

Review of Type 2 Diabetes Management Interventions for Obese Hispanic Youth

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Running Title: Latino Ethnic Identity and Diabetes

Abstract: *The purpose of this article was to review type 2 Diabetes management interventions among obese Hispanic youth. The population targeted was Hispanic youth ages 11 - 17 that resided in the U. S. - Mexico border. Following the PRISMA guidelines, a search of the online databases PubMed, Science Direct, Google Scholar, and EBSCO was conducted for identifying research articles with intervention components. Type 2 diabetes (T2D) management interventions with a population focus on obese Hispanic youths were selected. Six studies were included in the review. The majority of the interventions focused on a behavioral intervention that included weight management, physical activity, individual, group counseling, and lifestyle modification. All studies focused on improving weight status and a management approach for T2D. From the interventions, there has been a moderate effect in decreasing BMI among their participants through proper educational awareness such as diet and types of physical activities to execute. The Effective Public Health Practice Project, Quality Assessment Tool for Quantitative Studies (EPHPP), was conducted to evaluate the selected articles. Three articles resulted in a global rating of 2 (moderate), and the last three articles resulted in a global rating of 3 (weak). Few published articles resulted in having a significant impact on T2D management among the target population. The interventions focused on behavioral and physical outcomes reported more self - management interventions on how youths may adopt an improved lifestyle.*

Keywords: Type 2 Diabetes, Obesity, Youth, Hispanic, Intervention

1. Introduction

Type 2 diabetes (T2D) among youths has increased over the past two decades. By the year 2050, it is projected that over 30, 000 youths (<20 years of age) will be diagnosed with type 2 diabetes (Imperatore, 2012). Among youths, Hispanics are top 3 when dealing with the prevalence of type 2 diabetes, first being native Americans and second being African Americans, additionally, the prevalence of type 2 diabetes for Hispanics will increase by 25% in the year 2050. In addition, Hispanic youth have one of the highest prevalence of 34 percent with the expected growth of 15, 000 cases per year (Imperatore, 2012). The Hispanic population is twice as likely to develop diabetes at a younger age compared to non - Hispanics, with a total percentage of 17% compared to 8% (non - Hispanics) (CDC, 2019). The overall diabetes costs the U. S. over \$300 billion yearly (American Diabetes Association, 2018).

One of the primary risk factors for type 2 diabetes is obesity. While many youths are underdiagnosed with diabetes, weight is a common health indicator health provider are able to detect and code as a diagnosis. The Centers for Disease Control (CDC) defines obesity based on Body Mass Index (BMI) which takes into account a person's height and weight. BMI is used as a way to categorize weight status of youth composition is different for males and females, and the percentile range of overweight to obese has 85% - 95% percentile or greater (CDC, 2019). Similar to the prevalence and risk for diabetes Hispanic youths are twice as likely to be obese at an early age compared to non - Hispanic youths

(Isasi, 2016). This is of concern because obesity is a primary risk factor for the development of diabetes.

The U. S. Department of Health and Human Services states that among Hispanic ages 6 - 12 years, 25% is currently obese (HHS, 2016). The obesity prevalence among Hispanic youth ages 2 - 5 - year - old is 13.9%, 6 - 11 - year - olds is 18.4% among 12 - 19 - year - olds is 20.6% (CDC, 2019). Moreover, Hispanic youth have the highest prevalence compared to other ethnicities (CDC, 2019). Research indicates that the rise in obesity rates is a result of more processed foods, increased consumption of intake of sugary beverages, eating snacks with a high percentage of unsaturated fat, and a more sedentary lifestyle (Isasi, 2017). Obesity is not only a risk factor for diabetes but also other metabolic syndrome conditions. Obese children have an increased risk for high triglycerides, high cholesterol, and high blood pressure. Obese youth and youth with T2D are furthermore more likely to face life - threatening health conditions at an earlier adult age than expected. To address the increasing prevalence of obesity and diabetes in youth, many Lifestyle change programs are offered to improve overall health and teach skills to youth on healthy behaviors.

There is a substantial amount research showing the positive effect of lifestyle programs for prevention and managing diabetes; however, less is known about diabetes programs for obese youth with diabetes, particularly obese Hispanic youth. There is a need for understanding how diabetes prevention and management programs influence T2D outcomes in obese Hispanic youth with T2D. The purpose of this review is to identify T2D diabetes management programs for obese

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Hispanic youth living in the United States and identify the most effective interventions and components for this population.

Having quality access and self - care are critical contributors to outcomes in patients with diabetes. Socioeconomic mediators (education and income) do play a significant role in these processes, and it is the dagger with T2D. (Zgibor, 2001). Affordable health care provider, physical access to services in rural versus urban settings, access to transportation, and receipt of comprehensive managed care. There must be a need for programs with diabetes management to give people who have a low socioeconomic background. There are also options for transportation provided to them if they do not have access to go to a local physician if they are in a rural setting. There must be a need to enhance behavioral change with the health centers being the leaders with this intervention. Quality health care remains a pressing problem. Approximately 43 million Americans either have no medical insurance or who are otherwise medically underserved (Chin, 2001). Affording glucose and also having appropriate appointment times are the main limitations for T2D, in which the demographics of Hispanics have the worst outcome with these limitations. This is because 38.2 percent of all Hispanics have public health insurance coverage (HHS, 2016). Proper knowledge should be implemented alongside the right resources to help the person with diabetes. With the help of these strategies, T2D can be taken care of and well managed with the right skills, emotions, and the correct reinforcement to have a potential behavioral change.

Prevention programs offer families ways to improve lifestyles and help reduce the risk factor of obesity. Obesity has now become an epidemic which was declared by the World Health Organization; however, the prevalence among youth has been steadily rising, especially in the U. S. – Mexico border. It is well documented that childhood obesity already being a well - established risk factor for adulthood obesity (Hernández - Valero, 2018). Risk factors could include anywhere from asthma or go to the extreme to colon cancer. It is more difficult for people who have T2D to lose weight and maintain a healthy weight, but the right interventions the process may be slow, but effective. A person with T2D must have a proper nutrition plan and a specific regimen for the ingestion of food. Alongside constant monitoring of blood glucose levels is an essential routine to be conducted every day. With the combination of nutrition therapy and correct medication alongside the proper exercise or movement regime, management of obesity with onset T2D could be controlled.

2. Methodology

Article Search and Selection

The Preferred Reporting Items for Systematic Reviews and Meta - Analyses (PRISMA) guidelines were used to guide this systematic review. The search is a systematic process in conjunction with extracting. This systematic review included identifying research articles with an intervention component. A systematic review of the included studies was conducted to determine the types of management interventions for Hispanic youth in the U. S. - Mexico border region.

This systematic literature review used the following scholarly databases: PubMed, Google Scholar, EBSCO, and Science Direct. These databases were chosen for their scientific articles and assisted in the search for relevant articles related to the objective (Table 1).

Inclusion and Exclusion Criteria

The literature search focused on journal articles published between 2011 and 2019. This time frame was chosen because to reflect the current status of the target population better and provide articles that concentrated on management interventions for obese Hispanic youth with T2D. The literature search included any combination of the following keywords: Hispanic, Hispanic descendent, youth, children, T2D, obese, obesity, weight status, overweight, United States of America, interventions, management. The review was limited to obese Hispanic youth who have been diagnosed with T2D. Articles that were excluded: Non - U. S. born or living outside U. S., type I Diabetes, underweight, African American (blacks), Caucasian, Latino, adult, and elderly, and less than 2011 articles. The inclusion criteria were as follows: U. S. - born or living in the U. S., Hispanic descendent, obesity or overweight or weight status, T2D, youths (ages 11 - 17) between the years 2011 – 2019.

Article Analysis

The finalized articles were composed and organized with the software Zotero, and duplicate articles were removed. Titles and abstracts were scanned based on inclusion criteria (Step 1). Articles remaining after Step 1 were further scanned by the methodologies and results (Step 2) and retained if they met the inclusion criteria (Figure 1; Moher D, Liberati A, Tetzlaff J, Altman DG, 2009). Data extracted from the articles that remained after Step 2 and are presented in Table 1, including author/year, purpose, and study design, location of study, population size, and ethnicity. Additionally, the articles were carefully examined for appropriate quality measures that correlated with the objective. Disparities were then justified for further proof to retain the correct articles for further evaluation. The effectiveness of each study was evaluated based on the measured outcomes reported compared to the baseline. The evaluation proposed dealt in conjunction with having the correct selection bias, study designs, methodology in data, and interventions for management in type II diabetes. A quality assessment was conducted for each article using the Effective Public Health Practice Project Quality Assessment Tool for Quantitative Studies (EPHPP). Three researchers participated in Step 1, Step 2, and quality assessment.

3. Results

The initial search identified a total of 197 articles (Figure 1). After the removal of duplicates, a total of 190 articles remained for the abstract and title review for selection. Of these, 138 articles were excluded based on title and abstract as they did not meet the inclusion criteria (Step 1). A total of 52 full - text articles were read and reviewed to determine inclusion criteria (Step 2). Six remaining articles met all inclusion criteria. Study descriptions and approaches used in each intervention are included in Table 1. The interventions included within systematic review were those that investigated possible methods for diabetes management through weight control and behavioral change for the youth

with T2D among Hispanic youth in the U. S. various study designs (e. g., randomized clinical trial, observational cohort study). The methodologies for each finalized article were included. A list of outcome measures for each T2D and obesity management intervention was displayed in Table 2. The global rating for each study ranged from weak to moderate. The outcomes are provided in Table 3.

Target population

The targeted population ages 11 - 17 of this review focused on obese Hispanics youth with T2D. Obese Hispanic youth who participated each intervention were all reported to have diabetes was either the common outcome or risk factor mentioned in all 6 articles. This targeted population was chosen because of the increasing prevalence of type 2 diabetes among this certain demographic. If this demographic doesn't have the proper health management of T2D, more risk factors could develop of the years. Two research studies did not disclose the percentage of participants of different ethnic backgrounds. Whereas the remaining four disclosed the percentage of participants of different ethnic backgrounds. Three of 6 studies reported participant retention rates over 70%, 2 studies did not provide retention information, and 1 reported less than 60% participant retention.

Intervention Approaches

The majority of the studies in this review focused on a behavioral intervention approach, which included on weight management, physical activity, individual and group counseling, and lifestyle modifications. In two studies, the interventions took place in clinics and hospital centers where the participants were brought in for follow - ups or the next stage within the intervention (Kumar, 2019; Lucas, 2018). None of the studies indicated a specific theory was followed. Two studies incorporated a pharmacotherapeutic approach with a behavioral aspect through the use of metformin in three randomized groups for one study (Copeland, 2011; Lucas, 2018), and one study with group studies in three trials (Grossman, 2017). One telecommunication intervention was implemented via health centers in participants' homes (Delpier, 2013). The outcomes varied across each approach strategy. Only one study focused entirely on a lifestyle modification, where it was discussed the options obese youths with type II diabetes may decide to improve daily habits (Zappas, 2016). All studies primarily focused on improving the weight status of the youths as a management approach to type II diabetes.

Behavioral, Pharmacotherapy, and Physiological Outcome Measures

Behavioral Outcomes

A variety of behavioral outcomes were assessed in all six of the collected interventions, and at least 1 significant outcome was reported in 5 (Table 2). Two studies reported physical activity outcomes, two focused on weight management, and one focused on telecommunication on decreasing sugar - sweetened beverage (SSB) consumption (Kumar, 2019; Delpier, 2013). Three studies reported to be moderate to significantly effective in decreasing BMI among participants and improved exercise intensity (Kumar, 2019; Lucas, 2018; Grossman, 2017). One study varied in management approaches (e. g. medical, nutrition, physical activity, and

behavioral counseling), where the participants attended individual and group sessions (Grossman, 2017). The longer the duration of the intervention demonstrated to result in improved measured outcomes of BMI at the 95 percentile (%BMI95) and cardio metabolic risk factors (Kumar, 2019).

Pharmacotherapy Outcomes

The primary pharmacotherapy interventions measured the effects of the use of metformin (Table 2) (Copeland, 2011). Two study interventions incorporated the medication, metformin, within the basis of weight management for participants with abnormally high body mass index (BMI) (Zappas, 2017; Copeland, 2011). In one study, the study design incorporated 3 randomized groups: Group 1 metformin alone, group 2 metformin plus rosiglitazone, and group 3 metformin plus TODAY Lifestyle Program (TLP) (Copeland, 2011). A baseline was created to better understand type II diabetic youths with low significance on the effectiveness of the intervention and moreover the time to treatment failure.

Physiological Outcomes

Physiological outcomes, such as BMI and HbA1c, were assessed in 4 of the articles reviewed (Table 2). All four studies reported moderate to significant improvements in BMI (Kumar, 2019; Lucas, 2018; Grossman, 2017; Copeland, 2011). Improvements were primarily found in blood work studies pre - and post - intervention results (Lucas, 2018; Grossman, 2017). In one study, other physiological outcomes measured were levels of high - density lipoprotein cholesterol (HDL - C), fasting glucose, alanine aminotransferase (ALT), triglycerides (TG), body mass index values significantly above the 95 percentile (%BMI95) and hemoglobin A1c (HbA1c) (Kumar, 2019). Abnormalities and significant improvement outcomes were reported.

4. Conclusion

There are few published studies that evaluate the impact on T2D among obese Hispanic youth. Within the identified interventions in this review, there is limited support to show how effective the interventions were for the targeted population. The BMI results were broad in the ranges compared to the measured baseline in four articles. Although there were various interventions reviewed with different approaches in T2D for obese youth, the majority focused on behavioral and physiological changes that did not report sustainability in their interventions for long - term goals. The cognitive process was not considered for further investigation in the studies in how the youth may implement self - care behaviors and resolve problems with limited resources.

Diabetes management programs are imperative for youth because of the increasing high prevalence rates in the US. Management of diabetes could be more important than prevention because of the knowledge and education that is being taken from the diabetes management program. This education could be taught more frequently and the prevalence of T2D could also be reduced. The hardest part of any management program involves lifestyle change. Current interventions focus on weight loss and increased activity to have success and many programs reviewed did not show sustainability. The lack of information given to the readers to

show great sustainability of the program and management of the diabetes outcome of their patients resulted with the global ratings between weak to moderate. Few interventions assessed BMI and HbA1c. It was reported that participants sometimes did not show up to all the sessions or dropped out, skewing the data. The environment also plays a role in the obesity rate in the papers, this is because of the low socio-economic background of many families, and some of them even had multiple jobs to make the end of the monthly payments. Obesity is one of the largest epidemics in the United States and the obesity rates keep increasing at an alarming rate. However, even if public health does determine what to eat and how to eat it, it all comes down to the person wanting to do a lifestyle change for the better. These programs had great objectives in mind when dealing with obesity first to fully on prevent diabetes, and also in the same programs they also illustrated on how to manage their disease for a better quality of life outcome. The programs that concentrated in total BMI as a whole generally had the best results, if only they had better incentives the barriers of sustainability would not have been so predominant. Suggestions for the programs could have been to add better incentives and possible emphasize the need for a better diet first then follow through with physical activity.

Ways to improve the programs could have been with more outreach that concentrates on the specific community. Another is partnering with celebrity with public influence to share their struggle with obesity and still manages to install more motivation for the subjects. Reciprocity and sustainability should be the key to any program that does management for diabetes. Programs should ensure the community's needs are served and that subjects within are reaping from the benefits and knowledge that was provided to them. Sustainability because it should the program to focus on long term solutions and consider the future needs to make sure that there was an impact in the community even though there is help in the community, there needs to be a plan for when the subjects are by themselves and should work for themselves. All of these are to improve their overall quality of life, in which the programs can concentrate on better results, and also making sure the programs could run itself.

T2D interventions have been designed with behavioral and pharmaceutical approaches without creating a sustainable approach compared to preventative programs and general obesity management programs, while at the same time not having correct health outcomes with patients with T2D. This review emphasizes the importance of updated interventions to be proposed and implemented among obese Hispanic youths in the United States. Management programs should be the main preventative measure for future research in T2D. Cultural sensitivity measures should be considered when an intervention is being addressed among all ethnic backgrounds to have a greater impact on Hispanic youths. Understanding the social structures that are involved with obesity and T2D may be a key link to this research gap.

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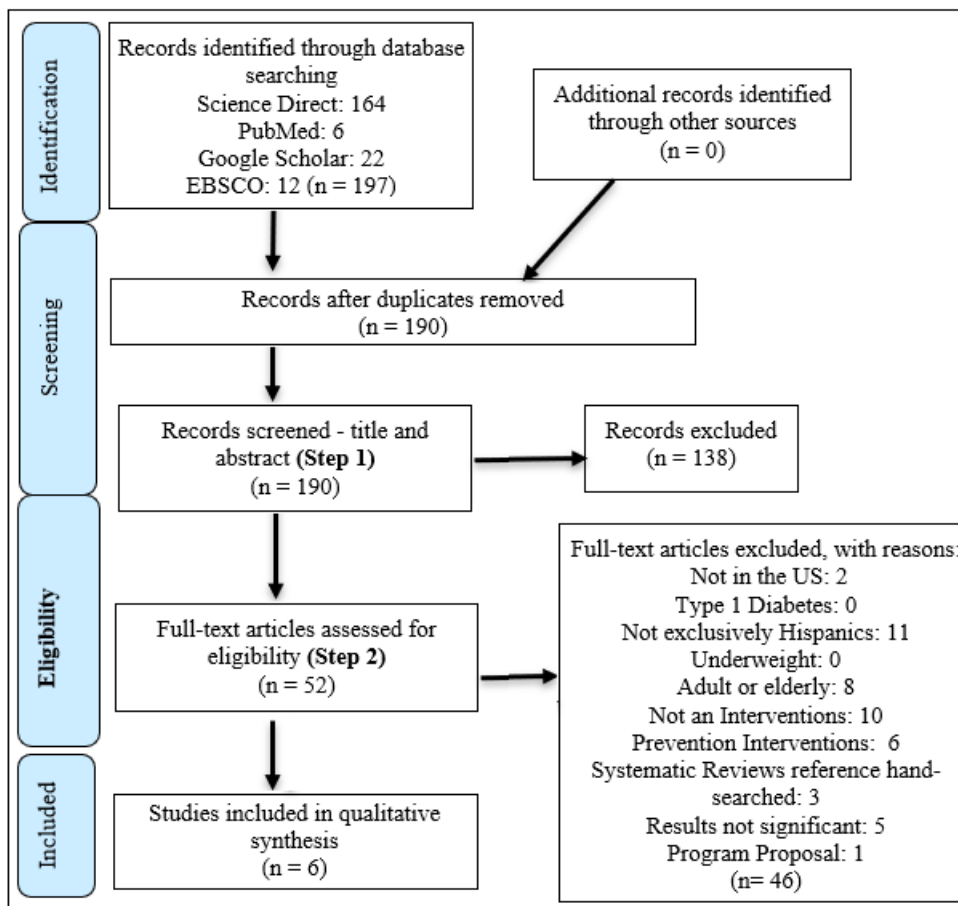


Figure 1: PRISMA Flowchart

Table 1. Type 2 Diabetes Intervention Studies Summary.

Author / Year	Purpose / Aims	Study Design	Setting / Location of Study	Population Size, N	Ethnicity, n (%)
Kumar, S., et al. / 2019	1. Describe the treatment among youth in the POWER program. 2. POWER program also provide multicomponent PWM services that included medical, nutrition, physical activity and behavioral assessments with counseling. 3. The study was conducted with a 3 follow up time periods 4-6 months, 7-9 months and 10-12 months.	OCS	31 POWER sites located at: Rochester, MN, Cincinnati, OH, Peoria, IL, Minneapolis, MN, Chicago, IL, Los Angeles, CA, and Houston, TX	6454 Obese Adolescents	White = 4321 (53%) Hispanic = 2065 (32%) Other = 967 (15%)
Lucas, J. A., et al. / 2018	To evaluate attrition rates and program outcomes measures (Body Mass Index [BMI] and maximum oxygen consumption [VO2max]) among asthmatic and non-asthmatic participants.	Cohort	Children's Heart Center Nevada (CHC) in the United States	232 Obese Adolescents (227 with Type II diabetes)	Black/African-American = 28 (12.1%) Hispanic = 149 (64.2%) White = 39 (16.8%) Other 16 (6.9%)
Grossman, D. C., et al. / 2017	To update the 2010 US Preventive Services Task Force recommendation on screening for obesity in children 6 years and older.	NR	USPSTF in the United States	6956 Obese Adolescents	NR
Zappas, M. P., Granger, T. A. / 2017	1. To achieve optimal blood glucose control and preventing comorbidities. 2. To provide the nurse practitioner with the tools necessary to treat target population using a holistic approach	NR	USA	699 Type II Diabetic Adolescents	NR
Delpier, T., Giordana, S., Wedin, B. M. / 2013	1. Evaluate the effects of a teaching intervention by health care providers on SSB consumption of rural adolescents. 2. Provide a meaningful experience that allows graduate students to use smart phones in research	RCT	Upper Peninsula of Michigan, USA	27 Adolescents	Non-Hispanic, White = 17 Native American, Hispanic, or mixed = 10
Copeland, K. C., Zeitzer, et al. / 2011	1. Describe the baseline characteristics of participants in today in a randomized clinical trial. 2. To evaluate patients in three randomized intervention groups by 1) metformin alone, 2) metformin + rosiglitazone 3) metformin + lifestyle program of weight management.	RCT	University of Oklahoma College of Medicine, Oklahoma City in the United States	704 Type II Diabetic Adolescents	NHW = 138 (19.6%) NHB = 222 (31.5%) Hispanic= 291 (41.4%) AI = 42 (6.1%) Asian =11 (1.7%)

NR = Not Reported
 NHW = Non-Hispanic White
 NHB = Non-Hispanic Black
 AI = American Indians
 RCT = Randomized Clinical Trial
 OCS = Observational Cohort Study

Table 2. Type 2 Diabetes Intervention Behavioral, Pharmacotherapy, and Physical Outcomes

Author / Year	Study Design	Incentive	Intervention Approach	Behavioral Outcomes	Significant Change	Pharmacotherapy Outcomes	Significant Change	Physical Outcomes	Significant Change
Kumar et. al. / 2019	OCS	NR	Weight management	Weight monitoring	NR	None	N/A	1. %BM95 2. HDL-C 3. ALT 4. TG 5. HbA1c	* ** ** ** **
Lucas et. al. / 2018	Cohort	NR	Exercise/Physical Activity	Exercise	NR	None	N/A	BMI z-score	**
Grossman et. al. / 2017	NR	NR	Behavioral - Individual and group sessions (healthy eating, safe exercising, and reading food labels)	1. Exercise 2. Eating habits 3. Weight monitoring	NR	Medication adherence	NR	1. BMI 2. HDL-C 3. ALT 4. TG 5. HbA1c	NR
Zappas, M. P., Granger, T. A. / 2017	NR	NR	Lifestyle modifications	1. Eating habits 2. Exercise	NR	1. Glycemic control 2. Lipid metabolism	NR	Blood glucose	NR
Delpier, T., Giordana, S., Wedin, B. M. / 2013	RCT	Stainless steel water bottle	Behavioral (telecommunication)	1. Eating/Drinking habits 2. Weight monitoring	**	None	N/A	BMI value	NR
Copeland et. al. / 2011	RCT	Monetary Compensation (Amount not specified)	Pharmacotherapy and Behavioral (weight management)	Weight monitoring	*	Medication adherence	**	1. BMI z-score 2. HbA1c 3. HDL-C 4. TG 5. ALT	* ** ** ** **

NR = Not Reported
 N/A = Not Applicable
 %BM95 = Percentage of the 95th percentile for BMI
 HDL-C = High-density lipoprotein cholesterol
 ALT = Alanin aminotransferase
 TG = Triglycerides
 HbA1c = Hemoglobin A1c
 Note: 1 = Strong, 2 = Moderate, 3 = Weak
 * P ≤ 0.05; ** P ≤ 0.01; *** P ≤ 0.001

Table 3. Quality Assessment of Included Articles.

Author / Year	Selection Bias	Study Design	Confounders	Blinding	Data Collection Method	Withdrawals and Dropouts	Global Rating
Kumar et. al. / 2019	1	2	1	1	1	3	2
Lucas et. al. / 2018	1	2	2	3	1	1	2
Grossman et. al. / 2017	2	N/A	3	3	2	N/A	3
Zappas, M. P., Granger, T. A. / 2017	2	N/A	3	3	N/A	N/A	3
Delpier, T., Giordana, S., Wedin, B. M. / 2013	1	1	3	3	1	2	3
Copeland et. al. / 2011	2	1	1	3	1	2	2

Note: 1 = Strong 2 = Moderate, 3 = Weak; N/A = Not available

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