



Preventing dentures and putting aside the fry bread: A systematic review of micro, mezzo, and macro conditions for dental health and obesity interventions for Native American youth

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Abstract

This systematic literature review was focused on childhood obesity and dental health interventions which have relevance to Native American communities. Childhood oral health and obesity have become significant problems across North America and among Native American Nations. Subsequently, a growing number of dental health and obesity interventions are surfacing for ethnic minority populations including Native peoples. The value and purpose of this review was to stimulate thinking about obesity and dental health intervention commonalities within micro, mezzo, and macro conditions. Two macro findings included the need for schools to be involved contributors in the intervention process and the promotion of both sensible eating and healthy drinking. Micro and mezzo results included the importance of nutrition and food preparation education for food service staff within schools; the incorporation of culturally attuned activities for physical education incorporating family, and structuring intervention programs to be multi-year.



INTRODUCTION

Dental health and obesity have become significant problems across North America youth especially within Native American Nations. Native children have particularly high odds of health problems, no health insurance, no personal doctor, unmet dental needs, and problems getting specialty care (Flores & Lin, 2013). In the same study, almost $\frac{1}{4}$ of Native children were obese, compared with 13% of white children and nearly 1 of 3 Native youth had suboptimal teeth conditions compared with only 20% in whites.

Obese youth are also at an increased risk for chronic health problems and psychological problems associated with reduced social acceptance (Henson, 2005). Hearst, Biskeborn, Christensen, & Cushing (2013) conducted a study with repeated measures, cross-sectional design, of school children's height and weight over 350,000 measures of children who were 5 to 19 years of age were collected. According to the study, Native American children consistently had higher rates of obesity compared to white children. Across the years, 14.5% of white children were obese and 25.9% of Native youth were obese. Findings suggested that targeted rural interventions beginning at an early age are necessary to improve the health of rural children, especially in Native American communities.

The existing literature describes the high prevalence of both obesity and dental health concerns in vulnerable populations and the conceptual models for intervention. Yet, there has been very little attention on intervention models which put into place a long term plan for addressing and intertwining interventions that address or translate co-occurring health disparities such as healthy consumption, dental health, obesity, and diabetes.

This review focused on childhood obesity and dental health interventions that had relevance to Native American youth situated in the continent of North America. There is little research showing commonalities between interventions for obesity and dental health in Native youth populations. The value and purpose of this review was to determine if there was interplay between micro, mezzo, and macro best practice conditions for childhood obesity and dental health interventions. The ultimate goal was to develop a guide for how these can be translated into recommendations for Native American Nations and Indigenous communities.

RESEARCH METHODOLOGY

SEARCHING

The specific focus for this paper was theoretically driven by the question, "What is the core conditional/consequential matrix which stimulated thinking about obesity and the dental health intervention commonalities between micro, mezzo, and macro

conditions and their consequences?” The hypothesis stated that relationships will emerge that highlight commonalities among obesity and dental interventions among Native children. The approach to this systematic review used specific selection criteria to:

- a) Identify pertinent investigations and;
- b) Examine the intervention methodology of the selected studies.

The secondary dataset was in the form of studies, articles, and related resources via public and university databases were used. The review identified all studies reporting outcomes of childhood obesity and childhood dental health interventions used with Native American populations. Resources included a multitude of tribal areas and did not focus on one specific nation, tribe, or Native American territory. The studies selected were published between 1985 and 2010. Although some obesity research in this area had begun prior to 1985, Bothwell, Eberling & Reifel (1994) noted that the initiation of dental health intervention work with Native American youth did not occur until well after this period. Studies prior to 1985 were excluded in order to limit the review to studies from both the obesity and dental health literature conducted during the same time period.

DATA SELECTION & PAPER SCREENING

A team of people and organizations independently collected and reviewed scholarly articles. They included the Native Circle Program at the Mayo Clinic, two trained librarians at the master and doctoral level, a doctoral candidate in social work, a doctoral level social work researcher, and a United States Department of Health and Human Services Minority Health Librarian. A majority of the data collection team were either Native American or familiar with specific Native American health databases and resources.

The following key words were used for the search criteria: American Indian, Native, First Nations, Aboriginal, Indigenous, childhood obesity, childhood diabetes (obesity related), oral health disparity, gum disease, periodontal disease, diabetes, intervention, Indians, North American, weight gain, children, adolescents, intervention, dental health, newborn, infant, preschool, diabetes, obesity, dental caries, Indigenous, patient education, prevention, tx, and treatment. Articles were collected from specific databases including the Native Health Database (University of New Mexico), PubMed, EMBASE, CINAHL Plus, ProQuest Digital Dissertations, Compendix, NTIS, GeoRef, GeoBase, Inspec, EBSCOHost, OAISTER, MEDLINE, PsychInfo and gray literature resources. The compiling of research appropriate to the subject under study reached a saturation point when independent searches of distinct databases returned duplicate articles. Such duplication indicated to the authors that

the literature search was sufficiently comprehensive and complete, given the scope of the review. Finally, a scoring sheet was developed and two authors independently reviewed abstracts (and entire studies if needed) for appropriateness of inclusion. Any discrepancies were discussed among the co-authors.

DATA EXTRACTION

A total of 120 articles were collected and sorted. Three categories emerged. These included: background and prevalence studies only (n= 94), quantitative studies (n= 20) and qualitative studies (n=6). Qualitative studies included case studies, one to one interviews and focus groups. Qualitative investigations informed the comparison of results from the larger number of quantitative studies. The qualitative analysis helped identify commonalities between intervention investigations (Noyes, Popay, Pearson, Hannes, & Booth, 2008).

DATA ANALYSIS

Grounded theory (Strauss & Corbin, 1998; Glaser, 1978) was used to guide the analytic process of the systematic review. Traditionally meta-analysis is a statistical procedure that brings together the findings of several independent studies considered to be similar or having the capability of being combined and compared (Strube & Hartman, 1982). Rather than looking at various statistical components, this paper describes a qualitative approach to compare and contrast study results, narratives of intervention descriptions, process of implementation, and storied intervention commonalities as described in previous methodology and frameworks for qualitative analysis in the review of literature (Onwuegbuzie, Leech, & Collins, 2012).

Specifically, the macro conditions related to obesity and dental health intervention commonalities in Native youth populations are reported. To better understand relationships among best practices a conditional/consequence matrix was developed to guide direction during coding. What emerged were two main events which revolved around eating for wellness and shaping the environment when environment is defined as in the school context, home setting or within the community. These items were also influenced by other interactions which included culturally attuned activities, family involvement, long-term programming, and policy intervention. These are referenced in previous works (Haring, Skye, Jr., Battleson, Wampler, Brings-Him-Back-Janis, & Muramoto, 2014).

ARTICLE ANALYSIS

Secondary data were subjected to review by two coders. Each article was open coded several times to identify and label codes and like-codes were grouped into categories which represented a guide for developing a greater understanding of any

emerging categories by first examining micro, mezzo, and macro level conditions. In this systematic review, two findings were noted as “macro level conditions” from multiple studies that utilized, performed, or developed interventions in the areas of obesity or dental health within Native American communities.

A potential category that was represented often and appeared central to the study was represented as a core macro level condition. As coding progressed, conditions were further delineated through micro/mezzo properties. Throughout the analysis, micro and mezzo properties were developed and eventually merged within macro level conditional and consequential matrix relationships.

RESULTS

The focus of this paper in relation to the systematic review was to construct a conditional/consequential matrix which stimulated thinking about relationships between micro, mezzo, and macro conditions (Strauss & Corbin, 1998). A matrix revolving around the core macro level condition—consuming in healthy ways, stressed the importance of eating and drinking for wellness. This was intertwined with another macro condition represented as the shaping of the environment. An event is that can be seen as a potential change action was centered on policy development for future intervention implementation. This is commonly defined as a contingency event that has the potential to change micro, mezzo, or macro conditions (Strauss & Corbin, 1998). Included in these macro level events were micro and mezzo relationships related to the need for incorporation, awareness, and preventive measures of nutritional oversight, i.e.; reviewing school cafeteria practices including but not exclusive to healthy food and beverage distribution, cook education and review of proper proportion size.

MICRO/MEZZO/MEZZO RELATIONSHIPS

A generalist practitioner’s style to intervention involves working with people on many levels and conditions at micro, mezzo, and macro levels. A micro approach is defined as working with individuals while a mezzo approach focuses on group relationships (Kirst-Ashman & Hull, 1999). Macro systems involve approaches that maintain positive community social processes that can contribute to human development and help to empower individuals to influence the larger systems directly affecting people’s lives (Kirst-Ashman & Hull, 2008).

Consuming in healthy ways: Drinking and eating for wellness (Macro)

The core event identified between obesity and dental health was “healthy consumption”. Obesity studies used techniques for healthy consumption while many of the dental health studies examined factors of liquid consumption as determined by severity of dental health

disease, specifically tooth decay. Hence, healthy consumption (eating and drinking) was the most important commonality between all studies examined.

Intervention components commonly included educational approaches that were used to teach healthy eating and drinking at both school and home environments through improved techniques in the preparation and delivery of food or beverages. These approaches included educational topics, including how to properly bottle-feed babies, how children eat, and how food is prepared. Specifically, educational programs advocated for decreased sugary beverage consumption, adding water coolers, and increasing fruit and vegetables in school lunches (Ritenbaugh, Teufel-Shone, Aickin, Joe, Poirier, & Dillingham, et al., 2003; Harvey-Barino & Rourke, 2003). Other studies supported these components by enhancing individuals' knowledge of good nutrition during and after school (Bachar, Lefler, Reed, McCoy, Bailey, & Bell, 2006) as well as school food service programming such as supportive measures designed to monitor food preparation process for making healthy foods for school children (Caballero, Clay, Davis, Ethelbah, Rock, & Lohman, et al., 2003).

Results from various studies were in-line with the intervention concepts of healthy consumption. Brown, Harris, Harris, Parker, Ricci, & Noonan et al. (2010) found that the restriction of access to unhealthy foods at home was important. This was represented by a Native elder who said, “[i]f I don’t have sugar in the house then it’s not being eaten” (Brown et al., 2010, p. 928). Teachers also supported this intervention in the school setting by sharing that “[t]he other fifth grade teacher and I worked together and the culture teacher really helped...”; “...setting good examples for them by providing healthy snacks and walking with them daily” (Gittelsohn, Merkle, Story, Stone, Steckler, Noel, et al., 2003B, p. S100).

Shaping the school environment for obesity/dental health interventions (Macro)

The second major event identified was the concept of “environment” where consumption occurs. A large proportion of intervention studies were implemented in a tribal community setting or a blend of community based and school based environments (Figure 1) (Perry & Hoffman, 2010; Patrick, Lee Shuk Yin, Nucci, Grembowski, Jolles, & Milgrom, 2006; Brown et al., 2010; Karanja, Lutz, Ritenbaugh, Maupome, Jones, Becker, et al., 2010; Bachar et al., 2006; Bruerd, Kinney, & Bothwell 1989). Of particular importance was the multiple Pathways related intervention studies conducted across 41 schools in 7 Native American communities with 1,704 children (Cabellero et al., 2003). These obesity specific interventions were implemented within school systems with a predominately Native American student body ranging from third to fifth grade. While this was the primary intervention tested across the country other non-Pathways studies targeted this age

range (Weber, Cunningham-Sabo, Skipper, Lytle, Stevens, Gittelsohn, et al., 1999; DeRenne, Maeda, Chai, Ho, Kaluhiokalani, & Braun, 2008; Saksvig, Gittelsohn, Harris, Hanley, Valente, & Zinman, 2005; Bachar et al., 2006). Other investigations were implemented within a larger range including middle school and high school aged youth (Ritenbaugh et al., 2003; Davis et al., 1993; Carrel, Meinen, Garry, & Storandt, 2005; Macnab, Rozmus, Benton, & Gagnon, 2008).

The dental health literature also identified the school environment as an intervention delivery system. Macnab et al., (2008) worked with a Native community to improve dental health among school children. This particular school-based program implemented daily brush-ins, fluoride application, educational presentations, and a recognition/incentive scheme designed to promote continuation of these practices. Prior to intervention, 8% of children were cavity free. Following the three year intervention, 32% were cavity free. Breurd, Kinney, & Bothwell (1989) worked within an Indian Head Start school program and conducted a quasi-experimental study with 12 Native American communities where the target population was the caretakers of young children through Indian Head Start programs. 1,319 three- to five-year-old Native children in 10 different states were part of an overall community based health intervention. Training of the research objectives and the intended change as a result of the intervention was provided to parent volunteers, health professionals, and tribal employees who counseled those providing care to young children. Direct interventions included talking to parents both individually and through group meetings. A second method was a community-wide media campaign designed to raise awareness and knowledge about baby bottle tooth decay (BBTD). Prevalence of BBTD prevalence was reduced from 57 to 43 percent at 12 sites. This represents a 25 percent reduction ($p < .001$) and, at high intensity sites, BBTD had decreased from 53 to 35 percent, a 33 percent reduction ($p < .001$).

POLICY INTERVENTIONS (CONTINGENCY)

Another condition that emerged was policy intervention and is represented at a contingency level in the conditional/consequential matrix (Strauss & Corbin, 1998). Policy changes at the school or organizational level were an important first step in implementing intervention and healthy change. Snyder, Anliker, Cunningham-Sabo, Dixon, & Altaba, Chamberlain, et al. (1999) described an 18-month program used to influence policy change in nutrition staff training guidelines and kitchen staff education. Another initiative at the policy level was a National Congress of American Indians (NCAI) resolution in support of federal and state policies to make dental health care more accessible among tribal communities through the integration of dental therapist models (NCAI, 2011). Policies that address obesity and dental health care issues can be an important part of future health care initiatives in these arenas.

To date, efficacy of policy to address these co-occurring conditions are yet to be determined. Hence, policy interventions for change as a fully involved macro level condition are still in their infancy within Native American landscapes.

FIGURE 1. EXAMPLES OF EDUCATING SCHOOL STAFF ON THE PROPER TECHNIQUES OF RINSING FOOD, AND THE PROMOTION OF HEALTHY DRINKING (WATER).



Incorporating culturally attuned activities were seen as relationships between micro and mezzo conditions and were an important feature of interventions for both dental health and obesity (Cabellero et al., 2003; Davis et al., 1993). Results from a healthy lifestyle intervention showed the incorporation of traditional activities into physical or academic/learning exercise was important to the tribal community members (Brown et al., 2010). Davis et al. (1993) exemplified culturally attuned activities with a school and community intervention that included encouragement to promote exercise and a healthful diet. Findings showed a significant increase in overall knowledge of healthy lifestyles ($p < 0.001$) for student in the intervention group ($n = 674$) compared to control schools ($n = 375$) (Davis et al., 1993).

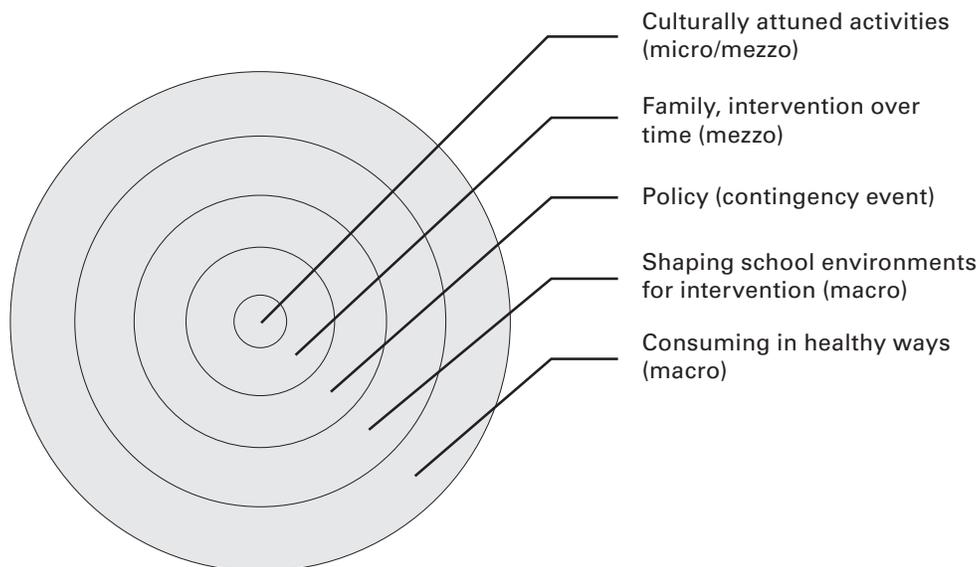
In both obesity prevention and dental health publications, programs indicated inclusion of family involvement (mezzo) was a key part of program success (Caballero et al., 2003; Stevens, Story, Ring, Murray, Cornell, & Juhaeri, et al., 2003; Harvey-Barino & Rourke, 2003). From a dental health perspective mezzo based interventions which promoted breastfeeding and reduced sweetened beverage consumption helped reduce weight and that parent involvement was valuable (Karanja et al., 2010; Bruerd et al., 1989).

At both the mezzo and macro level—multi-year, culturally tailored interventions were important for successful outcomes in both dental health obesity concerns (Perry & Hoffman, 2010; Patrick et al., 2006; Brown et al., 2010; Karanja et al., 2010; Bachar et al., 2006; Bruerd et al., 1989; Macnab et al., 2008). Lengths of programs were often between three to five years in overall length. However, actual intervention time included session times between 8 to 24 weeks (Caballero et al., 2003; Going et al., 2003; Stevens et al., 2003; Teufel et al., 1999; Ritenbaugh et al., 2003; Saksvig et al., 2005; DeRenne et al., 2008).

DISCUSSION

Overall, micro and mezzo conditions informed macro conditions towards relational processes with a goal of sharing an analytic story and to serve as a means to keep track of the interplay of conditions. These included culturally attuned interventions that incorporated family which led the way into multi-year interventions in macro level environments (home, school, community) and an opportunity for policy change. These relationships of emerging conditions towards process are depicted in Figure 2 and show a series of concentric circles that move toward and surround the interactions (Strauss & Corbin, 1998).

FIGURE 2. CONDITIONAL/CONSEQUENTIAL MATRIX FOR DENTAL HEALTH AND OBESITY INTERVENTION RELATIONSHIPS OCCURRING AT THE MICRO, MEZZO, AND MACRO LEVELS



RECOMMENDATIONS

Recommendations are based on results which emerged from this review. These suggestions serve as a means to filter results into Native communities by taking the research findings and delivering them into the hands of tribal workforces, human service centers, and practitioners working in Native American landscapes. These include the following:

Recommendation 1: Develop and advocate policy change at the school level for the inclusion of obesity/dental health prevention programs which have a focus on weight management, healthy eating, and the inclusion of overall healthy lifestyle efforts including healthy dental care behaviors;

Recommendation 2: Intervention programs must include family. Both nuclear and extended families are an important feature of successful interventions;

Recommendation 3: It is imperative that programs are culturally attuned for the tribal areas they intend to work in;

Recommendation 4: Intervention programs must be multi-year in nature in order to be successful.

In sum, primarily school-based interventions for increasing the knowledge of healthy consumption, dental health awareness, dietary planning, and nutrition are keys for success. Schools promoting healthy eating programs for intervention (with family inclusion), educating dietary staff on food handling and preparation, and encouraging healthy eating and drinking are likely to make significant wellness changes in the dental health and obesity epidemic for Native youth attending.

STUDY LIMITATIONS

Most studies in both the quantitative and qualitative literature were either reservation-based or near reservations. Future studies should include schools based in urban settings with a large Native student body. There was also a lack of dental health intervention studies applicable to the target population. Specifically, of the dental health studies that fell in the realm of qualitative investigations (n=6), none were described in a methodologically rigorous fashion. Overall results may be biased due to larger numbers of obesity related intervention studies compared to dental health studies, that is, much of the available research seems rooted in a secondary prevention perspective and little, if any, acknowledged the beneficial effects of primary and/or tertiary prevention. The programs that showed promise in both the quantitative and qualitative literature were studies related to the Pathways intervention (n=8).

FUTURE STUDIES

A next step for examination includes improved methodological parameters at the onset. These parameters should include stronger inclusion criteria which focus on controlled trials, ideally, randomized trials of the interventions of interest with comparable outcome measures. Studies that are not randomized would be included but analyzed separately. All studies selected should clearly report sample sizes and variance measures. This would facilitate future meta-analysis (Montori, Swiontkowski, & Cook, 2003).

The current state of the scientific literature on childhood obesity and dental health interventions among Native Americans is growing and at the current time there is little in terms of tested interventions designed to investigate dental health and obesity. Overtime, as more studies are published, a meta-analysis would be helpful to discern quantitatively effective intervention approaches. Further, this initial review of the interplay of conditions using a conditional/consequential matrix provides a foundation for future research hypotheses testing as well as theory development.

The book, *Plate Full of Color*, by Perez (2008) shared the following passages:

“...She (Mother Earth) gives us things that grow....she gives us food to eat and water that helps the food to grow”; “The fruits and vegetables that grow in the gardens are food for you to eat, too. They are very good for all of us”; “...it is important that growing children eat enough fruits and vegetables every day to grow strong”. A second book in the series, *Tricky Treats* (Perez, 2008), shared, “...water is a gift from Mother Earth and something we should have every day” and “when picking a snack or treat, we need to make sure it does not have a lot of sugar in it. We also need to remember that small amounts are better. Fruits and vegetables every day make healthy snacks too”.

There are a number of policy recommendations by the United States Congress to encourage healthy eating programs. However, these standards may not be applicable or enforceable for dietary environments situated in the setting of federally recognized nations. These entities have the unique and often sovereign ability to develop policy related to the operations of their departmental programming. This systematic review highlights the need for change in dietary policies related to food delivery to Native youth programming which promotes healthy eating.

In short, policy development and implementation designed for reducing the combined health effects of dental and obesity-related disease among Native American youth needs to be founded on input from key stakeholders including parents, schools, and related support systems. This is not to imply that all parents or systems are not currently equipped to instill healthy habits into their children. Rather, it is an acknowledgement that, as evolving social conditions place greater demands on parents

and children's support systems, a broader collective is needed if we are to effectively address the growing health challenges facing Native youth in North America and in other Indigenous landscapes worldwide.

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