation as measured by citizenship.

$H_{A\ 2b}$: There is an independent association between the BMI of Mexican American children 12 to 19 years of age and acculturation as measured by citizenship.

H_{02c}: There is no independent association between the BMI of Mexican American children 12 to 19 years of age and acculturation as measured by length of stay in the United States.

H_{A2c}: There is an independent association between the BMI of Mexican American children 12 to 19 years of age and acculturation as measured by length of stay in the United States.

The statistical tests for hypotheses 2a and 2b were the *t* test because both have two groups. Country of birth responses are "born in the United States" or "born in Mexico" and citizenship is either citizen or noncitizen of the United States. Hypotheses 2c, length of stay, was a continuous variable like BMI and the statistical test was a Pearson correlation coefficient.

BMI and Social Ecology Measures

      Research question 3. Is there an independent association between the BMI in Mexican American children, 12 to 19 years of age and social ecology and environment as measured by the household and family income, the household size, and school attendance?

      H_{03a}:   There is no independent association between the BMI of Mexican American children 12 to 19 years of age and social ecology 8and environment as measured by the household and family income.

      H_{A3a}:   There is an independent association between the BMI of Mexican American children 12 to 19 years of age and social ecology and environment as measured by the household and family income.

      H_{03b}:   There is no independent association between the BMI of Mexican American children 12 to 19 years of age and social ecology and environment as measured by household size.

      H_{A3b}:   There is an independent association between the BMI of Mexican American children 12 to 19 years of age and social ecology and environment as measured by household size.

      H_{03c}:   There is no independent association between the BMI of Mexican American children 12 to 19 years of age and social ecology and environment as measured by school attendance.

H_{A3c}: There was an independent association between the BMI of Mexican American children 12 to 19 years of age and social ecology and environment as measured by school attendance.

Hypotheses 3a-c were measured with ANOVA.

Regression Analysis

Research question 4. Is there an overall association between BMI and the multiple independent variables that are aggregate concepts of acculturation and social ecology and environment—language preference and use, citizenship, birth country, length of stay in the United States, household income, family income, household size, and school attendance? Is there an interaction between multiple terms?

H_{04}: There was no overall association with BMI in Mexican American children 12 to 19 years of age and one or more of these variables.

H_{A4}: There was an overall association with BMI in Mexican American children 12 to 19 years of age and one or more of these variables.

Using SPSS ® 18.0 a regression coefficient was calculated to determine if there was a significant association between one and more of these variables.

Protection of Subjects

This study was a secondary data analysis and the NHANES-insured confidentiality of the subjects was described in detail in the section labeled Instruments and Descriptions. The CDC provided Certificates of Confidentiality to everyone and to institutions that participate in the collections and reporting of

research information. This study was approved by the Institutional Review Board

of Walden University # 10-29-10-0250024.

Summary

In this quantitative study the overall purpose was to determine if there was

an association between BMI, acculturation measures, and environmental

measures. Acculturation and environment were measured with multiple variables.

These variables were primarily categorical and the BMI measures are continuous

in this study. The statistical tests included t test, ANOVA, Pearson's correlation

coefficient and linear regression in the analysis. The data were available from the

public access files at www.nhanes.gov. The data were weighted and all the

records represent children from the population at large. The regression analysis

provided insight into the variable or variables that have the most effect on BMI in

this age group.

Chapter 4: Results

Introduction

Mexican Americans are one of the fastest growing groups in the United States, and the rates of obesity for this ethnic group are above the national average (McDowell et al., 2008). Mexican American children's weight between 12 and 19 years of age continues to increase at a higher rate than that of children of other ethnicities (Schaefer et al., 2009; Wang, 2007). Research indicates that poverty (Villa-Caballero et al., 2006), low physical activity (Escobar-Chavez, 2008; Hernandez et al., 1999), family dynamics (Miranda et al., 2006; Yeh et al., 2008), food consumption behaviors (Akresh, 2007; Kaiser, 2009), and greater acceptance of obesity (Bates, 2008) are some of the more common environmental and demographic factors associated with increasing weight in this population.

The aim of this study was to generate new knowledge about the relationship between acculturation and weight in Mexican American children, ages 12 to 19 years. The data for analysis were from NHANES, a national, cross-sectional, weighted, random sample in the United States. In this quantitative study secondary data analysis of three 2-year sets of NHANES public access information was used. SPSS® version 18 was used to run the statistical tests with the weighting information provided by NHANES Analytic Guidelines (CDC, 2009).

Demographics

There were 1,732 12- to 19-year old Mexican American children in the 6 years of data from the NHANES datasets from 2003-2008. The sample represents equal proportions of male (49.8%) and female (50.2%) respondents, with an average age of 15.86 years of age at screening and an average age of 15.92 months at examination. A very small percentage of the respondents (0.2%) indicated that they served in the armed forces of the United States. A majority of respondents (77.8%) were born in the 50 states or the District of Columbia, 23.2% of the respondents were born in Mexico, 0.2% where born elsewhere, 0.1% were born in another Spanish speaking country, and 0.1% refused to answer about their country of birth. Three-fourths of the respondents (74.3%) reported that they were U.S. citizens by birth or naturalization and 25.5% of the respondents indicated that they were not citizens of the United States. The student's distribution in school was as follows: fourth grade (0.3%), fifth grade (5.5%), sixth Grade (13.4%), seventh grade (12.1%), eighth grade (12.9%), ninth grade (14.0%), 10th grade (12.3%) and 11th grade (12.1%). The distribution of students beyond K-12 was: high school graduates (6.7%), more than high school (4.4%), GED and equivalent (0.7%), and 12th grade, no diploma (2.1%). Table 2 provides an overview of these demographics.

Table 2

Descriptive Statistics

	N		
	3750954	MeanBMI	Standard error
Male	1802639	24.26	0.32
Female	1817119	24.17	0.23
Respondent prefers English	2953748	24.26	0.26
Respondent prefers Spanish	434932	23.20	0.41
Family preferring English	2585940	24.37	0.29
Family preferring Spanish	989040	23.65	0.32
Born in the US	937408	24.91	0.25
Born outside the US	283610	23.37	0.41
US citizen by birth or naturalization	1778784	24.21	0.26
Not holding US citizenship	609697	23.51	0.35

Data Analysis Procedure

Descriptive statistics were generated for all variables. The dependent variable, BMI, was measured on the ratio scale. The association between BMI and each independent variable was assessed separately using the *t* test, ANOVA, or Pearson's correlation coefficient. A linear regression analysis was performed on all variables to determine if there were associations among all the independent variables and BMI that were detected during the bivariate analysis of each

variable and BMI. The research questions, hypotheses, and statistical analysis are described below.

Univariate outliers. A test for univariate outliers was conducted to identify scores outside of the distribution. Univariate outliers were sought by converting observed scores to Z scores and then comparing case values to the critical value of +/-3.29, $p < 0.001$. Case Z scores that exceed this value are greater than three standard deviations from the normalized mean. There were 19 univariate outliers detected for BMI. They were retained for the analysis because discussion about BMI and obesity includes the whole range. The BMI range for this group was 13 to 60 in this very large sample and the outliers were less than 1% of the cases.

Tests of normality. Before analyzing the hypotheses, basic parametric assumptions about the dependent variable were assessed. The frequency histogram is presented to provide visual evidence of normality in Figure 4.
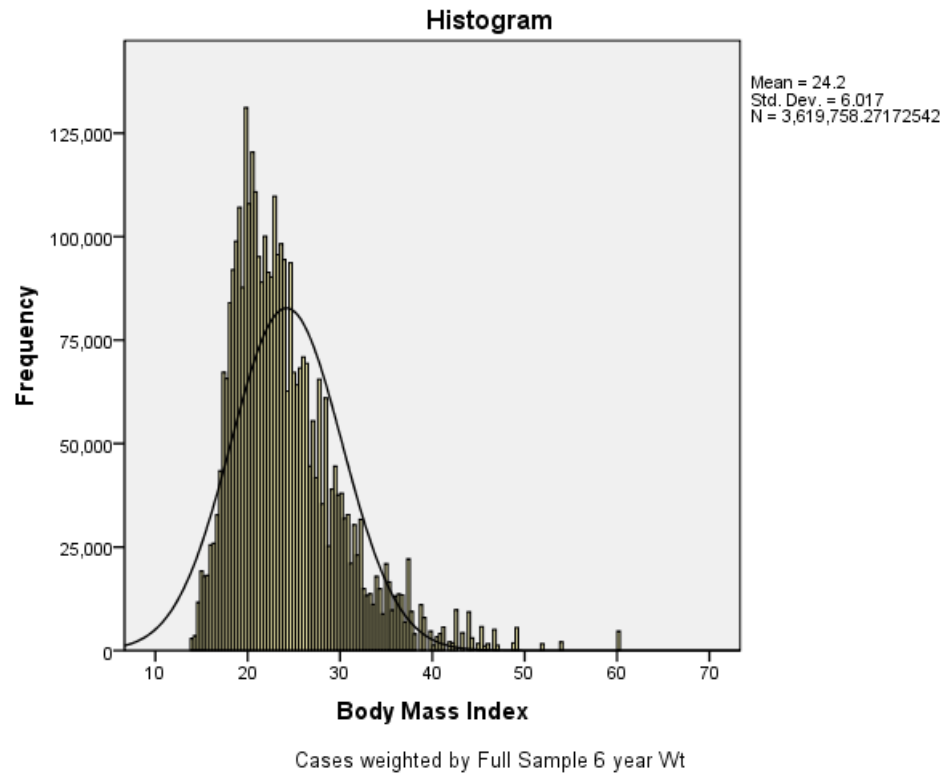
Figure 4. Histogram of the body mass index variable with normal curve superimposed.

The normalized histogram indicated that the variable BMI was both positively skewed (skewedness = 1.408) and positively kurtotic (kurtosis = 3.174). Results indicated that the constructs were not normally distributed ($p >$ 3.29). However, the variables exhibited expected deviations from normality, and therefore the assumption of normality was conditionally assumed. Descriptive statistics for the two variables are presented in Table 2.

Table 3

Descriptive Statistics for Body Mass

	√	n	x	Mean		eviation	riance	Skewness			ʻurtosis	
				Statistic	Std. error	Statistic	Statistic	Statistic	Std. error	Statistic		Std. error
Body Mass Index	3619758	14	60	24.20	.003	6.017	36.202	1.408	.001	3.174		.003
(listwise)	3619758											

Results

BMI and Acculturation Measures

Research Question 1 assessed the association between BMI of Mexican American children 12 to 19 years of age and acculturation as measured by the language used and language preferred by the child and the family. The alternative hypothesis held that there would be an association between BMI of Mexican American children 12 to 19 years of age and acculturation as measured by the language used by the child.

***T*-test analysis of hypothesis 1a.** Language preferred by the child and the language preferred at home can be different and it is believed that the language may have a strong influence on the body measures of the child. Using Survey Procedures in SPSS ® 18.0, the *t* statistic was calculated to assess whether the mean BMI between the two language groups was statistically different. The *t*-test results suggest a significant difference in the BMI of 12- to 19-year-old Mexican

American children, depending on the language preferred. The BMI of children

who preferred English (M = 24.26) was significantly higher than was the BMI of

children who preferred Spanish (M = 23.20). See Table 4 for descriptive statistics

and Table 5 for the comparison of the mean BMI.

Table 4

Descriptive Statistics Comparing BMI for Children Preferring English and Spanish

Language preferred by children	N	Mean	Std. deviation	d. error mean
	2953748	24.26	6.216	.004
	434932	23.20	4.093	.006

Table 5

T-Test Results Comparing BMI for Children Preferring English and Spanish

Independent samples test

	Levene's test for equality of variances		*t* test for equality of means					Confidence interval of the difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference	Lower	Upper
Equal variances assumed	78531.776	.000	109.632	3388678	.000	1.066	.010	1.047	1.085
Equal variances not assumed			148.383	767547.817	.000	1.066	.007	1.052	1.080

The alternative hypothesis held that there would be an association between BMI

of Mexican American children 12 to 19 years of age and acculturation as

measured by the language preferred by family.

_T_-test analysis of hypothesis 1b, language preferred by family.

Findings from the analysis related to the difference in the BMI depending on the

language groups may provide information that is related to the environmental

factors that could influence behaviors affecting both acculturation and BMI.

Retaining language is more common when there is a large immigrant community

with businesses, churches, and other activities that can be transacted in Spanish.

Using Survey Procedures in SPSS ® 18.0 the _t_ statistic was calculated to assess

whether the mean BMI between the two language groups was statistically

different. The _t_ test results suggested that there was a significant difference in the

BMI of 12- to 19-year-old Mexican American children depending on language

preferred by their family. The BMI of children whose family preferred English (_M_

= 24.37) was significantly higher than the BMI of children whose family

preferred Spanish (_M_ = 23.65). Table 6 and Table 7 show the descriptive

statistics and the results of the _t_ test.

Table 6

Descriptive Statistics of BMI Depending on Language Preferred by the Family

Group statistics				
Language preferred by family				
	N	Mean	Std. deviation	Std. error mean
	2585940	24.37	6.222	.004
	989040	23.65	5.373	.005

Table 7

T-Test Results Comparing BMI Depending on Language Preferred by the Family

Independent samples test								
test for equality of variances		*t* test for equality of means						
							ιfidence interval of the difference	
	F	Sig.	*t*	df	Sig. (2-tailed)	Mean difference	Std. error difference	Lower	Upper
Equal Variances assumed	22894.29	.000	129.08	1160979	.000	1.400	.011	1.379	1.421
Equal variances not assumed			144.03	839898.494	.000	1.400	.010	1.381	1.419

Research Question 2 assessed the association between the BMI of

Mexican American children 12 to 19 years of age and acculturation as measured

by the country of birth, citizenship, and length of stay? The alternative hypothesis

held that there would be an association between the BMI of Mexican American children 12 to 19 years of age and acculturation as measured by the country of birth.

   ***T*-test analysis of hypothesis 2a, country of birth.** The variable country of birth was recoded into two categories because there were not enough cases under each category. The two categories under which the children were reclassified were children born in U.S. and children born outside U.S. Using survey procedures in SPSS ® 18.0 *t* statistic was calculated and it was assessed that there was a significant difference in the BMI of 12- to 19-year-old Mexican American children depending on their country of birth, (*t(df=38) = 2.13, p=0.039*). That is, the BMI of children who were born in the U.S. was significantly higher (Mean = 24.21) than the BMI of children of the same ethnicity and age group born outside of the United States (Mean = 23.51). Table 8 shows the descriptive statistics and Table 9 shows the results of the *t* test.

Table 8

Descriptive Statistics Comparing BMI for Children Born in U.S. and Outside U.S.

Group statistics				
Country of birth -recoded	*N*	Mean	Std. deviation	Std. error mean
	937408	24.91	6.825	.007
	283610	23.37	5.117	.010

Table 9

_____

Independent samples test born in United States

Country of birth	Levene's test for equality of variances		*t* test for equality of means						
								95% Confidence interval of the difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference	er	er
Equal variances assumed	16269.940	.000	111.046	1221016	.000	1.539	.014	1.512	1.567
Equal variances not assumed			129.173	616946.422	.000	1.539	.012	1.516	1.563

T-Test Results Comparing BMI for Children Born in U.S. and Outside U.S.

The alternative hypothesis held that there would be association between the BMI of Mexican American children 12 to 19 years of age and acculturation as measured by citizenship.

T test analysis of hypothesis 2b, citizenship. As with the variable country of birth, the variable citizenship was recoded into two categories because there were not enough cases under each category. The two categories under which the children were reclassified were children having U.S. citizenship by birth or naturalization and children not holding U.S. citizenship. Using survey procedures SPSS ® 18.0 *t* statistic was calculated and a significant difference in the BMI of 12- to 19-year-old Mexican American children depending on their citizenship status was found. The BMI for children who are U.S. citizen by birth or

naturalization was significantly higher ($M = 24.21$) than the BMI of children of the same ethnicity and age group who are not U.S. citizens ($M = 23.51$). Table 10 shows the descriptive statistics and Table 11 shows the *t*-test results.

Table 10

Descriptive Statistics Comparing BMI for Children Having U.S. Citizenship and Other Citizenship

Group statistics				
Citizenship status	*N*	Mean	Std. deviation	Std. error mean
U.S. citizen	1778784	24.21	6.042	.005
Not a citizen	609697	23.51	4.797	.006

Table 11

T-Test Results Comparing BMI for Children Having U.S. Citizenship and Other Citizenship

Citizen or not citizen	Independent samples test citizenship								
	s test for equality of variances		*t* test for equality of means						
						Mean		95% Confidence interval of the difference	
	F	Sig.	*t*	df	Sig. (2-tailed)	differ-ence	Std. error difference	wer	per
Equal variances assumed	35541.687	.000	81.838	2388479	.000	.698	.009	.682	.715
Equal variances ot assumed			91.479	1319135.708	.000	.698	.008	.683	.713

The alternate hypothesis held that there was an association between the BMI of Mexican American children 12 to 19 years of age and acculturation as measured by length of stay in the United States.

Correlation analysis of hypothesis 2c, length of stay in the United States. Length of stay is a continuous number representing the years spent in the United States. Using survey procedures in SPSS ®18.0 Pearson's correlation coefficients were calculated and a significant association between the BMI of 12- to 19-year-old Mexican American children and their length of stay in the United States was found. The correlation results indicated that the BMI of children increases as their length of stay in the U.S. increases. Table 12 shows the descriptive statistics. Table 13 shows the correlation results.

Table 12

Descriptive Statistics for BMI and Length of Stay in U.S.

	Descriptive statistics		
	Mean	Std. deviation	*N*
	24.20	6.017	3619758
Length of time in U.S.	6.62	17.972	969370

Table 13

Pearson's Correlation Coefficient Between BMI and Length of Stay in U.S.

	Correlations		
		BMI	Length of me in U.S.
	Pearson correlation	1	.077[**]
	Sig. (2-tailed)		.000
	Sum of squares and cross-products	1.310E8	;23474.185
	Covariance	36.202	6.891
		3619758	946663
ᴐf time in US	Pearson correlation	.077[**]	1
	Sig. (2-tailed)	.000	
	Sum of squares and cross-products	;23474.185	3.131E8
	Covariance	6.891	322.996
		946663	969370

Note.**. Correlation is significant at the 0.01 level (2-tailed)

BMI and Social Ecology Measures

Research Question 3 assessed the association between the BMI in

Mexican American children 12 to 19 years of age and social ecology and

environment as measured by the household and family income, household size,

and school attendance. The alternate hypothesis held that there was an association

between the BMI of Mexican American children 12 to 19 years of age and social

ecology and environment as measured by household and family income.

ANOVA analysis of hypothesis 3a, household and family income.

Using survey procedures in SPSS ® 18.0 ANOVA tests were calculated and

showed a significant association between the BMI of 12- to 19-year-old Mexican American children and their household and family income. Increased BMI was noted at the lower and higher incomes. Tables 14 and 15 and Figures 5 and 6 shows the ANOVA results. Table 16 provides the income levels for the codes used in the graphs in this section.

Table 14

ANOVA Between BMI and Household Income

ANOVA household income

	Sum of squares	df	Mean square	F	Sig.
Between groups	3701666.197	15	246777.746	6360.967	.000
Within groups	4.757E7	1226245	38.796		
	5.127E7	1226260			

Table 15

ANOVA Between BMI and Family Income

ANOVA family income

	Sum of squares	df	Mean square	F	Sig.
Between groups	1676041.701	14	119717.264	3709.599	.000
Within groups	7.597E7	2353947	32.272		
Total	7.764E7	2353961			

Table 16

Income Codes

Code	Income range	Code	Income range
1	0-$4,999	8	$45,000 - $54,999
2	$5,000-$9,000	9	$55,000 - $64,999
3	$10,000 - $14,999	10	$65,000 - $74,999
4	$15,000 - $19,000	11	$75,000 +
5	$20,000 - $24,999	12	> $20,000
6	$25,000 - $34,999	13	< $20,000
7	$35,000 - $44,999		
77	Refused	99	Don't know
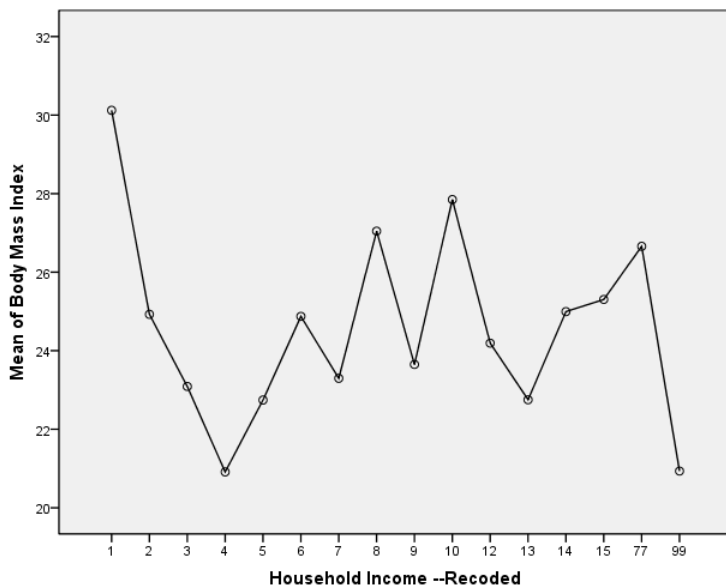
Figure 5. *ANOVA graph between BMI and household income.*

Figure 6. ANOVA graph between BMI and family income.

The alternate hypothesis held that there was an independent association between the BMI

of Mexican American children 12 to 19 years of age and social ecology and

environment as measured by household size

ANOVA analysis of hypothesis 3b, household size. The number of

persons living in the home or members of one family has been a measure of

acculturation and socioeconomic status in the United States and Mexico. Smaller

household sizes are known to be associated with higher BMI, especially in male

children. Using survey procedures in SPSS ® 18.0, ANOVA tests were conducted

and a significant association between the BMI of 12- to 19-year-old Mexican

American children and their household size was found. The results indicate that

there is a sharp increase in BMI for children in 3-person households. Table 17

shows the results of the ANOVA tests. Figure 7 shows the graph for BMI and

household size.

Table 17

ANOVA between BMI and Household Size

ANOVA household size

	Sum of squares	df	Mean square	F	Sig.
Between groups	3701666.197	15	246777.746	6360.967	.000
Within groups	4.757E7	1226245	38.796		
Total	5.127E7	1226260			
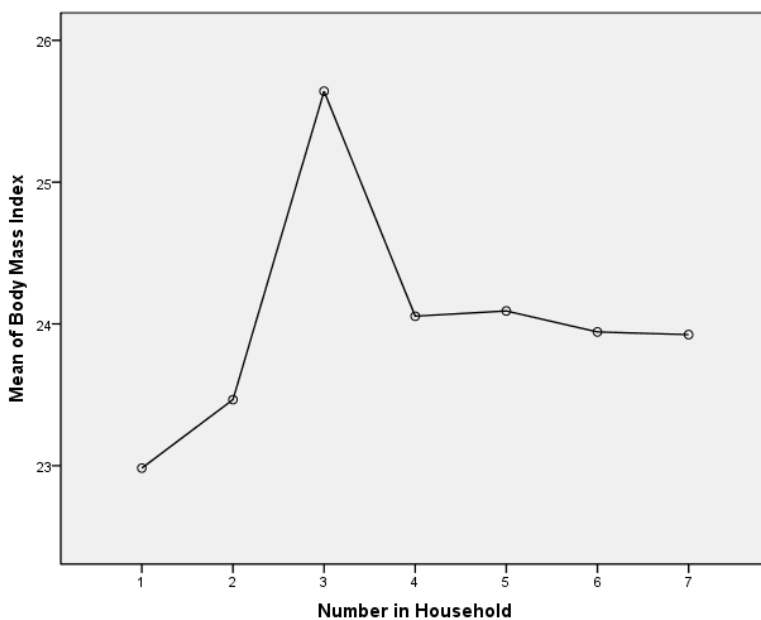
Figure 7. Graph of BMI and household size.

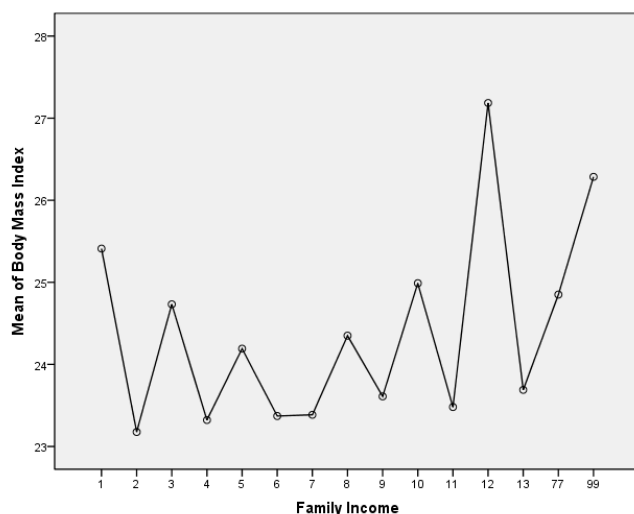The alternate hypothesis held that there was an independent association between the BMI of Mexican American children 12 to 19 years of age and social ecology and environment as measured by school attendance

ANOVA analysis of hypothesis 3c, school attendance. School attendance is a measure of both acculturation and environment. Earlier research studies showed that older adolescents in school have lower BMI ratios than those who are not in school. Researchers believe that children who are connected with school develop the skills of autonomy, competence, and relatedness (Thurber et al., 2007; Waters et al., 2009). Using survey procedures in SPSS ® 18.0, an ANOVA statistic was calculated and a significant difference in the BMI of 12- to 19-year-old Mexican American children depending on whether they are attending school or not was found. The BMI for children who are not attending school ($M =$ 24.72) was significantly higher than the BMI of children of the same ethnicity and age group who are attending school ($M = 24.07$). Table 18 shows the results of the ANOVA tests, and Figure 8 shows the graphical presentation, where 1 is attending school, 2 is attending school and on vacation or school break and 3 is not attending school and not on vacation or school break.

Table 18

ANOVA Between BMI for Children in or out of School

ANOVA in or out of school					
	Sum of squares	df	Mean square	F	Sig.
Between groups	532125.823	2	266062.912	7372.335	.000
Within groups	1.303E8	3611351	36.089		
Total	1.309E8	3611353			
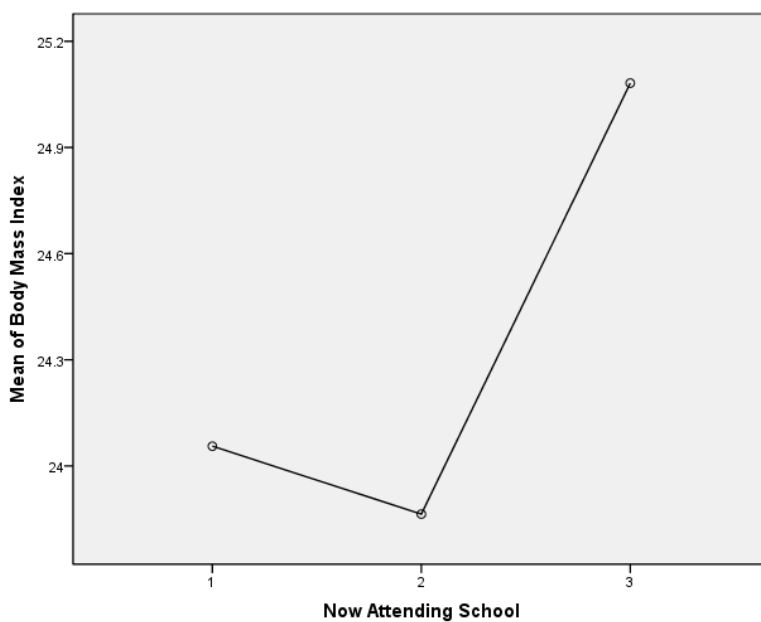
Figure 8. Graph from ANOVA comparing BMI for children who are attending school and

not attending school.

Regression Analysis

Research Question 4 assessed the overall association between BMI and the

multiple independent variables that are aggregate concepts of acculturation and

social ecology and environment, including language preference and use, citizenship, birth country, household and family income, number of individuals in the household, and school attendance, and whether there is an interaction between multiple terms. The alternative hypothesis held that there is an association with BMI in Mexican American children 12 to 19 years of age and one or more of these variables.

Regression analysis of hypothesis 4, multiple terms. Using survey procedures in SPSS ® 18.0, regression coefficients were calculated to assess whether there is a significant association between the BMI of 12- to 19-year-old Mexican American children and language preferred by children, language preferred by family, birth country, citizenship status, household or family income, household size, and school attendance (Table 19). The F-test results shown in Table 20 suggested that the regression model was significant in explaining the variation in the BMI. However, the R-square value (0.136) suggested that only 13.6% of the variation in the BMI can be explained with the help of the regression model.

The regression results shown in Table 21 suggested that the BMI of children is negatively related to language, citizenship, country of birth and household income. However, there was a positive relationship with length of time in the United States, family income, number of persons in the household and attending school.

Table 19

R-Squared for Association Between BMI, Language, Citizenship, Birthplace, Length of Time in U.S., Income, Household Size, and in or out of School

<u>Model summary</u>

Model	R	R square	Adjusted R square	Std. error of the estimate
1	.372[a]	0.138	0.138	4.889

Note. [a]*Predictors: (Constant), Now Attending School, Length of Time in U.S., Family Income, Number in Household, Country of Birth, Language of SP Interview, Language of MEC Interview, Citizenship Status, Household Income*

Table 20

ANOVA for Association Between BMI, Language, Citizenship, Birthplace, Length of Time in U.S., Income, Household Size, and in or out of School

<u>ANOVA[b]</u>

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	1017993.922	9	113110.436	732.536	)00[a]
		6338303.143	!65194	23.901		
		7356297.065	!65203			

Note. a. Predictors: (Constant), Now Attending School, Length of Time in US, Family Income, Number in Household, Country of Birth, Language of SP Interview, Language of MEC Interview, Citizenship Status, Household Income

b. Dependent Variable: Body Mass Index

Table 21

Regression Coefficients for Association between BMI, Language, Citizenship, Birthplace, Length of Time in U.S., Income, Household Size, and in or out of School

	Coefficients[a]				
	Unstandardized coefficients		Standardized coefficients		
	B	Std. error	Beta	*t*	Sig.
(Constant)	38.707	.164		235.946	.000
Language of MEC interview	-.849	.024	-.077	-34.935	.000
Language of SP interview	-1.469	.025	-.132	-59.815	.000
Citizenship status	-2.792	.034	-.185	-81.680	.000
Country of birth	-5.042	.065	-.155	-76.984	.000
Length of time in US	.012	.001	.043	22.025	.000
Household income	-.224	.007	-.599	-30.962	.000
Family income	.204	.007	.550	28.564	.000
Number in household	.038	.008	.010	4.969	.000
Now attending school	1.883	.012	.323	157.884	.000

Note. a. Dependent variable: BMI

Summary

The analyses completed in chapter 4 were undertaken to test the theoretical constructs of acculturation and social ecology. The NHANES public access data set provided the information. The variables used to measure acculturation from this data set were language preferred, country of birth, citizenship, and length of stay in the United States. In the bivariate analysis, if English was preferred by both the family and the children, higher BMIs were expected and this was in agreement with previous studies. The variables used to

measure social ecological factors were income, household size, and school attendance. In the bivariate analysis all were significantly associated. In the final regression, analysis of all variables again had a significant association yet the *R*-squared of .138 was very low; 14% of the variation in BMI was explained by the independent variables and 86% was because of random factors or chance. The large sample size could cause this to be statistically significant. The importance, meaning and significance of these results are discussed in chapter 5.

Chapter 5: Discussion

Overview of Summary and Findings

The analysis from chapter 4 is discussed in detail below. This research was conducted to fill a gap in the knowledge about Mexican American children 12-19 years of age and demographic, cultural, community, and behavioral factors that may be associated with increasing BMI (Boumtjea et al., 2005). A large study with only Mexican American children in the sample comparing BMI changes along with acculturation and SEM measures was not found in the literature review. The steep rise in obesity among all children is beginning to level off but not in this population (Ogden & Carroll, 2010). The chapter is divided into the following headings: methods, findings, interpretation of the independent variables, implications for social change, recommendations for actions, limitations of the study, recommendations for future research, and conclusion.

Methods

The NHANES data set was used because it is well designed and has been professionally administered in this format since 1999. NHANES is a stratified cross-sectional study of civilian noninstitutionalized residents conducted annually with 5,000 randomly selected households using census track information in the United States (CDC, 2009). All Mexican American children 12-19 years of age were used from three 2-year sets of data to provide adequate sample power including the years 2003-04, 2005-06 and 2007-08. The final sample size was 1,732 records. Two 2-year sets of data provided a national random sample. Four

research questions were designed to determine if there are associations with BMI

in children using measures in the database that are associated with acculturation

and environmental factors. The independent variables for acculturation were

language, country of birth, citizenship status, and length of stay in the United

States; the independent variables for SEM were household and family income,

household size, and school attendance.

The measures of acculturation theory and SEM are similar, as both use

social demographic factors, culture, location, access, and their effects on

individual and their families. To facilitate this discussion, acculturation focuses on

the individual's adaptation of cultural values and SEM focuses on the network of

relationships that have influences on values and behaviors of the individual in the

context of their family and community. This separation was used in the design to

differentiate the variables into one or the other theory. Figure 3 provided a visual

of how this overlapping exists (Berry et al., 2006; McLeroy, 1988; & Waters,

2009). The linear analysis of all the independent variables showed an association

among all the independent variables and BMI.

Findings

Although the independent variables showed an association in the linear

regression analysis, only 13-14% of the variation in BMI was explained by those

variables. The results of the bivariate analysis among the acculturation variables

for language, country of birth citizenship, and length of time in the United States

were all significant. BMI increased when children and their families preferred

English, were born in the United States, were U.S. citizens, and as length of time in the United States increased. The final regression analysis, with both the acculturation and SEM variables, was significant. All the acculturation variables except length of time in the United States had a negative coefficient; they decreased on the *y*-axis/BMI. Length of time was positively correlated and was within .04 of the regression line. Because the *R*-squared was not large, this may not have had a consequence; however, studies with adult women have also noted length of time in the United States as an important marker for high BMI and other health risks (Himmelgreen et al., 2004).

The results of the bivariate analysis, among the SEM variables for household income, family income, number in household, and school attendance, were significant. Income varied as expected with the aggregate incomes measured at below and above $20,000 with higher BMI below $20,000 and lower mean BMI above $20,000. There was much greater variation in the high and low mean BMI in family income with the range between 27 and 23.5, whereas the mean difference in household income ranged between 24 and 23. Both family and household income at the lowest category (0-$4,999) had the highest mean BMI, yet the mean BMI decreased in the lower income levels. The decrease was sharp and ended early in the household measures, whereas in the family measures of income, BMI fluctuated and remained low until it reached the median incomes (>$35,000), at which point it began to rise. In the final regression analysis, household income had a negative coefficient almost the same as the positive

coefficient for family income. Family size was not evaluated in this study because there were only two years of data for this variable. Household size was available for all 6 years and the mean BMI was highest for families of three. This configuration could have been two adults and one child or one adult and two children. Single-parent households have special challenges. The two- person household, which is assumed to be one adult and one child or a teen couple, had a much lower mean BMI. There was little variation in mean BMI from four to seven or more in household. The final regression analysis for household size was positive and closest to 0 of all the variables analyzed. Attendance in school was significant in the bivariate analysis and increased substantially for children in school, which was not expected. In the final regression, now attending school was positively correlated with BMI and the other variables.

The SEM variables as a group may have a stronger associations with BMI variation than the acculturation variables. Although length of stay in the United States was discussed throughout this presentation as an acculturation variable it may have belonged in the SEM category. It would not have changed the final analysis; it is only for this discussion that the SEM variables are relevant. Family income, now attending school, length of time in the United States, and number in household are variables that may be slightly more significant in identifying risk for high BMI in this group.

Interpretation of Findings

BMI and Acculturation

All the variables representing acculturation showed a significant

relationship in both the linear and bivariate analysis. Language was the only

variable used by NHANES to determine acculturation (CDC, 2006). All the

information used in this study came from the demographic questionnaire. The

association between BMI increasing when English is the preferred language is in

agreement with other obesity studies that ethnic minorities, as they lose language,

become more identified with and adopt the language of the dominant culture

(Dubard & Gizilce, 2008; Eamranond et al., 2009), local customs (Espitia, n.d.;

Farkas et al., 2003), and values (Arredondo, Elder, Ayala, Campbell, & Baquero,

2005; Ayala et al., 2007). As noted in the discussion above, length of stay in the

United States is probably the stronger indicator of increasing BMI in this group

and this finding is in agreement with studies of Mexican American women where

length of time in the United States has shown increased risks for obesity and other

adverse health behaviors such as smoking (Gordon-Larsen et al., 2003). In this

study group more than 75% of the children were not immigrants. A study

focusing on only the immigrant children could have had different results. Not

having been born in the United States and place of citizenship were closely

related because less than 1% of the children born in Mexico were citizens. Except

for length of stay in the United States, the negative regression coefficients could

slowly reverse the increasing BMI association noted in the bivariate analysis of

the acculturation variables. Therefore, as was expected language, citizenship, and country of birth may not be as important in children as it is in adults in predicting risk of increasing BMI.

BMI and SEM

It was expected for household income and family income to be interchangeable; yet there is an effect occurring beyond the scope of this study that family income has a greater effect on changes in BMI than does household income. This possibility could stem from larger households. Small household size has been linked in both Mexico and the United States with higher BMIs, especially in middle and higher income children (Brewis, 2005; Goel et al., 2004). The results of this study were aligned with those findings. After four members in the household, BMI did not change much and it decreased ever so slightly at greater than seven. School attendance was also associated with BMI changes. When the frequency was charted to see if there is any relationship with how the BMI increases or decreases with school status. The highest BMI were found among children not attending school and represents the smallest of the three groups of children in this category. Household size and family income should be reviewed further. Larger households have been related to less acculturation and less increases in BMI, and these findings also supported other work by Ayala et al. (2007) and Brewis (2003).

Implications for Social Change

Reversing the trend of childhood and adult obesity in the United States would be one of the greatest social changes to occur in 50 years. This finding is important because childhood obesity can lead to a lifetime of high BMI and the early diagnosis of chronic diseases that lead to death and disability. Mexican Americans have a 50% chance of being diagnosed with diabetes because of their genetics without lifestyle and behavior issues (Cisneros-Tapia et al., 2005). This finding is significant because on a national level the demographic shift in the population of the United States places Mexican Americans as one of the fastest growing segments. Understanding how this health risk can be avoided through prevention in the future will provide a better quality of life for the individuals, more productivity for the community, and a decrease in the services for functional disabilities. Diabetes in both children and adults is prevalent in the Mexican American community, and generally presents with obesity and other metabolic syndrome components (Cisneros-Tapia et al.; Gomez-Diaz et al., 2005; Jones, 1998; May & Rew, 2010). Using simple, noninvasive, objective methods to target communities to become less obesogenic environments is a first step (Swinburn et al., 1999). Language has been used as an easy way to identify high risk groups. It is not always that simple, as it has been shown in this small study, that speaking Spanish and living in a large household may actually be protective to increasing BMI. Also, in this group language has mixed purpose since the children operate in both languages between school and home activities. The tactics used for

identification, interventions, and prevention need to be sensitive to the needs of

children during this developmental stage to assure that the efforts do not become a

negative experience with stigmatizing effects (Puhl & Latner, 2007).

Balancing healthy growth in children without excess weight gain into

adulthood in one ethnic subgroup would have major public health implications.

The public health focus in Mexico has been to solve the malnutrition in young

children, especially in poor, isolated, indigent populations; yet in the United

States, death of children from malnutrition has been replaced with over nutrition.

Changing the cultural perception—that a healthy baby is not a fat baby—takes

time. This study is just one small contribution to reducing obesity. Using

currently available datasets will promote this global goal of healthy weights for

all.

Recommendations for Action

Targeting juniors and seniors at the high school level may have more

impact on the future of obesity among Mexican American children 12-19 years of

age. School programs have been in place nationwide as part of the School Health

Policies since 2002 and many model programs predate this legislation. Because of

funding cuts, community-based programs developed, executed, and evaluated by

trained professionals such as registered dietitians are not available to oversee

community programs for teens at risk for obesity during high school and beyond.

The media children use today, such as texting, *"YouTube",* and blogs as

vehicles could be effective for information dissemination. Contacts with hard-to-

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reach children would start with the student bodies in high schools, community

colleges, and technical and vocational schools using short health and lifestyle

messages that are age, culture, and regionally appropriate and designed with

student participation. Projects like these would require special handling to provide

protection of children both in research and, increasingly, from media outlets. A

project that was proposed and never executed with the Monterey County Office of

Education Media Center in 2005 fits this description. In the fall of 2010 a blog

was initiated by students in a nutrition course at the local community college

about how to eat on a student's budget, living arrangements, and time constraints.

This blog is not written by the teacher; it is only moderated and commented on by

faculty. The inspiration and information were student-led. These and other efforts

should be reviewed and evaluated for effectiveness. An excellent project by the

University of California Cooperative Extension in Salinas, California, was a

photonovela project that was popular in local high schools. It explored health

promotion themes using a Mexican, *soap opera/cartoon*, booklet format

(Necheles et al., 2010, p. 223).

Although the results did not support the original expectation that boys

have an increased risk of high BMIs and that immigrant children's BMIs increase

with time spent in the United States, the opposite was actually shown. As girls

aged their BMI increased at a faster rate than that of boys. Programs designed by

boys for boys are important because historically they have been harder to reach

with health promotion messages, and after age 18 most healthy unincarcerated

boys do not have access to public health promotion activities. Income and household sizes remain important variables and schools should continue to be a program location. Since all the variables were related to each other and no strong associations could be made, actions should consider the complex web that the community and culture of each child is when planning and disseminating programs in the community.

Limitations of Study

To keep the study manageable there were many limitations. First, the quantitative nature of the questions did not allow for more in-depth questioning about family dynamics and values. Second, using the NHANES data set precludes the addition of information and more questions (CDC, 2004). Yet these limitations are strengths in the confidentiality and scope of the data available. Ethnic identification may be underreported in persons born in the United States to parents born in the United States. This may affect the results because Hispanic ethnic identification triggers the questions on acculturation in NHANES (CDC, 2009). The language variable in this data set was collected from questions developed before the increase in both migration and birth rates among Mexican Americans (Berry et al., 2006; Cuellar, Maldonado, & Arnold, 1995). Another issue about language was that the level of proficiency in Spanish or English of the interviewee or individuals in the household translating was not collected. Language proficiency has economic and educational ramifications for the individual and the family members communicating and interacting in the

community (DuBard & Gizilce, 2008; Schumann, 2006). Also, preferring to speak Spanish and being able to communicate and transact school or business in Spanish could not be evaluated and may or may not have an influence on results. Language has been considered an easy measure of acculturation but may not be for children.

Another significant limitation in this study was not taking into account age of the child. For example, the CDC growth charts provided the evaluation of BMI and individual ages from 0-19 years of age. A BMI of 23 for 12-year-old boys according to the CDC growth charts would place them at the 90th percentile for weight in their age group and an 18-year-old .5 points above the 50th percentile. For girls the BMI for age percentiles are slightly different. At 12 years of age a BMI of 23 would also be the 90th percentile but at age 19 in the 60th percentile or higher than that of boys (CDC, 2010; Kuczmarski et al., 2002). BMI was chosen because it is a tool used to evaluate "body fatness" (CDC, 2010). Most studies and discussions of BMI for all age groups report the numbers in aggregates and generally they are >25 overweight, >30 obese. Often only 30 is used (Flegal et al., 2004). The CDC growth charts of 2000, along with the evaluation by trained medical professionals, are more sensitive measures of healthy weight in children. The growth charts list healthy weight in the 50th percentile and less. Overweight is > 85th percentile and obese is > 95th percentile (CDC, 2010). Many discussions of BMI in childhood do not translate this information back to the child growth charts.

Recommendations for Further Research

More in-depth analysis of the NHANES files can be done. This study only used public access information because there was no funding and the analysis is much more robust, especially protecting the confidentiality of the families. If the ability exists to pair the children, parents, and siblings to the variables studied here more family dynamics could be studied and determined how these dynamics might impact BMI in this group of children. What do the children with higher and lower BMI consume? A comparison of food intake and nutrition, BMI and SEM measures may provide insights for nationally funded food program and prevention efforts. The Healthy Eating Index addresses part of the previous recommendation that uses the NHANES information, but all projects have their limitations. Another research idea would be a side-by-side comparison of results from NHANES and other national and local studies with information collected within the last 5-10 years. The purpose of such a study would be to determine if there are similarities and differences, especially since the present study was not conclusive. All the variables were significant, but none of them stood out to provide an easy screening or grouping tool. Questions that are raised are how do these children compare to the findings of all Hispanic children and then all children? Are they more similar to children in general or to their ethnic grouping for the SEM measurements? Another research project could be pairing this group with another ethnic minority group of children with large immigrant populations with the same database and acculturation and SEM variables.

More qualitative research is recommended to determine how to measure acculturation in Hispanic and Mexican American communities. Measuring acculturation is based on theory developed in the mid-1980s and the theory may no longer be relevant, especially on a national scale or with children. Research is recommended on how to empower adolescents to take care of their health and nutrition within the cultural context of youth and their community. Studies showed that grade school children cannot process the information about health behavior change and that efforts need to be age appropriate (Bornstein & Arterberry, 2010). Evaluation of the effectiveness of the life skills coursework for high school juniors and seniors needs be evaluated. Easy tools for educators to measure the student's internalization and understanding of the life concepts should be a requirement in health interventions. Programs should be less prescriptive for weight loss and more about health and weight maintenance because children of all sizes need this information for the future (Butryn, Wadden, Rukstalis, Bishop-Gilyard, Xanthopoulos, … Berkowitz, 2010; Wing & Phelan, 2005). The challenge is to not stigmatize the children but to provide the information during the middle to high school years. The results of the present study found that BMI of the children was most unhealthy when they were younger and it improved as they aged. A question that could not be asked in this study was how much of the improvement in BMI could be attributed to puberty and would that change reverse in young adulthood (Lee et al., 2010).

Regional analysis of these questions is also recommended to determine how regions vary from the national findings using the same data set and others. Regional information may be found in NHANES and then disaggregated so that it can be compared to these regional studies. Integrating the information in the Behavioral Risk Factor Surveillance Survey (BRFSS) and the Youth Risk Factor Surveillance Survey (YRBSS) with other state and local school health surveys along with information from the NHANES could provide new insights for health and nutrition planning at the local level (CDC, 2008). The BRFSS and YRBSS are not of the same data collection quality as NHANES and the comparison could be misleading. New questions may be recommended for all these surveys. The surveys ask about the children's source of nutrition and health information. Another question that needs to be asked is: what preventative doctor visits should healthy teens and young adults be encouraged to make on a regular basis? The collection of BMI in schools is not universal and there is much confusion and controversy between parents, administrators, and local and state agencies on its collection and use. This data should not be collected if there is not a vehicle to use the information collected to provide interventions for the children. Age should be accounted for in future research and any future analysis of this data. Much research conducted using NHANES data is encouraging and assists new researchers in publishing their results.

Conclusion

The findings and recommendations from this study on BMI, acculturation, and social ecology confirmed previous finding from other researchers while focusing on a very specific ethnic subpopulation and age. Mexican American children are at high risk for increasing BMI throughout the teen years. The finding that family income, now attending school, length of time in the United States and number in household are variables that may be slightly more significant in identifying risk for high BMI helps focus intervention and prevention efforts. Focusing on schools with small family sizes may have the most benefit. The negative regression coefficients in many of the variables provide hope that increasing BMI can be reversed to reduce the risk of chronic diseases and improve quality of life for Mexican American children and their families.

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Appendix: Permissions to Use Drawings

RE: Permission to use graphic in dissertation

Subject : **RE: Permission to use graphic in dissertation**
Date : Mon, Mar 08, 2010 10:00 AM CST
From : **Sarah Kooi <sarah.kooi@acs-aec.ca>**
To : 'Elsa Ramirez Brisson' <erami001@waldenu.edu>

Hi Elsa,

You are free to use this graphic for your dissertation. Best of luck,

Sarah Kooi
Association for Canadian Studies

From: Elsa Ramirez Brisson [mailto:erami001@waldenu.edu]
Sent: Saturday, March 06, 2010 7:12 PM
To: sarah.kooi@acs-aec.ca
Subject: Permission to use graphic in dissertation

Dear Sarah Kooi,

This message is to request permission to use figure 1 in an article by Berry, Acculturation and adaptation of immigrant youth from the Canadian Diversity publication page 50. I do not have the year, it should be between 1999-2006. This graphic is found in most publication by Berry after 2001. Your organization is listed as the copy right holder. I am using this for academic purposes. My university makes dissertation available through dissertation databases, I will not be able to control how it is distributed.

The article I am citing for this graphic is Berry, J. W. (2001). A psychology of immigration. *Journal of Social Issues, 57(3)*, 615-631. Figure 2. My research is on acculturation and BMI in Mexican American adolescents.

Thank you in advance.

Sincerely yours,

Elsa Ramirez Brisson, MPH, RD
Doctoral Student, Walden University

Curriculum Vitae

Elsa Ramirez Brisson, MPH, RD

> **Background**

Born, Austin, Texas, raised in El Paso, Texas

Nationality, United States Citizen

Languages Spoken, English, Spanish, and German

Education

> Doctorate, Community Public Health, Walden University, 2011. Dissertation Committee: Dr. Talmage Holmes, PhD, Chair, Dr. Chinaro Kennedy, Content Expert and Dr. Regina A. Galer-Unti, The relationship between overweight/obesity and acculturation of 12-19 year old Mexican American children, dissertation defense Summer 2011

> California Designated Subject Credential, Full Time Adult Education, 2007

> Masters in Public Health, Nutrition Administration, University of MN, Minneapolis, MN, 1994

> California Lifetime Teaching Credential, University of California, Santa Cruz, CA, 1986

> Dietetic Internship, Harper-Grace Hospitals, Detroit Medical Center, Detroit, MI. 1982

> Bachelors of Science in Dietetics, University of Maryland, College Park, MD, 1980

Teaching

Central Texas College, European Division, Civilian Faculty, 1983-1985. Lead instructor for Food Services Credential offering courses in Institutional Administration, Nutrition, and Food Safety. Provided civilian synonyms for military training manuals vocabulary and assisted soldiers in careers in food service.

Monterey Peninsula College, Faculty in Older Adult Program and Culinary Arts Instructor. (1985-1989). Created a curriculum of nutrition and cooking classes for institutional and community based senior facilities. Lead instructor for baking, purchasing, garde manger, soups, sauces, etc. for restaurant chefs and cooks.

Hartnell College, Salinas California, Adjunct Faculty, 1988-present. Revised Family and Consumer Studies courses FCS 23 and 22 three times, translated FCS 22 into Spanish and taught several semesters at East Campus, 1990-1998. Developed curriculum for the Department of Social and Employment Services partnership with Hartnell and the Independent Living Program, 1998. Committee member for the Early Childhood Education Department, Independent Living Program Community wellness projects with students, 2000, and Academic Senator Spring 2011-present.

ServSafe Certification, National Educational Foundation, Chicago, Il, 1983-present. National exam review committee, 2004

Professional Experience

Food FUNdamentals, Salinas California, CEO, 1985-present.

Monterey County Office of Education (MCOE), School Health Coordinator, 2004-2006

Department of Social Services, Aging and Adult Programs, Nutrition Manager 1988-
    2004

Professional Affiliations

American Dietetic Association, 1976-present. MD/RD Media Spokesperson, 1996-
    present; Gerontological Nutritionist, 1980-present; 1987 Area Coordinator , 2004-
    06 Treasurer; Hunger and Malnutrition Practice Group, 2006; 1995-98 Area
    Coordinator.

American Diabetes Association, 1995-2006; 1997-2001 Editor, Diabetes Forecast
    Magazine.

California Dietetic Association, 1985-present; 1996 Web Site Founder,
    http://www.dietitian.org; 1988-2000 Media Spokespersons; 1992 Past Chair
    Gerontological Nutritionist; 1989 Affirmative Action Task Force.

Center for Nutrition and Aging 1990-2000

Florida International University and the Administration on Aging, Nutrition 2030, Expert
    Panel.

Monterey County Nutrition Council, 1986 Founding committee, 1992 Past President.
    This organization folded into the Nutrition and Physical Fitness Coalition of the
    Central Coast in 2001.

Society for Nutrition Education, 1976-present. 1999 & 2005 Speaker at annual meeting.

> 2007-09 Treasurer, Healthy Aging Division

California Association of Nutrition Directors for the Elderly, 1988-1994
National and California Restaurant Association, 1988-present

Central Coast Hunger Coalition, founding member and past chair, 1988- present. This organization folded into the Nutrition and Physical Fitness Coalition of the Central Coast in 2004.

Health Eating and Lifestyle Principles Coalition Member, 2004-2006

Latino Childhood Obesity Coalition of California, member 2004-present

Nutrition and Physical Fitness Coalition of the Central Coast, 2001-present. 2001-2006 Executive Advisory Board member

Community Nutrition Education Services, Inc., La Brea, CA, http://www.cnesinc.org, founding executive board, vice-president, 2006-present

Publications by Elsa Ramirez-Brisson

Culinary Hearts Kitchen Cookbook, American Heart Association Minority Cardiovascular Grant

> 1990-1992. Published by Area Agency on Aging, Monterey County Repo-graphics, 1992; published and distributed to Elderly Nutrition Programs by the Region IX, Administration on Aging, 1996; translated into Spanish and reformatted, printed by the Area Agency on Aging, Monterey County Repo-Graphics, 2003; reprint and distributed to Salinas Schools by the Curriculum and Instruction Department, Monterey County Office of Education, 2005 and updated for household sizes and including shortcuts with new value added products, 2008

Hispanic Section for the Nutrition Care Manual, an on-line subscription publication of the American Dietetic Association 2002-present.

Area Agency on Aging, Food For Thought and Food Safety Newsletters, monthly publications from 1998-2004.

Professional Presentations by Elsa Ramirez-Brisson

American Dietetic Association

1997, 1998, 2000 Annual Meeting Technology Speaker Tech Zone

Center for Nutrition and Aging, Florida International University and the Administration on Aging Nutrition 2030, 1999-2000, Expert Panel Presenter on Nutrition programs and menu planning.

Society for Nutrition Education and Behavior, Center for Nutrition and Aging, Hispanic Culture and Foods

2003 Florida International University and Gerontological Dietetic Practice Group Implementation of the DRI in the Elderly Nutrition Program

Society for Nutrition Education and Behavior
2005 Speaker on Hispanic Food Issues and Nutrition, Orlando, Florida

Awards and Events

National Restaurant Associations, Educational Foundation, Review Committee for
      Examination Excellence, ServSafe Food Service Manager Certification, 2008-09

California Dietetic Association, Crystal Award, volunteer of the year in honor
      developing, launching and managing a volunteer operated web site, 1998

National Association of Nutrition and Aging Services Programs, Apple Award for
      Outstanding Innovative Nutrition Programs Recognition for the creative solutions
      to a fiscal emergency and collaboration with three school districts to provide
      meals to seniors, 1995

American Red Cross, Recognition for work during and after the Loma-Prieta
Earthquake, 1992.
      Disaster Preparedness Grant, Just-in-Case Kits and more at www.prepare.org,
        1992-96.

Western Fair Association, Best New Program, Seniors Day at the Fair, 1993
      Seniors Day enjoyed a five year partnership with the Monterey County Fair and
      then it moved to Northridge Shopping Center, 1993-2005.

American Heart Association, Minority Cardiovascular Health Education Initiative Grant,
      1990-93; and Gourmet Art for the Heart, annual event and campaign.

American Cancer Society, National Honor Citation for Nutrition Project, 1990