Native American Diabetes Prevention Intervention Programs: A Systematic Review

Yue Dong[1], Maria Collado[2], and Paul Branscum[2]

[1]*Department of Anthropology, The University of Oklahoma*
[2]*Department of Health and Exercise Science, The University of Oklahoma*

Abstract

Background and Purpose: Diabetes is one of the biggest health problems for the American Indian and Alaska Native communities. The purpose of this study was to review lifestyle based diabetes interventions from January 1995 to January 2015. **Methods**: The target population within this systematic review was adult American Indians and Alaska Natives. Four databases (Medline, Google Scholar, PsychINFO, and JSTOR) were used to find articles, of which nine articles met the inclusion criteria of being either an intervention or prevention program that reported at least one physiological or biological indicator of diabetes. **Results**: Among the nine articles reviewed, six articles showed significant changes of physiological indicators. Three of the studies only targeted the female population. Most of the programs lasted between 6 to 12 months. A major limitation among intervention or prevention programs was an inadequate use of a theoretical behavior change model. **Conclusion**: Overall, it was found that physical activities and diet -based methods have the potential for diabetes prevention and intervention programs among American Indian and Alaska Native populations. Recommendations for future research include using randomized controlled trial research design, and using theory to guide program development.

Keywords: Native American, Indian, indigenous, North American Indian, American native, diabetes prevention, program, and lifestyle intervention

Introduction

Diabetes is one of the largest problems for American Indian and Alaska Native communities. According to the Division of Diabetes of Indian Health Service, diabetes increased 3.57% from 1990 to 2009 among American Indians and Alaska Natives, and overall, 15.9% of the American Indian and Alaska Native adult population has diabetes (CDC, 2011; CDC, 2014). According to the 2014 National Diabetes Statistics Report, the prevalence of diabetes among the American Indian and the Alaska Native populations (15.9%) is also more than double the rates compared to the non-Hispanic/Caucasian population (7.6%;National Diabetes Statistics Report, 2014). Concurrently, the diabetes rate (1.74 per 1000) in the American Indian and Alaska Native youth (ages 10-19 years) populations is much higher when compared to the diabetes rate of non-Hispanic whites (0.19 per 1000) (Liese et al. 2006).

For the American Indian and Alaska Native communities, the diabetes epidemic is associated with a number of factors including lifestyle behaviors (i.e. insufficient physical activity and unhealthy food practices), geographic factors (i.e. live in rural area or live in areas with poor health services), low socio-economic status, and predisposing genetic risks. Among these factors, physical activity and food choices are often viewed as two major modifiable risk factors. According to Franz (2007), Herder (2006), and Hagobian and Phelan (2013), altering these two modifiable factors can reduce the morbidity rate of diabetes by up to 20% when compared to control groups, or up to 10% when compared to groups taking diabetic medication (i.e. Metformin). By targeting physical activities and diet, both diabetes

intervention and diabetes prevention programs can provide effective and accessible service to American Indian and Alaskan Native communities.

In an older systematic review of articles from 1980-1994, a number of chronic disease prevention programs and intervention programs targeting the American Indian and Alaska Native communities were reviewed (Lemaster, 1994). Among the chronic disease conditions reviewed, the authors reviewed six diabetes related studies, and focused on the demographic information of the target population, locations, duration, sample size, and settings of the programs. It was summarized that both diet change and physical activity were crucial components to lifestyle interventions. Since this review, to our knowledge there have been no other systematic reviews of Type-2 diabetes programs targeting American Indians and the Alaskan Natives. It should also be noted that while the previous review article provided information about program area, demographic information, sample size and setting for each study, crucial methodological information, such as use of theory, was missing (Lemaster, 1994). Therefore the following information was included in this systematic review including: Research design, recruitment, significant research findings, and use of theory.

Methods

Search Criteria

This review follows the PRISMA guidelines for reporting Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al. 2015). Four databases were used to collect articles for this review from January 1995 to January 2015: Medline, PubMed, PsychINFO, and JSTOR. The following 18 sets of keywords were used for each search: 1. Indians AND Diabetes AND Intervention; 2. Native American AND Diabetes AND Intervention; 3. North American Indian AND Diabetes AND Intervention; 4. American Native AND Diabetes AND Intervention; 5. Indigenous AND Diabetes AND Intervention; 6. Indigenous American AND Diabetes AND Intervention; 7. Indians AND Diabetes AND Program; 8. Native American AND Diabetes AND Program; 9. North American Indian AND Diabetes AND Program; 10. American Native AND Diabetes AND Program; 11. Indigenous AND Diabetes AND Program; 12. Indigenous American AND Diabetes AND Program; 13. Indians AND Diabetes AND Prevention; 14. Native American AND Diabetes AND Prevention; 15. North American Indian AND Diabetes AND Prevention; 16. American Native AND Diabetes AND Prevention; 17. Indigenous AND Diabetes AND Prevention; and 18. Indigenous American AND Diabetes AND Prevention.

Inclusion and Exclusion Criteria

The inclusion criteria for this review included: 1.) the intervention or prevention programs only include American Indian and Alaska Native populations; 2.) intervention or prevention programs only targeted diabetes; 3.) articles were published in English; and 4.) programs have at least one of these following research designs: Randomized controlled trial, quasi-experiment or pre and posttest. In the first stage, 103 articles were found to be suitable by reading the title of each study; in the second stage, 22 articles were removed as duplicates. In the third stage, articles were further screened based on the date of publication. The first two authors of this study then read the abstracts of the remaining 54 articles. After examining the abstracts, 45 articles were excluded based on the following reasons: 1.) Articles did not focus on American Indian and Alaska Native communities; 2.) There were no intervention or prevention program being evaluated; 3.) Programs were not focused on diabetes; 4.) Articles did not have any research design (were either a review article or commentary article); and 5.) Article had no outcome measurements. In sum, nine articles were included in this systematic review.

Summarization

After examining each article, the authors selected key information from each study to extract (study design, sample size, duration of the study, theories used, recruitment procedures and salient findings). Use of theory was searched throughout all the articles and recorded, and in cases where theory was not explicitly mentioned, constructs from theories

were identified. Study designs were categorized by randomized control trial (RCT) and quasi-experimental research design and pre and posttest design (no control group). Furthermore, the following physiological and biological markers were reported in this systematic review: Blood pressure, fasting serum glucose, BMI, weight, and hemoglobin A1c. Behavioral and behavioral antecedent changes were also reported.

Results

Nine studies were reviewed for this systemic review. Tables 1 and 2 demonstrate synthesized data extracted from each article in this review. In this section, information from Tables 1 and 2 are broken down and discussed upon in following sections: Program duration and description, research design, theory used, and findings.

Program Description and Duration

All articles used physical activity and/or dietary change as modifiable factors in their program. Three articles exclusively used dietary change to alter diabetes related physiological and biological markers (Allen et al. 2008, Henderson et al. 2012, Gittelsohn et al. 2013, and Kattelmann et al. 2009). Allen's 18-month program used written and oral didactic material with culturally appropriate illustrations to provide healthy eating information for their intervention group (Allen et al. 2008). Henderson and his research team (2012) used a web-based education program (the Lakota Oyate Wicozani Pi Kte (LOWPK) trial) to promote Indian culture based healthy eating for 24 months. Gittelsohn and his team (2013) worked with the Najavo Nation to increase healthier food availability in local food stores, and promoted these foods both in the stores and through community media for 14 months. Kattlemann and colleagues (2009) used a *traditional* based Northern Plains Indian hunter/gatherer food model, "The Medicine Wheel," to promote healthy eating within the Cheyenne River Sioux Tribe for six months. Four articles used both physical activity and dietary change in their programs (Narayan et al.1998; Jiang et al. 2013; Gilliland et al. 2002; Thompson et al. 2008). In their program, Narayan and colleagues (1998) asked the control group to increase their physical activity while decreasing their starchy food intake for 12 months. Jiang and colleagues (2013) used the Lifestyle Balance Curriculum (local culture based education classes) to educate participating tribal members to increase their physical activity and healthy eating for three years. For one year, Gilliland and colleagues (2002) educated a tribe in New Mexico by teaching tribal members about: Traditional Native American values, Native American foods, information about exercise and diet, and videos featuring Native Americans. Thompson and colleagues (2008) implemented a discussion group lasting two years and targeted the American Indian community. The discussion group promoted healthy eating and physical activity. Only one article solely used physical activity (Lingärde & Ahrén, 2007). In their research, they developed a program that incorporated a mixture of traditional folk and modern aerobic dances lasting six months.

Research Design

Three types of research designs were studied in this systematic review: Randomized controlled trial, quasi-experimental design, and pre and post design. Five studies followed the randomized control trial guidelines (Thompson et al. 2008, Kattelmann et al. 2009, Allen et al. 2008, Narayan et al. 1998, and Henderson et al. 2012). Among these five RCT articles, Henderson's research included a double-blinded design for all laboratory staff, clinic staff, analytic staff, and data management staff (Henderson et al, 2012). As it is shown in Table 1, three articles used pre and post design in their research (Gittelsohn et al. 2013, Lingärde & Ahrén 2007, and Gilliland et al. 2002). A quasi-experimental research design was used in only one study (Jiang et al. 2013).

Table 1.

Native American Diabetes Review: Description of Programs and Strength of the Body of Evidence

#	Program duration, Description, Design & Sample	Strength of the body of evidence *	Recruitment
1	Allen et al. (2008): Lifestyle intervention study with an 18-month follow-up to reduce risk of T2DM. Both intervention and control completed the 4 clinic measurements and 6, 12, and 18 months clinic visits. RCT; New Mexico women without T2DM, but with IFBG. *n*= 100 (control); *n*=100 (intervention).	Downgraded RCT- no blinding - Moderate	No detailed information
2	Narayan et al. (1998): Pima Indian diet and physical activities for 12 month. Self-directed learning, facilitated by an appreciation of Pima culture (Pima Pride). RCT; Pima Indian in Arizona. *n*= 47 (intervention), *n*= 22 (observation).	Downgraded RCT- no blinding - Moderate	No detailed information
3	Gittelsohn et al. (2013): 14 Month community based intervention trial (Navajo Healthy Stores) on the Navajo Nation. 6 intervention phases (lasting 6-10 weeks) provided nutrition knowledge in both English and Navajo. Pre & Post Test, Baseline= 276; Completion= 145. Navajo nation with or without T2DM.	Observational Study - Low	From participating sites
4	Henderson et al. (2012): 24-month web-based diabetes and nutrition educational intervention trial in the Lakota Oyate Wiconzani Pi Kte Reservation. Double Blinded RCT. n= 180 grouped by age and gender.	Double Blinded RCT - High	Recruited participants from another study (HEART).
5	Jiang et al. (2013): 16-lesson Diabetes Prevention Program (DPP) curriculum covering diet, exercise, and behavior modification to help achieve the goal (weight reduction of at least 7% of initial body weight). Whole program lasts for 3 years. Quasi experimental: n=2,553 phase 1 intervention, n=1,891 finished Post-test, n= 1,503 finished 1-year test, n= 1,079 finished 2-year test, n=834 finished 3-year test	Observational Study – Low	No detailed information
6	Kattelman et al. (2009): 6 month education intervention consisting of 6 nutritional lessons based on the Medicine Wheel Model (culturally and tribally adapted) for Nutrition. RCT. TX=51, CNT=53.18-65 y/o with T2DM from Indian Health Services Hospital in western South Dakota	Downgraded RCT- no blinding - Moderate	Assisted by Missouri Breaks Industries
7	Lingärde & Ahrén (2007): Exercise training 3 times/week for 6 months. Each training session lasted for 60 minutes. Pre & Post. n=142; 25-64 years old with normal FPG Lima, Peru. n= 83 women participated in a follow-up examination.	Observational Study - Low	No detailed information
8	Gilliland et al. (2002): 1 year program include traditional Native American values, Native American foods, information about exercise and diet, and videos featuring Native Americans. Pre & Post. *n*= 71 (intervention), *n*= 33 (observation)	Observational Study - Low	Local diabetes registries by way of an agreement with the IHS.
9	Thompson et al. (2008): Community-based intervention targeting specific dietary and activity behaviors. Participants were block-randomized on FBG into intervention and control groups. Program lasted for 2 years. RCT. *n*= 200 (women) 18-40 y/o not having T2DM	Downgraded RCT- no blinding - Moderate	Through flyers, word-of-mouth, and local print and television media

Notes: TX (treatment group); CNT (control group); PA (Physical Activity); BMI (Body Mass Index); SSB (sugar-sweetened beverage); BF (body fat); BP (blood pressure); SBP (Systolic blood pressure); DBP (Diastolic blood pressure)BG (blood glucose); IFBG (impaired fasting blood glucose); HDL(high density lipoprotein); LDL(low density lipoprotein); SDPI(Special Diabetes Program of Intervention); HbA1C (hemoglobin A1C); NS (not significant); RCT (randomized control trial); HIS (Indian Health Service); * Strength of the body of evidence were assessed based on Cochrane Handbook for Systematic Reviews of Interventions guidelines.

Strength of the Body of Evidence

Higgins and Green proposed that different research design can affect the strength of the body of evidence (Higgins & Green, 2011; *see also* O'Neil et al. 2014). According to them, double blinded RCT studies usually have the highest strength, while RCT and observational studies usually have moderate strength (Higgins & Green, 2011). As it was shown in Table 1, four RCT studies have moderate strengths of body of evidence. One double blinded RCT studies has high strength of the body of evidence. The other four observational studies have low strength of body of evidence.

Risk of Bias

As it was suggested in Table 2, without additional information, Henderson's double blinded RCT study has the lowest risk of bias (Henderson et al. (2012). All other non-blinded RCT studies have risk of performance bias (Thompson et al. 2008, Kattelmann et al. 2009, Allen et al. 2008, and Narayan et al. 1998). All non-RCT studies in this review have both selection bias and performance biases (Gittelsohn et al. 2013, Lingärde & Ahrén 2007, Jiang et al. 2013, and Gilliland et al. 2002). In addition, due to the low retention rate, three articles have attrition bias (Gittelsohn et al. 2013, Jiang et al. 2013, Lingärde & Ahrén 2007). Because Lingärde and Ahrén had not reported p-value or any other statistics in their article, their research also had potential detection bias (Lingärde & Ahrén, 2007).

Table 2.

Native American Diabetes Review: Theory Used, Risk of Bias and Findings

#	Author/	Theory Used/ Potential Risk of bias*	Findings
1	Allen et al. (2008)	No Theory Performance bias.	30 of the 42 completed the study and showed a mean FBG decrease from baseline to follow-up ($p < .001$) and 62% of the 30 women converted to normal (<5.6 mmol/L or <100 mg/dL) from both groups. Significant decreases in mean fasting blood total cholesterol and low-density lipoprotein cholesterol levels. And intake of total energy, saturated fat, total fat, total sugar, sweetened beverages, proportion of sweet foods in the diet, and hours of television watching.
2	Narayan et al. (1998)	No Theory Performance bias.	Significant changes of 2-Hour Plasma Glucose (1.33 mM vs 0.03 mM, p = 0.007) Significant changes of 2-Hour Insulin (8.8 pM vs 3.2 pM, p = 0.02).
3	Gittelsohn et al. (2013)	Social Cognitive Theory and the Theory of Planned Behavior Selection bias, attrition bias, performance bias.	Significant changes in: BMI is reduced (p<0.05) Improved healthy food intention (p<0.01) Healthy cooking methods (p<0.05) Healthy food getting (p<0.01)
4	Henderson et al. (2012)	Social Cognitive Theory No	All have minimal detectable mean differences with 80% power: Hemoglobin A1c; Systolic BP/Diastolic BP; LDL cholesterol and BMI
5	Jiang et al. (2013)	No Theory Selection bias, performance bias, attrition bias.	Significant change of Cumulative diabetes incidence (p < 0.0001). Specifically, the crude incidence of diabetes was 3.5% each year among those who finished all 16 classes. In comparison, the rate for participants who did not finish all of the classes is above 7.5%
6	Kattelman et al. (2009)	No Theory Performance bias.	Education group had significant weight loss (p<=0.05) and decrease in BMI (p<=0.05) from pre to post. The usual care/CNT group had no change in weight or BMI. There were no significant between group changes.
7	Lingärde & Ahrén (2007)	No Theory Selection bias, attrition bias, performance bias, detection bias.	No significant difference of plasma glucose between groups. There was a statistical significant correlation between exercises and: waist circumference, VO2Max, and plasma glucose (however, the correlation was weak). BMI was not related with exercises.
8	Gilliland et al. (2002)	Social Learning Theory Selection bias, performance bias.	Significant changes of DBP (mmHg), *P* value = 0.02, difference = 0.25; Cholesterol (mg/dl), *P* value = 0.79 difference = 0.50; Triglycerides (mg/dl), *P* value = 0.21, difference = 0.81.
9	Thompson et al. (2008)	Social Cognitive Theory Performance bias.	Significant increase in vegetable and fruit intake in the intervention group (p=0.002). Significant effect between visit and SSB intake (p<0.001), TV watching (p<0.001), insulin sensitivity (p<0.001), BF (p<0.001), waist circumference (p<0.001), total cholesterol (p<0.001), LDL (<0.001), and HDL (p<0.03).

Notes: TX (treatment group); CNT (control group); PA (Physical Activity); BMI (Body Mass Index); SSB (sugar-sweetened beverage); BF (body fat); BP (blood pressure); SBP (Systolic blood pressure); DBP (Diastolic blood pressure)BG (blood glucose); IFBG (impaired fasting blood glucose); HDL(high density lipoprotein); LDL(low density lipoprotein); SDPI(Special Diabetes Program of Intervention); HbA1C (hemoglobin A1C); NS (not significant); RCT (randomized control trial). Risk of bias were assessed based on Cochrane Handbook for Systematic Reviews of Interventions guidelines.

Use of Theory

As shown in Table 2, Social Cognitive Theory was used in three different studies (Gittelsohn et al. 2013; Henderson et al. 2012; Thompson, 2008). Social Learning Theory, the predecessor of SCT, was used in one study (Gilliland et al., 2002). The only other theory mentioned in the articles for this review was the Theory of Planned Behavior (Gittelsohn et al. 2013). The other five studies did not report using a theory to guide their research (Narayan et al., 1998; Allen et al., 2008; Jiang et al., 2013; Kattelman et al., 2009; Lingärde & Ahrén, 2007).

Findings

As shown on Table 2, Allen (2008), Gittelsohn (2013), Kattelmann (2009), Narayan (1998), Gilliland (2002), Jiang (2013), and Thompson (2008) all showed statistical significant results for their intervention and prevention programs. Lingarde (2007) reported a significant correlation between exercise and physiological change in the cohort analysis part of the research. However, their study failed to show significant differences between the intervention and the control groups. Henderson and his research team did not report any significant changes, and instead, stated that there are minimal detectable mean differences with 80% power for the following physiological indicators: Hemoglobin A1c, systolic and diastolic blood pressure, low-density lipoprotein cholesterol, and BMI.

Discussion

This systematic review is built upon a previous systematic review by reviewing more recent

research (Lemaster. 1994). Also, in comparison to the previously published review, this systematic review has added more information such as research design, theory used, strength of the body of evidence, recruitment, and potential risk of bias. The rationale for conducting this review is to provide crucial information to help researchers to produce effective program in the future.

As it is shown in this review, only five articles used RCT in their research design. One major advantage of using RCT is that this research design can better represent the true nature of the program (Kaptchuk, 2000). There are several explanations for the low usage of RCT research design. First, studies with RCT research design usually require large number of participants; however, many tribes have limited members, thus, it is difficult to conduct RCT studies in those tribes. Second, RCT's usually requires more resources (money, labor and time) to conduct; thus, if a study only has limited funding, the researchers will likely use alternative research designs in order to service the community needs. However, RCTs can provide stronger evidence, and it can reduce the risk of bias; thus, future researchers should still use RCT research design whenever possible.

According to Tang (2003), rigor of research can be partially expressed by the use of theory during the program development phase (Tang, 2003). The importance of using theory in public health related programs is also supported by others (Eakin, 2001; Sanchez, 2000). In this systematic review, the author examined whether articles used theory or not. As it is shown in this review, Social Cognitive Theory was used for three times. Besides Social Cognitive Theory, Social Learning Theory and the Theory of Planned Behavior were both used for once. As it was shown in Table 2, all studies that utilized a theory found significant results. Based on these findings, it is recommended that future research can incorporate at least one behavioral theory in their studies.

Conclusion

The authors feel that it would be beneficial to for all empirical articles to include information such as retention rates, attendance rates as well as recruiting strategies. The aforementioned information is crucial for researchers to better understand how to effectively recruit and retain participants. In addition, it has been suggested that a needs assessment is beneficial for both health researchers and participating communities to determine the ideal components of an intervention (Gone, 2013; Barrera et al., 2013).

In sum, the purpose of this study was to conduct a systematic review of lifestyle interventions and preventions within the American Indian and Alaska Native population from January 1995 to January 2015. As the results suggest, lifestyle based programs can help those communities to reduce the impact of the Type 2 Diabetes epidemic. In one study, authors suggest that when comparing lifestyle-based programs to drug-based methods, lifestyle-based programs are more acceptable to participants (Gillies et al., 2007). As shown in Tables 1 and 2, through different programs, there were significant changes in physiological indicators, attitudes toward physical activity and eating healthy food, and changes in knowledge about how to prepare healthy foods. All of these studies concluded that lifestyle changes are beneficial and necessary for tribal members.

References

Acton, K. J., Burrows, N. R., Geiss, L. H., & Thompson, T. (2003). Diabetes prevalence among American Indians and Alaska Natives and the overall population--United States, 1994-2002. *U.S. Center for Disease Control. 52*(30), 702-704.

Allen, P. P., Thompson, J. L., Herman, C. J., Qualls, C., Helitzer, D. L., Whyte, A. N., & Wolfe, V. K. (2008). Impact of periodic follow-up testing among urban American Indian women with impaired fasting glucose. *Preventing Chronic Disease, 5*(3). A76.

Barnard, A. (1998). The foraging spectrum: Diversity in hunter-gatherer lifeways. *American Ethnologist, 25*(1), 36-37.

Barrera, M., Castro, F. G., Strycker, L. A., & Toobert, D. J. (2013). Cultural adaptations of behavioral health interventions: A progress report. *Journal of Consulting and Clinical Psychology, 81*(2), 196-205.

Bengmark, S. (2013). Processed foods, dysbiosis, systemic inflammation, and poor health. *Current Nutrition & Food Science, 9*(2), 113-143.

Benyshek, D. C., & Watson, J. T. (2006). Exploring the thrifty genotype's food-shortage assumptions: A cross-cultural comparison of ethnographic accounts of food security among foraging and agricultural societies. *American Journal of Physical Anthropology, 131*(1), 120-126.

Benyshek, D. C., Chino, M., Dodge-Francis, C., Begay, T. O., Jin, H., & Giordano, C. (2013). Prevention of type 2 diabetes in urban American Indian/Alaskan Native communities: The life in BALANCE pilot study. *Journal of Diabetes Mellitus, 3*(4), 184-191.

Benson K, Hartz A. J. (2000). A comparison of observational studies and randomized, controlled trials. *New England Journal of Medicine, 342*(25), 1878-1886.

Castro, S., O'Toole, M., Brownson, C., Plessel, K., & Schauben, L. (2009). A diabetes self-management program designed for urban American Indians. *Preventing Chronic Disease, 6*(4), A131.

Centers for Disease Control and Prevention. (2006). Diagnosed diabetes among American Indians and Alaska Natives aged <35 --- United States, 1994-2004. *Morbidity and Mortality Weekly Report. 55*(44), 1201-1203. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5544a4.htm

Centers for Disease Control and Prevention. (2006). State-specific prevalence of obesity among adults --- United States, 2005. *Morbidity and Mortality Weekly Report. 55*(36), 985-988. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5536a1.htm

Centers for Disease Control and Prevention. (2011). Diabetes: Successes and opportunities for population-based prevention and control at a glance 2011. *Chronic Disease Prevention and Promotion.* Retrieved from http://www.cdc.gov/chronicdisease/resources/publications/AAG/ddt.htm

Centers for Disease Control and Prevention. (2011). National Diabetes Fact Sheet, Fast Facts on Diabetes, 2011. Retrieved from http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2011.pdf

Centers for Disease Control and Prevention. (2013). Health, United States, 2013. *Fast Stats.* Retrieved from http://www.cdc.gov/nchs/data/hus/hus13.pdf#064

Centers for Disease Control and Prevention. (2014). National Diabetes Statistics Report: Estimates of Diabetes and Its Burden in the United States, 2014. Retrieved from http://www.cdc.gov/diabetes/pdfs/data/2014-report-estimates-of-diabetes-and-its-burden-in-the-united-states.pdf

Chauhan, G., Tabassum, R., Mahajan, A., Dwivedi, O., Mahendran, Y., Kaur, I., Nigam, S., Dubey, H., Varma, B., Madhu, S., Mathur, S., Ghosh, S., Tandon, N., & Bharadwaj, D. (2011). Common variants of FTO and the risk of obesity and type 2 diabetes in Indians. *Journal of Human Genetics, 56*(10), 720-726.

Companion, M. (2013). Obesogenic cultural drift and nutritional transition: Identifying barriers to healthier food consumption in urban Native American populations. *Journal of Applied Social Science, 7*(1), 80-94.

Dowling, H. J., & Pi-Sunyer, F. X. (1993). Race-dependent health risks of upper body obesity. *Diabetes, 42*(4), 537-543.

Eakin, J. M. (2001). From theory to practice: A determinants approach to workplace health promotion in small businesses. *Health Promotion Practice, 2*(2), 172-181.

Franz, M. J. (2007). The evidence is in: Lifestyle interventions can prevent diabetes. *American Journal of Lifestyle Medicine, 1*(2), 113-121.

Gilliland, S. S., Azen, S. P., Perez, G. E., & Carter, J. S. (2002). Strong in Body and Spirit: Lifestyle intervention for Native American adults with diabetes in New Mexico. *Diabetes Care, 25*(1), 78-83.

Gillies, C. L., Abrams, K. R., Lambert, P. C., Cooper, N. J., Sutton, A. J., Hsu, R. T., & Khunti, K. (2007). Pharmacological and lifestyle interventions to prevent or delay type 2 diabetes in people with impaired glucose tolerance: Systematic review and meta-analysis. *British Medical Journal, 334*(7588), 299–302.

Gittelsohn, J., Kim, E. M., He, S., & Pardilla, M. (2013). A food store-based environmental intervention is associated with reduced BMI and improved psychosocial factors and food-related behaviors on the Navajo nation. *The Journal of Nutrition, 143*(9), 1494-1500.

Glanz, K., Lewis, F.M., & Rimer, B.K. (1997) Linking theory, research and practice. In Glanz, K., Lewis, F.M., & Rimer, B.K. (eds), *Health Behavior and Health Education: Theory, Research and Practice, 2nd edn*. Jossey-Bass, San Francisco, CA.

Gone, J. P. (2013). A community-based treatment for Native American historical trauma: Prospects for evidence-based practice. Spirituality in Clinical Practice, 1(S), 78-94.

Green, J. (2000). The role of theory in evidence-based health promotion practice. *Health Education Research, 15*(2), 125-129.

Griffin, J. A., Gilhiland, S. S., Perez, G., Upson, D., & Carter, J. S. (2000). Challenges to participating in a lifestyle intervention program: The Native American diabetes project. *The Diabetes Educator, 26*(4), 681-689.

Hagobian, T. A., & Phelan, S. (2013). Lifestyle interventions to reduce obesity and diabetes. *American Journal of Lifestyle Medicine, 7*(2), 84-98.

Henderson, J. A., Chubak, J., O'Connell, J., Ramos, M. C., Jensen, J. B., & LOWPK Project Team. (2012). Design of a randomized controlled trial of a web-based intervention to reduce cardiovascular disease risk factors among remote reservation-dwelling American Indian adults with type 2 diabetes. *Journal of Primary Prevention, 33*(4), 209-222.

Herder, C., Peltonen, M., Koenig, W., Kraft, I., Muller-Scholze, S., Martin, S., Lakka, T., Ilanne-Parikka, P., Eriksson, G. J., Hamalainen, H., Keinanen-Kiukaanniemi, S., Valle, T. T., Uusitupa, M., Lindstrom, J., Kolb, H., & Tuomilehto, J. (2006). Systemic immune mediators and lifestyle changes in the prevention of type 2 diabetes: Results from the Finnish diabetes prevention study. *Diabetes, 55*(8), 2340-2346.

Higgins, JPT, Green S. (2011). *Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0*. The Cochrane Collaboration, 2011. Available from www.cochrane-handbook.org.

Jack, L., & Liburd, L. (2000). Race, ethnicity, and diabetes care: Where to from here? *The Diabetes Educator, 26*(1), 91-93.

Jiang, L., Manson, S., Beals, J., Henderson, W., Huang, H., Acton, K., & Roubideaux, Y. (2012). Translating the diabetes prevention program into American Indian and Alaska Native communities: Results from the special diabetes program for Indians diabetes prevention demonstration project. *Diabetes Care, 36*(7), 2027-2034.

Kahn, H. S. (2000). Race, parity, and gestational diabetes as risk factors for type 2 diabetes Mellitus. *The Journal of the American Medical Association, 284*(18), 2318-2319.

Karter, A. J. (2003). Race and ethnicity: Vital constructs for diabetes research. *Diabetes Care, 26*(7), 2189-2193.

Kattelmann, K., Conti, K., & Ren, C. (2010). The medicine wheel nutrition intervention: A diabetes education study with the Cheyenne River Sioux tribe. *Journal of the American Dietetic Association, 10*(5), S44-S51.

Kitabchi, A. E., Temprosa, M., Knowler, W. C., Kahn, S. E., Fowler, S. E., Haffner, S. M., …, Diabetes Prevention Program Research Group. (2005). Role of insulin secretion and sensitivity in the evolution of type 2 diabetes in the diabetes prevention program: Effects of lifestyle intervention and metformin. *Diabetes, 54*(8), 2404-2414.

Knowler, W., Pettitt, D., Bennett, P., & Williams, R. (1983) Diabetes mellitus in the Pima Indians: Genetic and evolutionary considerations. *American Journal of Physical Anthropology, 62*(1):107–114.

Kuhnlein, H. V., & Moody, S. A. (1989). Evaluation of the Nuxalk food and nutrition program: Traditional food use by a Native Indian group in Canada. *Journal of Nutrition Education, 21*(3), 127-132.

Lappalainen, T., Lindström, J., Paananen, J., Eriksson, J. G., Karhunen, L., Tuomilehto, J., & Uusitupa, M. (2012). Association of the fat mass and obesity-associated (FTO) gene variant (rs9939609) with dietary intake in the Finnish diabetes prevention study. *British Journal of Nutrition, 108*(10), 1859-1865.

Lemaster, P., & Connell, C. (1994). Health education interventions among Native Americans: A review and analysis. *Health Education & Behavior, 21*(4), 521-538.

Liese AD, D'Agostino RB Jr, Hamman RF, Kilgo PD, Lawrence JM, Liu LL, Loots B, Linder B, Marcovina S, Rodriguez B, Standiford D, & Williams DE. ().SEARCH for Diabetes in Youth Study Group. The burden of diabetes mellitus among US youth: Prevalence estimates from the SEARCH for Diabetes in Youth Study. *Pediatrics, 118*:1510–1518.

Lindgarde, F., & Ahren, B. (2007). Improved metabolic risk markers following two 6-month physical activity programs among socioeconomic marginalized women of Native American ancestry in Lima, Peru. *Diabetes Care, 30*(9), 2230-2232.

Linseisen, J., Rohrmann, S., Norat, T., Gonzalez, C. A., Dorronsoro, I. M., Morote, G. P., Riboli E. (2006). Dietary intake of different types and characteristics of processed meat which might be associated with cancer risk – results from the 24-hour diet recalls in the European prospective investigation into cancer and nutrition (EPIC). *Public Health Nutrition, 9*(4), 449-464.

McPherson, K. (1994). The best and the enemy of the good: Randomized controlled trials, uncertainty, and assessing the role of patient choice in medical decision making. *Journal of Epidemiology & Community Health, 48*(1) 6–15.

Narayan, K. V., Hoskin, M., Kozak, D., Kriska, A., Hanson, R., Pettitt, D. J., Knowler, W. C. (1998). Randomized clinical trial of lifestyle interventions in Pima Indians: A pilot study. *Diabetic Medicine, 15*(1), 66-72.

O'Neil, M., Berkman, N., Hartling, L., Chang, S., Anderson, J., Motu'Apuaka, M., Guise, J., & Mcdonagh, M. S. (2014). Observational evidence and strength of evidence domains: Case examples. *Systematic Reviews, 3*(1), 35. Retrieved from: http://www.systematicreviewsjournal.com/content/3/1/35

Pontzer, H., Raichlen, D. A., Wood, B. M., Mabulla, A. Z. P., Racette, S. B., & Marlowe, F. W. (2012). Hunter-gatherer energetics and human obesity. *PLoS ONE,* 7(7).

Ramesh, M., Schraer, C., Mayer, A., Asay, E., & Koller, K. (2008). Effect of special diabetes program for Indians funding on system changes in diabetes care and outcomes among American Indian/Alaska Native people 1994-2004. *International Journal of Circumpolar Health, 37*(2-3), 203-212.

Reynaldo M. (2005). Diabetes and Mexicans: Why the two are linked. *Preventing Chronic Disease, 2*(1), 1-5.

Sanchez, V. (2000). Reflections on Community Coalition Staff: Research Directions from Practice. *Health Promotion Practice, 1*(4), 320-322.

Saunders, P., Saunders, A., & Middleton, J. (2015). Living in a 'fat swamp': Exposure to multiple sources of accessible, cheap, energy-dense fast foods in a deprived community. *British Journal of Nutrition, 17:1-7.*

Saunders, R., Evans, M. H., & Joshi, P. (2005). Developing a process-evaluation plan for assessing health promotion program implementation: A how-to guide. *Health Promotion Practice, 6*(2):134-47.

Schulz, L. O. (2006). Effects of traditional and western environments on prevalence of type 2 diabetes in Pima Indians in Mexico and the U.S. *Diabetes Care, 29*(8), 1866-1871.

Sharma, M., & John, A. R. (2012) *Theoretical Foundations of Health Education and Health Promotion, 2nd edition.* Sudbury, MA: Jones and Bartlett Learning.

Speakman, J. R. (2013). Evolutionary perspectives on the obesity epidemic: Adaptive, maladaptive, and neutral viewpoints. *Annual Review of Nutrition, 33*(1), 289-317.

Story, M., Evans, M., Fabsitz, R. R., Clay, T. E., Rock, B. H., & Broussard, B. (1999). The epidemic of obesity in American Indian communities and the need for childhood obesity-prevention programs. *Journal of the American Academy of Child & Adolescent Psychiatry, 38*(10), 1324.

Tang, K. C. (2003). Evidence based health promotion: Recollections, reflections, and reconsiderations. *Journal of Epidemiology and Community Healt*h, *57*(11), 841-843.

Thompson, J., Allen, P., Helitzer, D., Qualls, C., Whyte, A., Wolfe, V., & Herman, C. (2008). Reducing diabetes risk in American Indian women. *American Journal of Preventive Medicine, 34*(3), 192-201.

Trask, K. A., & Bieder, R. E. (1996). Native American communities in Wisconsin, 1600-1960: A study of tradition and change. *The Michigan Historical Review, 22*(1), 135-136.

Tuomilehto, J., Lindström, J., Eriksson, J. G., Valle, T. T., Hämäläinen, H., Ilanne-Parikka, P., Finnish Diabetes Prevention Study Group. (2001). Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *New England Journal of Medicine, 344*(18), 1343-1350.

Varraso, R., & Camargo, C. A. (2014). Processed meat consumption and lung health: More evidence for harm. *European Respiratory Journal, 43*(4), 943-946.

Walshe, K. (2001). Evidence-based management: From theory to practice in health care. *The Milbank Quarterly, 79*(3), 429-457.

Wiedman, D. (2012). Native American embodiment of the chronicities of modernity: Reservation food, diabetes, and the metabolic syndrome among the Kiowa, Comanche, and Apache. *Medical Anthropology Quarterly, 26*(4), 595-612.

Author Information
*Paul Branscum, Ph.D., RD
Department of Health and Exercise Science
The University of Oklahoma
Email: pbranscum@ou.edu

* corresponding author