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EXPLORING COMMUNITY-BASED WEIGHT LOSS INITIATIVES, RETENTION, AND MOTIVATION

MIRIAM MARTINEZ

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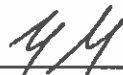
AND MOTIVATION

by

MIRIAM MARTINEZ, MPH

APPROVED:

ENMANUEL A. CHAVARRIA, PHD

BELINDA M. REININGER, DRPH

ANNA V. WILKINSON, PHD

DEAN, THE UNIVERSITY OF TEXAS
SCHOOL OF PUBLIC HEALTH

DEDICATION

To my parents and my husband

EXPLORING COMMUNITY-BASED WEIGHT LOSS INITIATIVES, RETENTION,

AND MOTIVATION

by

MIRIAM MARTINEZ
BS, NEW MEXICO STATE UNIVERSITY, 2012
MPH, TEXAS A&M UNIVERSITY, 2014

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EXPLORING COMMUNITY-BASED WEIGHT LOSS INITIATIVES, RETENTION,

AND MOTIVATION

Miriam Martinez, MPH, DrPH
The University of Texas
School of Public Health, 2020

Dissertation Chair: Belinda M. Reininger, DrPH

Obesity puts individuals at risk of developing diabetes, cardiovascular disease, and cancer. Traditionally obesity was primarily perceived as a personal disorder requiring treatment at the individual level. Strategies to prevent obesity have shifted to an ecological approach. Organizations such as the World Health Organization recommend population-based community approaches that connect people, families, schools, and municipalities. Community programs to facilitate weight loss are an effective strategy to reach large populations. The overall goal of this study is to assess community programs, factors associated with retention, and motivation for completing a community weight-loss initiative.

A systematic review was conducted to characterize and evaluate community-based weight loss programs for adults. Electronic academic databases were searched for studies published between January 2004 and December 2018. The systematic literature search retrieved 1,180 records, with a final synthesis of 11 publications describing eight unique programs. A variety of community strategies were implemented in the selected studies, including changes to the built environment to facilitate active living and healthy eating, and family components All the identified programs described resulted in some percentage of participants losing 5% of their body weight, a decreased BMI, or at least a 1.7 kg average

weight loss; this suggests that the diversity in programs and their components is a necessary strategy to meet diverse individual needs across US communities.

Understanding what factors help individuals complete weight-loss programs may improve participant retention, thus improving health outcomes. Factors associated with the completion of a community weight-loss challenge were examined. Sample participants included overweight and obese adults (n=6,225) participating in The Challenge. Multivariable regressions showed that the following increased the odds of program completion: increased age, being female, non-Hispanic, receiving text message support, a lower baseline BMI and participating in a group. It is essential to continue to work on increasing completion rates to enhance the effectiveness of community weight loss programs.

Research on the effect of motivation as a factor in behavioral interventions to reduce overweight or obesity is lacking. Individual semi-structured interviews were conducted with 20 participants who completed a community weight-loss intervention to assess motivation for participating and the role of social support and self-efficacy. Participants mentioned external sources of motivation, such as preventing adverse health outcomes, wanting to improve their physical appearance, and being motivated by financial incentives. Fewer participants mentioned intrinsic motivators, which are more likely to create lasting change and improved health behaviors. Understanding the motivation for behavior change and completion of weight loss programs is essential to help participants reach their goals effectively. A greater emphasis on the motives for individuals to lose weight may help improve outcomes in weight-loss interventions.

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Obesity as a public health problem

The World Health Organization (WHO) predicts that two to seven percent of global health-care spending is attributed to high body mass index (BMI). More than a third of adults in the United States and one-third globally are considered obese (Ng et al., 2014). The global annual medical cost of obesity is projected to cost over 30 trillion US dollars over the next two decades (Bloom et al., 2012). Following the current obesity rates trajectory, potentially half of the global population could be overweight or obese by 2030 (Kelly, Yang, Chen, Reynolds, & He, 2008). Obesity is characterized by excessive fat accumulation that puts individuals at risk of developing diseases such as diabetes, cardiovascular disease, and cancer (Bastien, Poirier, Lemieux, & Després, 2014; Gallagher & LeRoith, 2010). A variety of influences, including environmental, psychological, economic, and social factors, contribute to the development of obesity (Wright & Aronne, 2012). Those with obesity have a shorter life expectancy compared to people with a healthy weight (Kitahara et al., 2014). It is imperative to address the overwhelming economic and societal burden attributed to obesity.

Obesity determinants include physical inactivity, dietary behaviors, social support, and environmental and societal factors. Strategies that may reduce the prevalence of obesity include regularly engaging in physical activity, consuming more fruits and vegetables, and regulating caloric intake (Manna & Jain, 2015). Modest decreases of 5-10% of body weight in overweight and obese individuals can lead to significant health improvements, including a reduction of cardiovascular disease risk factors, drops in blood pressure, blood sugar, and cholesterol (Van Gaal, Mertens, & Ballaux, 2005). Factors that have consistently shown

success in predicting weight loss include social support (Elfhag & Rössner, 2005a; Heshka et al., 2003a), weight loss at the beginning of an intervention, (Fabricatore et al., 2009; Kong et al., 2010), and the absence of depressive symptomatology (Fabricatore et al., 2009; Teixeira, P. J. et al., 2004).

Traditionally obesityis primarily perceived as a personal disorder that requires treatment at the individual level (Kumanyika, Jeffery, Morabia, Ritenbaugh, & Antipatis, 2002). Strategies to prevent obesity have shifted to an ecological approach. There are variations of ecological models of health behaviors; levels often include intrapersonal, interpersonal, organizational, community, physical environment (built and natural), and policy (Sallis, Owen, & Fisher, 2008). The intrapersonal level of influence is comprised of characteristics of individuals such as knowledge, skills, and attitudes. Interpersonal processes provide social support and identity through relationships with family members, friends, colleagues, and other social networks. Institutional factors include organizations with policies, structures, rules, and regulations for operation (e.g., churches, community organizations, and workplaces). The relationships among organizations, institutions, and other networks within defined boundaries constitute community factors. The public policy level of influence includes local, state, and federal laws and policies. Based on the premise of interacting levels of influence on obesity, the International Obesity Task Force and the World Health Organization recommend population-based community approaches to combat overweight and obesity (Milliron, 2010; Waters et al., 2011; World Health Organization & World Health Organization, 2009)

O*besity among Hispanics*

Based on the 2010 US Census, Hispanics comprise 16% of the total US population and are the fastest-growing ethnic group (Ennis, Ríos-Vargas, & Albert, 2011). It is expected that by 2050, 29% of the US population will be Hispanic (Passel & D'Vera Cohn, 2008). More than a third of adults in the United States are considered obese (Ogden, Carroll, Kit, & Flegal, 2014). The rate of obesity is higher along the US-Mexico border, with approximately 50% of Mexican Americans along the border being obese versus 39.3% of Mexican Americans in the rest of the nation (Stoddard, He, Vijayaraghavan, & Schillinger, 2010). Extensive clinical, laboratory, and socioeconomic data have been collected on community members from Cameron County as part of the ongoing Cameron County Hispanic Cohort (CCHC).

At the time of a 2016 study, the CCHC was comprised of 3,257 participants recruited from 2003 to 2014. The individuals in the CCHC were randomly selected based on census tract data. The high prevalence of health conditions that increase the risk for morbidity and premature mortality was observed in the following measurements: 32.0% of the CCHC was overweight, 51.1% were obese, and about one-third had diabetes (Wu, Fisher-Hoch, Reninger, Vatcheva, & McCormick, 2016).

Data on 1,241 Mexican Hispanic adults from the 2013-2014 National Health and Nutrition Examination Survey (NHANES) showed that individuals who were born in the United States, had lived in the United States for greater than ten years, or who were not currently employed were more likely to be obese. Despite 42.6% of participants reporting that they had tried to lose weight in the past year, 88.8% of participants stated that they had not heard of *ChooseMyPlate*. The majority of participants did not engage in recommended physical activity with 75% and 63% reporting no vigorous or moderate physical activity,

respectively. The majority of the obese individuals in this study reported that they believed that their diets were unhealthy and had previously tried to lose weight (Forrest, Leeds, & Ufelle, 2017).

An emerging risk factor for excess weight is psychosocial stress (Harding et al., 2014; Torres & Nowson, 2007). The mechanisms through which psychosocial stress could contribute to overweight and obesity are both behavioral and biological. Behavioral factors linked to stress include consuming fast food more often and engaging in less physical activity (Barrington, Ceballos, Bishop, McGregor, & Beresford, 2012; Mouchacca, Abbott, & Ball, 2013). Biological mechanisms include activation of inflammation and the neuroendocrine system that may increase visceral adiposity and increase the accumulation of fat (Björntorp, 2001; Wardle, Chida, Gibson, Whitaker, & Steptoe, 2011). In the Hispanic Community Health Study/Study of Latinos (HCHS/SOL), the association between self-reported stress and BMI was studied in 5,077 Hispanic adults. There was a positive association seen between higher caloric intake and more chronic stressors (including health, work, and relationships) (Isasi et al., 2015). According to County Health Rankings, a project of the Robert Wood Johnson Foundation, 34% of adults in Cameron County reported fair or poor health compared to 18% for the state of Texas and the average number of physically unhealthy days reported in the past 30 days was 4.6. The uninsured rate is 47% for adults compared to the Texas uninsured rate for adults, which is 30%. Also, the median household income is $32,000 compared to a median income of $61,700 for the state (University of Wisconsin Population Health Institute.,).

Health behaviors that may have a protective effect on overweight and obesity, such as leisure-time physical activity and fruit and vegetable consumption, are also lower among

Hispanics compared to non-Hispanic whites. Findings from a study comparing Hispanic respondents from the 2009 national Behavioral Risk Factor Surveillance System (BRFSS) and the CCHC revealed significant health disparities in preventive health behaviors, including physical activity and fruit and vegetable consumption. BRFSS respondents were more likely than CCHC participants to meet recommended physical activity guidelines (44.14% vs. 33.3%) BRFSS respondents were also more likely than CCHC participants to meet guidelines for fruit and vegetable consumption (21.93% vs. 14.8%) (Reininger et al., 2015).

Interventions Addressing Obesity

The quest to find potential solutions to the obesity crisis has been underway for years by a variety of researchers (Compernolle et al., 2014a; Hassan et al., 2016; Teixeira, Pedro J. et al., 2015). The McKinsey Global Institute has identified interventions used in a wide array of settings in different sectors, including schools, health-care facilities, and employers. The McKinsey group- identified 74 interventions for addressing obesity categorized into 18 groups (Table 1) (Dobbs et al., 2016). Interventions for addressing this public health problem include both treatment and prevention approaches (Cecchini & Sassi, 2015a).

The Challenge implemented in south Texas is a community-level intervention targeting three of the 18 categories identified by the McKinsey Group to reduce obesity. The Challenge includes 1) health-care payers (encouraging healthy behaviors through incentives), 2) weight management programs (empowering people in behavioral lifestyle modifications), 3) public-health campaigns (promote healthy eating and physical activity through mass media) (Dobbs et al., 2016). The Challenge initiative is an example of a community-based weight loss program. The event is open to adult community members from throughout the

Rio Grande Valley. This initiative provides social support such as text messaging and phone calls with motivational interviewing, free resources such as exercise classes, and monetary incentives for participants to work towards their weight loss goals. It is also a key method of providing support and education at the community level. The Challenge focuses on promoting physical activity and healthy eating to achieve a healthy BMI.

Community-based weight loss programs

Interventions to prevent and combat obesity address modifiable risk factors such as unhealthy diets and insufficient physical activity (World Health Organization & World Health Organization, 2009). Due to the complex interplay of factors contributing to obesity, the International Obesity Task Force and the World Health Organization recommend population-based community approaches that connect people, families, schools, and municipalities (Milliron, 2010; Waters et al., 2011; World Health Organization & World Health Organization, 2009). The effectiveness can be increased by not only targeting educational aspects but also making changes towards shifting norms to create an environment that supports lifestyle changes to facilitate healthy eating and active living (Huang, Drewnowski, Kumanyika, & Glass, 2009). Evidence-based interventions (EBIs) to combat obesity are referenced in the *CDC Community Guide* published by the *Guide to Community Preventive Services (CDC, 2019).*

According to Merzel and D'Affliti (2003), six core elements comprise the framework of community-based interventions (CBIs). The six core elements are: 1) integrated and comprehensive; 2) include a range of locations; 3) utilize multiple interventions; 4) include various individuals, groups, and organizations; 5) include the community in program planning, implementation, and evaluation; and 6) include multiple individual-level

intervention strategies (Merzel & D'Afflitti, 2003). Evidence of the effectiveness of CBIs in addressing health behaviors is not well established. Findings from assessments of CBIs vary widely.

The Diabetes Prevention Program (DPP) is a highly regarded example of a successful lifestyle intervention for reducing diabetes risk and obesity. The Diabetes Prevention Program Research Group implemented a randomized clinical trial among US adults with an elevated risk of developing type 2 diabetes. Their primary questions were comparing the effectiveness of treatment with metformin (biguanide antihyperglycemic medication) or lifestyle interventions in preventing or delaying the onset of diabetes. Individuals recruited for DPP were nondiabetic adults with a high risk of developing type 2 diabetes based on an impaired glucose tolerance test (75-g oral glucose tolerance test). While the primary outcome of this study was the prevention or delay in the development of diabetes, obesity, physical activity, and nutrient intake were included as secondary research goals. As part of the original design (1999) participants in all treatment arms received a 20 to 30-minute one-on-one session and reading materials to encourage a healthy lifestyle including losing 5-10% of their baseline weight through diet and exercise, to eat less fat and fewer calories and to increase physical activity to complete 150 minutes each week.

The intensive lifestyle intervention had the following components: interactive training on behavior modification skills, nutritious eating and physical activity, behavioral change support, and emphasis on empowerment, social support, and self-esteem. The following goals for the intervention were also adopted: a 7% decrease of initial body weight through diet and exercise and at least 150 min/week of moderate-intensity physical activity.

Participants were encouraged to achieve their weight reduction and exercise goals within the first 24 weeks.

The intensive lifestyle intervention, which has been duplicated and adapted for different populations, has had many published successes. In 25 DPP programs assessed by DiBenedetto et al. (2016), it was reported that at the end of the year-long DPP program, all 25 programs had an average percentage body weight loss greater than 5% (DiBenedetto, Blum, O'Brian, Kolb, & Lipman, 2016a).

In another study examining the 1079 participants assigned to the lifestyle group as part of a randomized control trial had an average weight reduction of 7%, which is promising for programs to combat obesity (Diabetes Prevention Program Research Group, 2004). However, inequalities in weight loss were observed among minorities, including smaller weight loss among black women. Additionally, data are lacking for Hispanics in lifestyle interventions (West, Prewitt, Bursac, & Felix, 2008a).

In its original design, the DPP program was delivered in clinics but has since been translated into community settings such as YMCAs (Ackermann, Finch, Brizendine, Zhou, & Marrero, 2008). The successful translation of DPP in community settings sets the foundation for behavioral interventions to reach diverse U.S. communities (Venditti & Kramer, 2013).

Obesity interventions found in publications are generally those that occur in conjunction with a research study (randomized controlled trials), in partnership with academic institutions such as universities or that are large (Compernolle et al., 2014b). A need remains to identify models of community-based weight loss programs and their respective outcomes.

Attrition and Retention in weight loss programs

The effectiveness of interventions to influence obesity at the population level is contingent on program completion, sustainable lifestyle changes, reaching a large number of people, and the extent to which the priority population participates (Cecchini & Sassi, 2015b). There are numerous research studies on the effectiveness of weight management interventions; however, many do not include information on retention and attrition rates (Honas, Early, Frederickson, & O'brien, 2003; Teixeira, P. J. et al., 2004). Retention refers to keeping participants active until program completion, whereas attrition is the loss of participation before the program end date (Patel, Doku, & Tennakoon, 2003). Attrition and retention, however, are reciprocal and inversely related with an increase in retention, leading to decreased attrition and vice versa (Given, Keilman, Collins, & Given, 1990; Ribisl et al., 1996).

Intervention attrition rates are not always reported and vary considerably across different settings and delivery types from a 10% attrition rate to 80% (Moroshko, Brennan, & O'Brien, 2011). In a study assessing 25 CDC-recognized Diabetes Prevention Program implementations, the retention rate, defined as participants who attended four or more sessions, was 92%. This included 168 cohorts with 1,735 participants from 2013-2015 (DiBenedetto, Blum, O'Brian, Kolb, & Lipman, 2016b). The market leaders for commercial-weight loss programs include Weight Watchers, Jenny Craig, and Nutrisystem. In randomized control trials assessing Weight Watchers, the attrition rate varied from 71% (Heshka et al., 2003b) to 88% (Johnston, Rost, Miller-Kovach, Moreno, & Foreyt, 2013).

In three randomized control trials conducted for Jenny Craig and Nutrisystem both had a dropout rate of less than 20% (Gudzune et al., 2015). Other categories of commercial weight-loss products included low-calorie programs such as Medifast and Optifast. In a four-

month trial of Medifast, where participants were given 40 weeks of meal replacements free of charge, the retention rate was 53% (Davis et al., 2010).

Retention and attrition in weight management programs are understudied, and data on predictors are still scarce and inconsistent (Dalle Grave et al., 2005). In a systematic review conducted by Moroshko et al., (2011) the following variables were examined in the literature as they related to attrition: 1) demographic variables; 2) weight/shape factors; 3) eating behaviors; 4) psychological health; 5) physical health; 6) health behaviors; 7) personality factors; and 8) logistics. There were mixed findings for the relationship between attrition and age. Of thirty-two studies, seventeen (53%) did not find a relationship, thirteen (41%) found that there were higher attrition rates among younger participants, and two (6%) found that older age was associated with attrition. In sixteen studies that reported on gender, twelve (75%) did not find a significant association between gender and attrition, three (16%) said there was higher attrition in women, and finally, one (6%) study reported that men had an increased likelihood of prematurely withdrawing from a program. Of four studies examining ethnicity as a factor for attrition, two studies found that being non-white or African American increased the likelihood of dropping out of a program. Two other studies did not find ethnicity to be an associated factor for attrition. In summary, the demographic factor that was most consistently related to higher attrition was being a younger participant, whereas the associations for gender and ethnicity were not as explicit.

Variables associated with weight loss include initial weight status, weight loss expectations, and hip and waist circumferences. Eighteen of twenty-seven studies (67%) did not find a significant relationship between attrition and baseline weight. Five studies (19%) showed that higher baseline weights were positively associated with attrition. Of seven

studies that examined weight loss expectations, five (71%) found that greater and unrealistic weight-loss expectations were positively correlated with attrition. Two of the studies did not find an association. Hip and waist circumferences were only looked at in two studies, which were conflicting and inconsistent (Moroshko et al., 2011).

Factors positively associated with attrition, according to a 1992 systematic review included: life stress such as monetary problems, binge eating, and small weight loss at the beginning of a weight management program (Wadden et al., 1992). Another study by Jiandani and colleagues found that older individuals and non-smokers had lower rates of attrition from clinical weight management programs. The following variables did not predict attrition: age, ethnicity, smoking status, and health outcomes (Jiandani, Wharton, & Kuk, 2015). The predictors of retention and attrition described in the preceding sections are for individuals participating in more extensive clinical or randomized controlled trials. Thus, these findings may not be generalizable to a low-income, predominantly Hispanic population in a free community program. Understanding what factors help individuals complete weight-loss programs may improve participant retention, thus improving health outcomes.

Motivation in weight loss programs

In addition to identifying evidence-based interventions for weight loss in community settings, it is also necessary to understand what motivates people to lose weight. As referenced by the self-determination theory (SDT), behavior is influenced by different types of motivation, including autonomous motivation and motivation that is externally driven. The three premises of SDT are autonomy, competence, and relatedness. SDT posits that individuals who attribute behavior to autonomous regulation are more likely to engage in said behavior successfully. Additionally, higher self-efficacy and belief in ones' ability to

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accomplish an action are also positively associated with successful behavior change. Finally, relatedness refers to the desire to feel connected and interact with others (Deci & Ryan, 1985; Deci & Ryan, 2012; Ryan & Deci, 2000).

Motivators for weight loss may consist of health, physical appearance, social life, and mood (Dalle Grave et al., 2005; Kwan, 2009; LaRose, Leahey, Hill, & Wing, 2013) and the desire to improve self-esteem and confidence through weight loss (LaRose et al., 2013). Review articles have shown that predictors of successful weight control include self-motivation and internal motivation to lose weight (Elfhag & Rössner, 2005b; Teixeira, P. J., Going, Sardinha, & Lohman, 2005). Reasons for weight loss may also vary by age and sex. Research studies assessing men in the National Weight Loss Registry, who have successfully maintained weight loss, show that a health or medical concern was the most common motivator for starting the weight loss journey (Klem, Wing, McGuire, Seagle, & Hill, 1997).

Lemon and colleagues (2014) conducted a latent class analysis examining subgroups of adults for weight loss motivations. The researchers reported that this is one of the first studies to identify classes of adults based on motivation for weight loss and the association of the individuals' characteristics with class membership. The study examined a cross-sectional survey of 414 overweight/obese employees in twelve high schools in Massachusetts. The average age of the participants was 45.3 years, 69.8% were female, 95.6% were white, and 72.5% had at least a college degree. The following reasons for trying to lose weight were identified: improving health, mood, self-esteem, appearance, social life, job performance, and fitting into clothes, as well as being a better parent/spouse and serving as a positive role model. The latent class analysis revealed three classes for weight loss motivators: class 1) improving health status only (31%); class 2) improving health status and looking/feeling

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better (52.4%); and class 3) improving health status, looking/feeling better, and improving personal/social life (16.4%). It was found that those in the second class (appearance and health) were more likely to be younger and females. The individuals in class 3 were more likely to be female, young, but also perceived themselves as very overweight (Lemon et al., 2014).

Research on the effect of motivation as a factor in behavioral interventions to reduce overweight or obesity is lacking (Lemon et al., 2014; Wing, Tate, Gorin, Raynor, & Fava, 2006). Additionally, data are lacking for Hispanics in lifestyle interventions (West, Prewitt, Bursac, & Felix, 2008b)

Public Health Significance

The high prevalence of obesity and the morbidity and mortality from obesity-related conditions, especially in minority populations, warrants additional research on effective approaches to address this public health problem. Despite the importance of maintaining a healthy weight, there is a need for research on community-based resources for losing weight and the role of these programs in low-income and Hispanic populations. The effectiveness of interventions to affect obesity at the population level is contingent on program completion, sustainable lifestyle changes, reaching a large number of people, and the extent to which the priority population participates (Cecchini & Sassi, 2015a). Understanding why people do or do not complete programs and motivation for weight loss and program completion may improve participant retention, thus improving program outcomes.

Significant disparities exist in the overweight and obesity rates of Hispanics in border communities (Thomson, Nuru-Jeter, Richardson, Raza, & Minkler, 2013). The high burden of diabetes and other obesity-related complications among the Rio Grande Valley population

warrants additional research to address this public health crisis further. The information from this study will be used to reduce health disparities and inform future interventions targeted at improving

Objective and Specific Aims

The overall goal of this study is to assess community programs, factors associated with retention, and motivation for completing a community weight-loss initiative.

Study Aim 1: To identify (in the literature) models of community-based weight loss programs and their respective outcomes

Study Aim 2: To examine individual factors that characterize the completers and non-completers of a community weight loss challenge

Study Aim 3: To explore the perceptions and motivation of participants who completed a community weight loss Challenge

Table 1. Intervention Categories for Addressing Obesity

Category	Description	Approach
1. Active Transport	Increase physical activity through facilitating and promoting walking, cycling, and public transport	Prevention
2. Health-Care Payers	Encouraging healthy behavior through incentives (i.e., reward points, monetary prizes, free gym memberships).	Prevention/Intervention
3. Healthy Meals	Providing meals that meet dietary recommendations in controlled settings (i.e., workplaces, schools)	Prevention
4. High-calorie food and drink availability	Decreasing the availability of high-calorie foods and beverages (i.e., removing vending machines, fast-food establishment zoning)	Prevention
5. Labeling	Calorie/nutritional labeling on menus, etc.	Prevention
6. Media Restrictions	Regulating advertisements for high-calorie food advertisement/marketing	Prevention
7. Parental Education	Educational sessions for parents to promote healthier lifestyles for youth	Prevention/Intervention
8. Pharmaceuticals*	Intervening with drugs to reduce obesity	Intervention
9. Portion Control	Emphasis on a reduction in portion sizes and designing packaging to help moderate consumptions	Prevention
10. Price Promotions	Restrict the promotion of high-calorie foods	Prevention
11. Public-health campaigns	Promote healthy eating and physical activity through mass media	Prevention
12. Reformulation	Reduction of calories in food	Prevention
13. School curriculum	Increased time allotments to physical activity in the school day and include nutrition in curricula	Prevention
14. Subsidies, taxes, and prices	Adjust consumer prices for unhealthy foods/drinks	Prevention
15. Surgery*	Bariatric surgery and other surgical procedures to reduce stomach capacity	Intervention
16. Urban environment	Change the built environment through improving the walkability of cities, increasing green space, and increasing access to grocery stores	Prevention
17. Weight-management programs	Empower people in behavioral processes for lifestyle modifications (counseling, education, etc.)	Intervention
18. Workplace wellness	Offer programs at places of employment to encourage healthy behaviors such as healthy eating and physical activity	Prevention/Intervention

Title of Journal Article (A Systematic Review Of Community-Based Weight-Loss Interventions And Their Respective Outcomes)

Name of Journal Proposed For Article Submission (Obesity Reviews)

Miriam Martinez, MPH

Cindy Salazar-Collier, PhD

Enmanuel A Chavarria, PhD

Jessica Pena, MPH

Anna V Wilkinson, PhD

Belinda M Reininger, DrPH

University of Texas School of Public Health,

Health Science Center at Houston in Brownsville

Department of Health Promotion and Behavioral Sciences

Brownsville, Texas

SPH - RAHC Building

One West University Blvd.

Brownsville, Texas 78520

ABSTRACT

Traditionally obesity was perceived as a personal disorder that requires treatment at the individual level. Strategies to prevent obesity have shifted to an ecological approach, including interventions at the community level. This systematic review aims to characterize and evaluate community-based weight loss programs for adults. PubMed, WebOfScience, and Scopus were searched for studies published between January 2004 and December 2018 detailing community-based interventions with weight loss as a primary outcome. The systematic literature search retrieved 1,180 records. After removal of deduplication, 973 titles and abstracts were screened for inclusion. Full-text articles screened included 79, with a final synthesis of 11 publications describing eight unique programs. There was significant variation in program characteristics related to length, amount, and frequency of group sessions, theoretical basis, adaptations of the Diabetes Prevention Program, and use of technology. The effect size for BMI reduction ranged from 1.8% to 2.7% in 3-month interventions; average weight loss varied from 1.7 kg in 3 months to 6.4 kg in 12 months. A variety of community strategies were implemented in the selected studies, including changes to the built environment to facilitate active living and healthy eating, family components, and identification of resources within the community. The quality of the studies included was mostly weak due to limitations of selection bias, blinding, and study design. Community programs to facilitate weight loss are an effective strategy to reach large populations. This review provides programs and their characteristics related to effectiveness, reach, and priority population that should be considered when designing and implementing community programs.

Introduction

More than a third of adults in the United States (US) and one-third globally are considered obese [1,2]. The global annual societal cost of obesity is projected to cost over 30 trillion US dollars over the next two decades [3]. Following the current obesity rates trajectory, potentially half of the global population could be overweight or obese by 2030 [4]. Obesity is characterized by excessive fat accumulation that puts individuals at risk of developing diseases such as diabetes, cardiovascular disease, and cancer [5,6]. A variety of influences, including genetic, environmental, psychological, economic, and social factors, contribute to the development of obesity [7]. People who are obese have a shorter life expectancy compared to people with a healthy weight [8]. It is imperative to address the overwhelming economic and societal burden attributed to obesity.

Interventions to prevent and combat obesity, address modifiable risk factors such as unhealthy diets and insufficient physical activity [9,10]. Traditionally obesity was primarily perceived as a personal disorder that requires treatment at the individual level [11]. However, due to the complex interplay of factors contributing to obesity, the International Obesity Task Force and the World Health Organization (WHO) recommend population-based community approaches that connect people, families, schools, and municipalities [12-14]. Therefore, strategies to prevent obesity have shifted to an ecological approach. There are variations of ecological models of health behaviors; levels often include intrapersonal, interpersonal, organizational, community, physical environment (built and natural), and policy [15,16]. The effectiveness of interventions aimed at improving health behaviors can be increased by not only targeting educational aspects but also making changes towards shifting norms to create an environment that supports lifestyle changes to facilitate healthy eating and active living [17].

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Evidence-based interventions (EBIs) to combat obesity are referenced in the *CDC Community Guide* published by the *Guide to Community Preventive Services (2017).*

According to Merzel and D'Affliti (2003), six core elements comprise the framework of community-based interventions (CBIs). The six core elements are: 1) integrated and comprehensive; 2) include a range of locations; 3) utilize multiple interventions; 4) include various individuals, groups, and organizations; 5) include the community in program planning, implementation, and evaluation; and 6) include multiple individual-level intervention strategies [18]. Evidence of the effectiveness of CBIs in addressing health behaviors is not well established. Findings from assessments of CBIs vary widely.

The Diabetes Prevention Program (DPP) is a highly regarded example of a successful community-based lifestyle intervention focused on weight loss to reduce diabetes risk. In its original design, the DPP program was delivered in clinics but has since been translated into community settings such as YMCAs and serves as an example of a community-based intervention [19]. The successful translation of the DPP in community settings established the foundation for behavioral interventions to reach diverse U.S. communities [20].

The DPP Research Group implemented a randomized clinical trial among adults in the US with an elevated risk of developing type 2 diabetes. Their primary questions were comparing the effectiveness of treatment with metformin (biguanide antihyperglycemic medication) or lifestyle interventions in preventing or delaying the onset of diabetes. Individuals recruited for DPP were nondiabetic adults with a high risk of developing type 2 diabetes based on an impaired glucose tolerance test (75-g oral glucose tolerance test). While the primary outcome of this study was the prevention or delay in the development of diabetes, obesity, physical activity, and nutrient intake were included as secondary research

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goals. As part of the original design (1999) participants in all treatment arms received a 20 to 30-minute one-on-one session and reading materials to encourage a healthy lifestyle including losing 5-10% of their baseline weight through diet and exercise, to eat less fat and fewer calories and to increase physical activity to complete 150 minutes each week.

The intensive lifestyle intervention had the following components: interactive training on behavior modification skills, nutritious eating and physical activity, behavioral change support, and emphasis on empowerment, social support, and self-esteem. The following goals for the intervention were also adopted: a 7% decrease of initial body weight through diet and exercise and at least 150 min/week of moderate-intensity physical activity. Participants were encouraged to achieve their weight reduction and exercise goals within the first 24 weeks. The intensive lifestyle intervention, which has been duplicated and adapted for different populations, has had many published successes. In 25 DPP programs assessed by DiBenedetto et al. (2016), it was reported that at the end of the year-long DPP program, all 25 programs had an average percentage body weight loss greater than 5% [21]. In another study examining the 1079 participants assigned to the lifestyle group as part of a randomized control trial had an average weight reduction of 7%, which is promising for programs to combat obesity [22].

Obesity interventions found in publications are generally those that occur in conjunction with a research study (randomized controlled trials), in partnership with academic institutions such as universities or that are large [23]. The purpose of this systematic review is to identify (in the literature) models of community-based weight loss programs for adults and their respective outcomes.

METHODS

Our systematic literature search approach followed the Matrix Method, as communicated by Garrard (2016). To ensure thorough communication of our findings, we report following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [24]

Search Strategy

A systematic literature search of PubMed, WebOfScience, and Scopus was conducted in January 2019. The review included studies published between January 2004 and December 2018 that examined community-level interventions for obesity prevention or weight reduction in adults. The date restriction was determined based on the availability of interventions, as well as the increased pervasiveness and accessibility of the internet and interventions delivered through online mechanisms. The search was designed on PubMed with the following Mesh terms "Obesity/prevention and control"[Mesh]) OR "Weight Reduction Programs"[Mesh]) AND "Community Health Services"[Mesh]) AND "Adult"[Mesh]. The search terms were subsequently applied in WebOfScience and Scopus with the following search terms: obesity and prevention and "weight loss" and community and adults. After using the limiters: published during 2004 and 2018 and the English language, a total of 1,049 articles (including duplicates) were retrieved across the three databases (PubMed, Web of Science, and Scopus). Additional studies were identified through bibliographical reviews of studies identified through the search strategy.

Study screening and eligibility criteria

Citations were uploaded into RefWorks, and duplicates removed. Authors MM and CS independently screened titles and abstracts of all articles to select studies that met the

inclusion criteria. Author JP served as a third reviewer for resolving discrepancies. Titles and

abstracts obtained using the search strategy described in the preceding section were reviewed

to assess relevance to the study aim. Inclusion criteria were as follows:

- Interventions aimed towards adults (18-65 years)

- Interventions published between January 2004 and December 2018 in a peer-
  reviewed journal

- Implementation at the community level

- Primary outcomes adiposity measures: baseline BMI and change scores; baseline
  and follow-up weight; percent bodyweight reduction

- Various delivery methods were included: group, face-to-face, mobile applications,
  telephone, and mixed methods

Interventions aimed towards adult populations included projects, initiatives, and

programs led by a wide array of organizations (research-led, community-led). The

interventions, however, had to be at the community level. Community was defined broadly as

a group of people connected through their residence in a neighborhood, city, region, or state.

Adiposity measures were considered the primary outcome in this systematic review.

Additionally, the programs included in the review had to be implemented in the United

States. The search was limited to articles in English. Due to the evolution of approaches

(including technology components) aimed at combating obesity, only programs started or

ongoing in 2004 were included. This review included different study designs, including pre-

post uncontrolled studies without comparison groups, quasi-experimental studies, and

randomized controlled trials.

Studies were excluded if they were interventions aimed at particular populations (chronic disease other than obesity, cancer survivors, handicapped, pregnant women, etc.), interventions with bariatric surgery, pharmacotherapy, very low energy diets, residential services, free food/meals/exercise equipment, faith-based interventions and interventions taking place or primarily recruiting within healthcare or primary care settings, worksites and schools or universities. Pilot studies were also excluded because they would not be as readily scalable to larger communities.

If the abstract indicated that the study might be eligible for inclusion, the full paper was assessed. Reference lists of included studies and those where the entire article was reviewed were searched by hand for the identification of additional studies that met the criteria. The reviewing and screening of articles using the methods above and inclusion and exclusion criteria were conducted independently by two researchers. Figure 1 depicts the search process and study selection.

Data extraction and synthesis

The following components were extracted for participant characteristics and program components: state(s) in which intervention was delivered, study type, intervention, comparator, length of intervention, sample size, age, sex, weight status, and measures of race or ethnicity as reported by the authors.

Factors related to outcomes were extracted and included in a second table. Considering the heterogeneity of outcomes reported, an effect size percentage was calculated for baseline and follow-ups in each intervention. The formula used was: ([baseline BMI – follow-up BMI] / baseline BMI) x 100

Quality assessment and risk of bias in included studies

The Effective Public Health Practice Project Quality Assessment Tool for Quantitative Studies was used to assess the quality of the included studies. This standardized tool rates studies as strong, moderate or weak in the following sections: 1) selection bias; 2) study design; 3) confounders; 4) blinding; 5) data collection methods; 6) withdrawals and dropouts; 7) intervention integrity; and 8) analysis [25]. Two of the researchers MM and CS independently rated study quality and compared individual ratings to reach consensus. The overall study quality, as shown in Table 1, was rated based on the combination of component ratings. A strong rating was assigned to studies with four strong ratings with no weak ratings, moderate was less than four strong ratings and one weak rating, and a weak rating was assigned to studies that had two or more weak ratings.

RESULTS

Study Selection

The systematic literature search retrieved 1,180 records. After deduplication, 973 titles and abstracts were screened for inclusion (Fig. 1). Full-text articles screened included 79, with 11 selected for final synthesis. A total of 68 studies were excluded, with the main reason for exclusion being programs conducted in the wrong setting (church, work, school) followed by interventions implemented in another country, pilot studies, and the wrong participant population. Abstraction of selected components showed that there were multiple studies meeting criteria that described the same program. Thus 11 publications were describing eight unique programs.

Study Characteristics

Characteristics of the studies, programs, and participants are shown in Table 1. Study designs included randomized controlled trials (*n*=5) [26-30] and non-randomized experimental

pre-post studies (*n=6*) [31-36]. All of the programs described were categorized as lifestyle interventions, as all had a focus on healthy eating and physical activity. Many of the programs (*n=7*) [28-30,32,34-37] were modeled on the reputable DPP. Others described having a community-based participatory approach (*n=2*) [26,32], and others stated that a theoretical framework informed their intervention (*n=4*) [31,32,34,35].

The smallest program had a sample size of 147 [27] and a group component, and the largest was 40,308, [31], which had one-on-one online health coaching and relied on technology for the delivery of the intervention. The majority of participants across the programs were female, with one program being exclusively for women [26,38]. Racial and ethnic minorities comprised more than 50% of the study population in several studies (*n=2*) [26,32]. Study quality was rated as weak (*n=11*) for all of the included studies. Studies were rated as 'weak' if they had two or more 'weak' ratings in the following categories: selection bias, study design, confounders, blinding, data collection method, and withdrawals and dropouts. All of the programs had selection bias because participants were self-referred. It was also not possible to blind participants to the intervention they were receiving due to the nature of the programs.

Primary Outcome: Weight Loss

The effectiveness and characteristics of the interventions are shown in Table 2. The majority of programs had a group component (*n=7*) [26,27,29,30,32,34,35]. The number of group sessions ranged between 0 and 24 sessions and was usually administered weekly or biweekly. Some interventions employed one-on-one coaching (*n=5*) [26,29-31,35] usually on the phone or online in conjunction with other elements of the interventions. Technology was an additional

intervention component (*n*=7) [27,28,30,31,34,35] including e-mails, mobile applications, and program websites.

Height and weight were collected in all of the studies. Four of the studies [28,33,34,36] describing one intervention indicated that participants self-reported anthropometric measures. One of these four studies [36] provided validation data for the self-reported measures provided in this program and found that there was a statistically significant difference between self-reported and objective weight differences at 3.9 kg and 2.3 kg, respectively. The remaining programs had anthropometric measures collected by trained research staff on calibrated scales. The outcomes were reported in a variety of ways including: change in BMI which allowed for the calculation of effect size (*n*=3) [26,32,36], average weight loss (kg) (*n*=8) [26,27,30-33,35,36], average percent reduction in initial body weight (*n*=3) [28,29,34] and the percentage of participants achieving ≥5% reduction in body weight (*n*=8) [26,28,29,31,33-36].

The studies in Table 2 are grouped by the method used to report weight change (BMI effect size, average weight loss, and an average reduction of initial body weight). Among the studies that reported change in BMI, the effect size ranged from 1.8% in a three-month intervention [32] to 2.7% in a three-month intervention [36]. The study with the largest average weight loss was 6.4 kg in 12 months [30]. The study with the lowest was 1.7 kg in 9 months [32]. For percent reduction of initial body weight, the most considerable reduction was 10.9% at six months in the high-dose branch of the study with 24 weekly sessions [29]. The lowest percent body weight reduction was 1.1% in 3 months in participants randomized to the standard ShapeUp Rhode Island (SURI) program [28]. Both of these programs also had the highest and lowest percentage of participants that lost at least 5% of their body weight, with percentages of 81% and 7%, respectively.

Several of the included studies (*n=5*) [28,32-34,36] employed other levels of influence that support an ecological approach in addition to intrapersonal and interpersonal levels. Almost all of the programs had an interpersonal component operationalized in group sessions [26,29,30,32,34,35,39]. Journey to Better Health [26] had an additional component that provided financial support in the form of mini-grants to implement strategies that would facilitate physical activity or healthy eating in the community. Strategies included: enhancement of a walking trail, a dance class, a community garden, and incentives to purchase fruits and vegetables from the local farmers market.

The PILI 'Ohana Project (POP) had a family and community component in Phase II of the intervention. The family component aimed to build a supportive environment for weight loss by eliciting the help of friends and family to encourage the participants in their healthy living goals. Strategies included planning meals and physical activity together as a family, learning to communicate health goals, and teaching participants coping mechanisms for challenging social and family situations such as parties and gatherings. Connections in the community were established by finding resources within the built environment in their respective communities that facilitate healthy eating and active living such as parks and restaurants serving healthy options and sharing them with other participants. The family and community components were planned as activities between the monthly sessions [40]. This program had an effect size of 1.8% and an average weight loss of 1.7kg [32].

Shape Up Rhode Island was described in four of the included studies [28,33,34,36]. This statewide campaign offered random prize drawings for participants to enter their anthropometric measurements into the recording system. Prizes included yoga passes, gym memberships, and personal training. Engagement in the intervention was promoted through

media, newsletters, and a kick-off event. Participants were connected with existing community resources offered through partner organizations such as Zumba classes, cooking lessons, nutrition workshops, and activities to reduce stress. Other interventions provided financial incentives [31] and motivational incentives in the form of prize drawings [28,29,33,34,36].

Some studies included measurements at multiple points throughout the intervention, including follow-ups after the end of the intervention to assess maintenance. The length of follow-up ranged from 6 to 24 months after baseline measurements were collected. More than half of the studies (*n*=7) [26-28,30,34-36] reported retention rates. The range was 46% among young adult participants (18-35 years old) in one of the studies [33] to 99.5% at six months for another program [26].

DISCUSSION

This systematic review identified, summarized, and evaluated 8 community-based lifestyle programs and their respective weight-loss outcomes. All of the programs identified were successful at reducing BMI or weight, as shown by the reduction in BMI, average weight loss, and percentages of participants losing at least 5% of their initial body weight.

Considering the vast array of program components, the manner in which they were delivered, duration times, and manner of reporting outcome measures, it is difficult to determine what the most effective characteristics of the evaluated programs were. In a meta-analysis of 28 translational DPP studies, the authors reported a positive association between the number of sessions offered by the program and weight change [41]. In contrast, in this study, it is difficult to ascertain that a greater number of sessions correspond with a greater impact on weight loss, as shown by effect size for BMI. The intervention with the largest effect size had a 2.7% reduction in BMI and consisted of no group sessions [36]. The

intervention with the smallest effect size of 1.8% was 3 months in duration and had 8 sessions during the active phase and 6 sessions in the maintenance phase [32]. Again the relationship between the number of sessions and effect size varies considering a 3-month intervention with no group sessions had a greater effect size (2.7%) [36] than the other 3-month intervention with 14 total sessions [32].

The effectiveness of DPP has been well documented in the literature [21]; however, the interventions that were informed by DPP employed translational research and delivered adapted versions of the interventions in community settings. Given this information, it is important to consider the success of the community interventions identified in this study that followed DPP principles. Among the programs implementing DPP informed interventions, effect sizes for BMI included 1.8% [32], and 2.7 [36]. Additionally, weight loss ranged from 1.7kg [32] to 6.4 kg in two of the interventions [30,36]. Three of the studies that used DPP reported outcomes as the average percentage in the reduction of initial body weight and ranged from 1.1% [28] to 10.9% [29].

Ecological approaches were realized through the implementation of strategies to improve the built environment, incorporate family and social support, and connect participants with existing community resources. One of the interventions, Journey to Better Health [26], had an additional component that provided financial support in the form of mini-grants to implement strategies that would facilitate physical activity or healthy eating in the community. Strategies included: enhancement of a walking trail, a dance class, a community garden, and incentives to purchase products from the local farmers market. This intervention had a BMI effect size of 2.6, and 23% of participants lost at least 5% of their initial body weight. The mean weight loss for the subset of participants achieving ≥ 5% loss was 9.1 kg.

While these results are substantial, there were no statistically significant differences between the Weight Loss Only Intervention and the Journey to Better Health program that included strategies to foster healthy behaviors through an improved environment [26].

The PILI 'Ohana Project (POP) had a family and community component. This program had an effect size of 1.8% and an average weight loss of 1.7kg [32]. The effect of this intervention without these two components cannot be assessed due to the lack of a comparison group. Shape Up Rhode Island, which was described in four of the studies included connections to community resources such as exercise classes sponsored by partnering community organizations.

The percentage of participants losing at least 5% of their body weight ranged from 7% [28] to 81% [29]. Five of the eight programs included the percentage of participants with at least 5% of body weight lost as a program outcome. Across all 8 programs, there were reported successes in weight loss reported as either percentage of program participants losing at least 5% of their body weight, an average of between 1.7 to 4.6kg, and/or decreased BMI.

Strengths of this review include a systematic approach described in Gerrard (2016) using the well-regarded PRISMA guidelines, a targeted aim (community-programs in the United States since 2004 aimed at weight reduction), as well as guidance by an experienced research librarian. The use of PubMed Mesh terms ensured that the breadth of the study would capture programs that met the research criteria. Identification of the selected articles is essential for informing interventions at the community level that do not rely on clinics, schools, employers, or churches for program delivery and recruitment. It was considered whether to include studies where participants were recruited at clinic sites even when the intervention was delivered in community settings. These studies, however, were not

included due to the significant possibility that participants were also being followed by physicians at the time of the intervention.

Community interventions are accompanied by inherent study design limitations. Many of the studies in this review were assessed to have poor quality due to selection bias, given that participants were often self-referred or recruited through word-of-mouth. Additionally, participants could not always be randomized to interventions considering the level of intervention delivery was at the community-level. Furthermore, it was not possible to blind participants to intervention conditions. The deficiencies provided by the aforementioned study design characteristics limit the generalizability of the findings in the included studies. As is usually seen in the literature, many of the interventions were comprised of predominantly non-Hispanic white participants. Due to the time frame in which the literature review was conducted, more recent studies in 2019 that would have met the criteria for inclusion are not described.

This study provided a review of the literature to identify community programs and interventions for adults seeking to lose weight. The review included 11 studies describing 8 programs. While the reporting of outcomes was heterogeneous making comparisons between the programs difficult, it is still beneficial to consider the outcomes of the included studies. The percentage of participants that were able to lose at least 5% of their initial body weight is especially significant to consider due to the well-established benefit for reducing risk factors for chronic diseases such as cardiovascular disease and diabetes. A variety of community strategies were implemented in the selected studies, including changes to the built environment to facilitate active living and healthy eating, family components, and identification of resources within the community. This review provides programs and their

characteristics related to effectiveness, reach, and priority population that should be

considered when designing and implementing community programs. Given that all programs

resulted in some percentage of participants losing 5% of their body weight, a decreased BMI,

or at least a 1.7 kg average weight loss, this suggests that the diversity in programs and their

components is a necessary strategy to meet diverse individual needs across US communities.

Figure 1. Flowchart of Study Selection

| Identification | Records identified through database searching (n = 1,049) Records after duplicates removed (n = 944) | Additional records identified through reference checking (n = 131) Records after duplicates removed (n= 29) |

Records after duplicates removed (n = 973)

| Screening | Records screened (n =973) | Records excluded (n =894) |

| Eligibility | Full-text articles assessed for eligibility (n =79) | Full-text articles excluded, with reasons (n =68) |

Full-text articles excluded, with reasons (n =68)
Before 2004: 5
No intervention: 2
No outcome reported: 2
Other country: 9
Pilot study: 8
Wrong intervention: 6
Wrong participant population: 9
Wrong primary outcome: 5
Wrong setting: 22

Studies included in qualitative synthesis (n =11 studies describing n=8 programs)
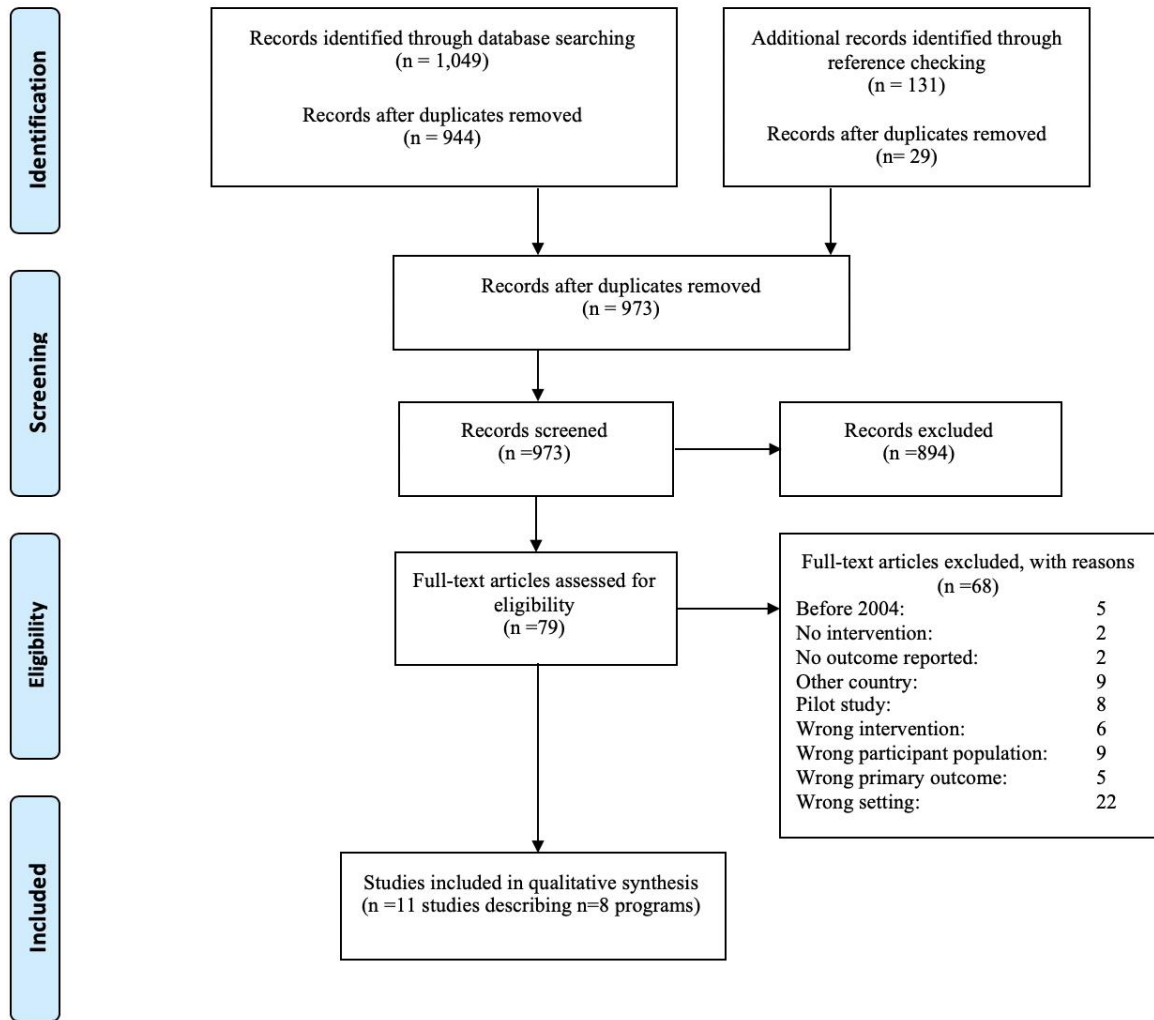
Table 1. Program and Participant Characteristics of All Included Programs

Author, date (reference)	Study type	Quality score[1]	Intervention	Comparator	Length, m	Sample size, n	Age	Sex (%F)	BMI	Race/Ethnicity (%)
Ard et al., 2017[26]	RCT	Weak	Journey to Better Health	Weight Loss Only intervention	24	409	44.8 (10.4)	100	38.6 (8.0)	African American 100
Estabrooks et al., 2017[31]	Non-randomized (pre-post)	Weak	Weigh and Win (WAW)	No comparator	12	40,308	43.9 (13.1)	79	32.4 (7.2)	Asian: 1.5 Caucasian: 72.6 Other: 8.8 Hispanic: 19.2
Johnston et al., 2013[27]	RCT	Weak	Weight Watchers	Self-help	6	147	46.5 (10.5)	89.8	33.0 (3.6)	Not Hispanic/Latino 90.2 Hispanic/Latino 9.8
Kaholokula et al., 2013[32]	Non-randomized (pre-post)	Weak	PILI 'Ohana Project (POP)	No comparator	3	239	50.8 (14.3)	84	38.3 (8.7)	Native Hawaiian 71%
LaRose et al., 2012[33]	Non-randomized (pre—post)	Weak	ShapeUp Rhode Island (SURI)	Older adults	3	6,795	44.7 (11.2)	81	29.4 (5.9)	White 90.7 African American 4.4 Asian 2.6
Leahey et al., 2012[34]	Non-randomized (pre-post)	Weak	ShapeUp Rhode Island (SURI) 2009	No comparator	3	3330	45.1 (11.1)	77.1	31.4 (5.4)	Not Hispanic/Latino 85.9 Hispanic/Latino 3.2 Declined to answer 10.8
Leahey et al., 2014[28]	RCT	Weak	ShapeUp Rhode Island 2011 (SURI)	Standard SURI	3	230	NR	NR- Mostly female	34.4 SE 0.05	NR- Predominantly non-Hispanic white
Perri et al., 2014[29]	RCT	Weak	Rural LITE Trial	Nutrition education control	24	443	52.3 (11.5)	NR-78.3	36.3 (4)	Non-Hispanic White 77.7 Black 15.5 Hispanic 3.7 Other/multiple 2.9
Piatt et al., 2013[35]	Non-randomized (pre-post)	Weak	Rethinking Eating and ACTivity (REACT)	Face-to-Face delivery, DVD, internet, self-selection	3	555	51.1 (11.3)	86.2	36.3 (6.6)	Non-Hispanic white 96.8
Vitolins et al., 2017[30]	RCT	Weak	Healthy living partnerships to prevent diabetes (HELP PD)	Diabetes Prevention Program	24	151	Males: 32.1(0.5) Females: 33.4(0.4)	58	32.1 (0.5)	Non-white 26%
Wing et al., 2009[36]	Non-randomized (pre-post)	Weak	Shape Up Rhode Island (SURI) 2007	No comparator	4	4717	43.3 (10.9)	83.4	29.4 (6.1)	NR

Table 2. Characteristics and Effectiveness of Programs

Author, date (reference)	Length /FU, m	# of sessions	Focus & Additional Strategies	Group Sessions	1:1	Tech.	Theoretical Basis	DPP/ CBPR	Retention %	Measure	Effect size End-I	Effect size FU	% Losing ≥ 5% BW
Ard et al., 2017[26]	6/24	**20 total** 6 m intensive weight loss phase: weekly group sessions; 6m fu: 3 m bimonthly sessions followed by 3 m of monthly sessions	Lifestyle Environmental: walking trail, dance class, community garden	Yes	Yes: fu TC	-	NR	CBPR	6m: 99.5	BMI / Mean Wt loss kg	↓2.6% / ↓2.4	NR	23
Kaholokula et al., 2013[32]	3m	**14 total** first 4 lessons weekly, next 4 lessons biweekly; maintenance phase 6 monthly sessions	Lifestyle Family meal/physical activity planning, dealing with challenging social situations Identifying community resources in built environment	Yes	No	-	SCT	CBPR, DPP	NR	BMI / Mean wt loss kg	↓1.8% / ↓1.7	NR	NR
Wing et al., 2009[36]*	3m	**No sessions**	Lifestyle Prize drawings, wellness activities, exercise classes provided by community organizations	No	No	Website	NR	DPP	70.2	BMI / Mean Wt loss kg	↓2.7% / ↓3.2	6m: regained 0.8kg	30.2
Estabrooks et al., 2017[31]	12m	**No sessions**	Lifestyle Financial incentives, Community-based kiosks	No	Yes: OHC	Yes- e-mail, website, SMS, OHC	SCT	-	NR	Mean Wt loss kg	↓2.1	NR	19

Study	Duration	Sessions	Intervention			Technology	Theory	Curriculum	% retention	Outcome	Result	Result	Result
Johnston et al., 2013[27]	6m	24 total Weekly group sessions	Lifestyle Commercially available: Weight Watchers	Yes	No	-	NR		88	Mean Wt loss kg	↓4.6	NR	NR
LaRose et al., 2012[33]*	3m	No sessions	Lifestyle Prize drawings, wellness activities, exercise classes provided by community organizations	No	No	Yes- WW mobile application, website Yes	NR	-	YA: 46 OA: 62	Mean wt loss kg	YA: ↓3.2 OA: ↓3.8	NR	YA: 46 OA: 33
Piatt et al., 2013[35]	3m/6m	Face to face:12 group education sessions over 12-14 weeks DVD: 4 group meetings to debrief from 1st 4 weeks Internet: 2 group sessions at baseline and completion	Lifestyle	Yes	Yes	Internet	SCT	DPP	60	Mean Wt loss kg	3m FF:↓5.7 DVD:↓5.5 INT:↓6.2	6m FF:↓4.9 DVD:↓3.4 INT:↓3.1	FF:57.2 DVD: 56.7 INT: 62
Vitolins et al., 2017[30]	24 total	First 6m: weekly group meetings Maintenance phase: months 7-24: monthly group meetings	Lifestyle	Yes	Yes: phone session	-	NR	DPP	83	Mean Wt loss kg	12m ↓6.4	24m ↓4.4	NR
Leahey et al., 2012[34]*	3m	No sessions	Lifestyle: prize drawings wellness activities, exercise classes provided by community organizations	No	No	Website	Social learning theory	DPP	66	% reduction initial body weight	↓4.2		33.6

Study	Follow-up	Sessions	Intervention components	Phone/SMS	OHC	Delivery		Comparator	Retention (%)	Measure	Outcome		Final retention
Leahey et al., 2014[28]*	3m/6m/12m	**12 total** Weekly sessions for SIG	Lifestyle: prize drawings, wellness activities, exercise classes provided by community organizations	Yes: optional for SIG	No	Website	NR	DPP	93	% reduction initial body weight	S:1.1 SI: 4.2 SIG: 6.1	-	S: 7 SI: 42 SIG: 54
Perri et al., 2014[29]	24m	Low: 8 weekly sessions Mod: 16 weekly sessions High: 24 weekly sessions	Lifestyle Motivational incentives for meeting campaign objectives	Yes: phone sessions	-	NR	DPP	NR		% reduction initial body weight	6m Cntrl: 4.1 Low: 7.2 Mod: 9.3 High: 10.9 / 24m Cntrl: 2.9 Low: 3.5 Mod: 6.7 High: 6.8		6m: Cntrl: 45 Low: 40 Mod: 63 High 75 81 / 24mod: Cntrl: 40 Low: 43 Mod: 58 High 58

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SMS: text message support; OHC: online health coaching; m: months; Lifestyle: includes behavior component such as physical activity or diet; Measure: BMI
S: standard SURI; SI: SURI plus internet behavioral weight loss intervention; SIG: SURI plus internet behavioral weight loss intervention plus optional group sessions FF: Face-to-face
YA: young adults 18-35; OA >35 years

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Title of Journal Article (Factors That Characterize Completers And Non-Completers Of A Community Weight-Loss Challenge)

Name of Journal Proposed For Article Submission (BMC Public Health)

Miriam Martinez, MPH

Cindy Salazar-Collier, PhD

Anna V Wilkinson, PhD

Miryoung Lee, PhD

Enmanuel A Chavarria, PhD

Belinda M Reininger, DrPH

University of Texas School of Public Health,

Health Science Center at Houston in Brownsville

Department of Health Promotion and Behavioral Sciences

Brownsville, Texas

SPH - RAHC Building

One West University Blvd.

Brownsville, Texas 78520

ABSTRACT

The objective of this study was to identify factors associated with the completion of a 16-week free community weight-loss challenge. Sample participants include overweight and obese adults (n=6,225) enrolled in The Challenge held in a south Texas border community. Participants were mostly female (72%, n=4508) and Hispanics (94%, n=4901). The mean age was 39.29 (SD=12.13) years, with a mean BMI of 35.02 (SD= 7.11). The majority of participants opted to participate as individuals (40%, n=2534) or in a small group of 2-10 participants (41%, n=2548) and to receive text message support (81%, n=4709). There were significant differences between completers and non-completers concerning sex, age, ethnicity, receiving text message support, group participation, and baseline BMI. Multivariable regressions showed that the following increased the odds of program completion: increased age, being female, non-Hispanic, receiving text message support, a lower baseline BMI and participating in a group. The predictors of program completion with the highest level of influence were participating in a small or large category. Participants who joined as part of a small group increased their odds of completion by 60% compared to participants who enrolled as individuals. The effect was even greater among those enrolling in a large group with a threefold increase in the odds of completing compared to registering as an individual. To improve the impact of The Challenge, it would be best to target changeable predictors of program completion, including group participation and support from text messages. It is important to continue to work on increasing completion rates to enhance the effectiveness of community weight loss programs.

Introduction

Based on the 2010 US Census, Hispanics comprise 16% of the total US population and are the fastest-growing ethnic group (1). It is expected that by 2050 Hispanics will comprise about 25% of the US population (2). More than a third of adults in the United States are considered obese (3). The rate of obesity is even higher along the US-Mexico border, with approximately 50% of Mexican Americans residing in border regions being obese versus 39.3% of Mexican Americans in the rest of the nation (4).

Obesity determinants include physical activity, dietary behaviors, societal influences, and environmental and social norms (5-7). Strategies that may reduce the prevalence of obesity include regularly engaging in physical activity, consuming more fruits and vegetables, and regulating caloric intake (8). Modest decreases of 5-10% of body weight in overweight and obese individuals can lead to significant health improvements, including a reduction of cardiovascular disease risk factors, improvements in blood pressure, blood sugar, and cholesterol (9). Factors that have consistently shown success in predicting weight loss include social support (10, 11), weight loss at the beginning of a weight-loss program (12), and the absence of depressive symptomatology (12, 13).

The effectiveness of interventions to influence obesity at the population level is contingent on program completion, sustainable lifestyle changes, reaching a large number of people, and the extent to which the priority population participates (14). There are numerous research studies on the effectiveness of weight management interventions; however, many do not include information on retention and attrition rates (13, 15). Retention refers to keeping participants active until program completion, whereas attrition is the loss of participation before the program end date (16). Attrition and retention, however, are reciprocal and

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inversely related with an increase in retention, leading to decreased attrition and vice versa

(17, 18).

Intervention attrition rates are not always reported and vary considerably across

different settings and delivery types from a 10% attrition rate to 80% (19). In a study

assessing 25 CDC-recognized Diabetes Prevention Program implementations, the retention

rate, defined as participants who attended four or more sessions, was 92%. This included 168

cohorts with 1,735 participants from 2013-2015 (20). The market leaders for commercial-

weight loss programs include Weight Watchers, Jenny Craig, and Nutrisystem. In

randomized control trials assessing weight watchers, the attrition rate varied from 71% (10)

to 88% (21).

In three randomized control trials conducted for Jenny Craig and Nutrisystem both

programs had a dropout rate of less than 20% (22). Other categories of commercial weight-

loss products included low-calorie programs such as Medifast and Optifast. In a four-month

trial of Medifast, where participants were given 40 weeks of meal replacements free of

charge, the retention rate was 53% (23).

Retention and attrition in weight management programs are understudied, and data on

predictors are still scarce and inconsistent (24). Addressing retention and attrition are

important to reduce selection bias and improve program adherence. Identifying factors that

lead to attrition in community interventions can help program planners adapt programs to

improve completion rates (25). In a systematic review conducted by Moroshko et al., (2011)

the following variables were examined in the literature as they related to attrition: 1)

demographic variables; 2) weight/shape factors; 3) eating behaviors; 4) psychological health;

5) physical health; 6) health behaviors; 7) personality factors; and 8) logistics. There were

mixed findings for the relationship between attrition and age. Of thirty-two studies, seventeen (53%) did not find a relationship, thirteen (41%) found that there were higher attrition rates among younger participants, and two (6%) found that older age was associated with attrition. In sixteen studies that reported on gender, twelve (75%) did not find a significant association between gender and attrition, three (16%) said there was higher attrition in women, and finally, one (6%) study reported that men had an increased likelihood of prematurely withdrawing from a program. Of four studies examining ethnicity as a factor for attrition, two studies found that being non-white or African American increased the likelihood of dropping out of a program. In comparison, the other two studies did not find ethnicity to be an associated factor for attrition. In summary, the demographic factor that was most consistently related to higher attrition was being a younger participant, whereas the associations for gender and ethnicity were not as explicit.

Variables associated with weight loss include initial weight status, weight loss expectations, and hip and waist circumferences. Eighteen of twenty-seven studies (67%) did not find a significant relationship between attrition and baseline weight. Five studies (19%) showed that higher baseline weights were positively associated with attrition. Of seven studies that examined weight loss expectations, five (71%) found that greater and unrealistic weight-loss expectations were positively correlated with attrition. Two of the studies did not find an association. Hip and waist circumferences were only looked at in two studies, which were conflicting and inconsistent (19).

Factors positively associated with attrition, according to a 1992 systematic review included: life stress such as monetary problems, binge eating, and small weight loss at the beginning of a weight management program (26). Another study by Jiandani and colleagues

found that older individuals and non-smokers had lower rates of attrition from clinical weight management programs. The following variables did not predict attrition: age, ethnicity, smoking status, and health outcomes (27). The predictors of retention and attrition described in the preceding sections are for individuals participating in more extensive clinical or randomized controlled trials. Thus, these findings may not be generalizable to a low-income, predominantly Hispanic population in a free community program. Understanding what factors help individuals complete weight-loss programs may improve participant retention, thus improving health outcomes. To our knowledge, this is the first study reporting on predictors of retention within a community-based weight-loss program.

A free community-based weight loss program has helped adults in the South Texas region improve their health through improved dietary habits and physical activity (28). This three-month community-weight loss Challenge is open to adult community members aged 18 years or older. The Challenge provides free resources for participants to support their lifestyle changes (text messaging, free exercise classes, etc.) (28). The objective of this study is to identify factors associated with the completion of an open community based-weight loss challenge.

METHODS

Program Description

The community-weight loss Challenge is voluntary and open to adults who are at least 18 years old, not pregnant, have not undergone bariatric surgery within the last year, and are free of medical conditions for which weight loss would be contraindicated. Participants were not required to be overweight to participate; however, analyses to identify characteristics associated with completing the program were restricted to include only

participants who were overweight or obese. The registrations for the Challenge were held at community locations and worksites. Consent forms, participant information, and measures of adiposity were collected by trained staff at the beginning of each annual event. Anthropometric measures were collected at the end of the program and were used to characterize completers. Participants were linked to free resources in the community such as nutrition classes, exercise classes, text message support, and health coaching and could enroll in The Challenge annually. Text message support was offered to Challenge participants at registration and included up to 3 weekly messages to encourage healthy choices towards weight loss and remind participants about upcoming events. Participants were encouraged to attend the final weigh-in, which was offered after each Challenge (14 weeks average length). Participants and teams with the highest percentage of weight loss received monetary prizes (28).

Anthropometric Measures

Anthropometric measures were collected by a team of two trained staff members and included: height, weight, and waist and hip measurements. Self-standing stadiometers with measures to the nearest 1/8 inch and calibrated electronic Tanita scales were used to measure height and weight respectively and subsequently calculate body mass index (kg/m^2). (28).

Participant Characteristics

Participant characteristics were collected on a registration form that was checked by a staff member. Data gathered included biological sex, age, ethnicity (Hispanic or non-Hispanic), language preference (Spanish or English), and participating category (individual, a small group of 2-10 people, or a large group of 11-20 people).

Statistical Analyses

All analyses were conducted using STATA v15. This study utilized a retrospective, observational study design to assess factors associated with the completion of a community weight-loss challenge among participants from 2010 to 2018. Demographic and other individual characteristics of the overweight and obese study population were stratified as 'completer' and 'non-completers.' Completers are participants who attended both the initial weigh-in during the registration and the final weigh-in. Non-completers are participants who did not attend the final event and therefore had no final weight recorded. Individuals who participated in the event multiple years (24.9%, n= 1552) only had data from their initial participation year included.

Continuous and categorical participants' characteristics between 'completers' and 'non-completers' were compared using t-tests and chi-square tests, respectively. The role of individual factors in predicting program completion was determined by controlling for all variables that demonstrated a significant difference by program completion status (p<0.05) in a multivariable logistic regression model. Language was included in the logistic regression because it serves as a proxy for acculturation (29).

RESULTS

Baseline characteristics

The completion rates by BMI group showed that 23.5% (n=337) of participants in the overweight range completed, and 20.2% (n=971) (p<.01) of participants categorized as obese completed. Participant characteristics of all overweight and obese program participants and stratification by program completion are reported in Table 1. Participants were mostly female (72%, n=4508) and Hispanic (94%, n =4901). The mean age was 39.29 years (SD= 12.13). Mean BMI was 35.02 (SD= 7.11), with 82%, n= 1258 of participants with elevated or high

blood pressure. The majority of participants opted to participate as individuals (40%, n= 2534) or in a small group (41%, n= 2548) and to receive text message support (81%, n= 4709). There were significant differences between completers and non-completers concerning sex, age, ethnicity, receiving text message support, group participation, and baseline BMI. Among Hispanics, 21.3% (n =1119) completed, whereas 26.4% (n=91) (p<0.05) of Non-Hispanics were able to complete The Challenge. Of participants that were in a large group, 36.3% completed, which was the largest rate among participation categories. Individuals who participated in a small group had a completion rate of 20.8%, and individuals finished at a rate of 14.1%.

Predictors of Completion

Of the 6,225 overweight and obese participants enrolled, 20.9% completed (n= 1,308). The Challenge. Bivariate analyses showed factors that significantly differed between completers and non-completers. These factors were sex, age, ethnicity, baseline BMI, text message support, and group participation. Language preference and blood pressure did not differ between overweight and obese participants who completed The Challenge and those that did not complete.

The results of the logistic regression model are presented in Table 2. Significant predictors of program completion age, sex, ethnicity, language preference, text message support, and participating in a group. Thus increased age, being male, identifying as Non-Hispanic, having a Spanish language preference, accepting text message support, participating in a group, and having a lower baseline BMI are all factors likely to increase the odds of completing The Challenge.

For every one-year increase in participant age, there was a 1% increase in the odds of completing the program. Hispanics have an approximately 30% decreased odds of completing the program compared to non-Hispanics. Participants who received text message support increased their odds of program completion by 23% compared to those who declined this support. Spanish as the preferred language increases the odds of completion by 22%. When taken as a proxy for acculturation, this would indicate that being less acculturated increases the odds of completion.

The predictors of program completion with the highest level of influence were participating in a small or large category. Participants who joined as part of a small group increased their odds of completion by 60% compared to participants who enrolled as individuals. The effect was even more significant among those joining in a large group with a threefold increase in the odds of completing compared to registering as an individual.

DISCUSSION

To our knowledge, this is the first study evaluating predictors of retention in a community weight loss program. Studying retention is important because retaining program participants reduces selection bias and ensures that participants are able to receive the benefits of program completion (25). The retention rate for this program was 20.9% (n=1,308). The completion rates by BMI group showed that 23.5% (n=337) of participants in the overweight range completed, and 20.2% (n=971) (p<.01) of participants categorized as obese completed. Among the overweight and obese, multivariable regressions showed that the following were associated with the odds of program completion: increased age, being female, non-Hispanic, opting to receive text messages, a lower baseline BMI and participating in a group.

Similarly to other weight loss programs, the majority of the program participants were female. Hispanic participants comprised 94% (n=4901) of the participants, which is representative of the demographics for Brownsville, Texas, at 94% Hispanic according to the 2010 US census. Older age was associated with greater completion rates. This may be due to a potential motivation stemming from the declining health associated with increasing age or perhaps fewer work or family obligations among older individuals that may facilitate participation in community activities. Studies examined by Moroshko et al., (2011) in their systematic review on predictors of dropout in weight loss interventions included thirteen of thirty-two studies (41%) that found a higher completion rate among older participants (19). Other studies have findings similar to ours in that older age is associated with increased completion (15, 30)

In bivariate analyses, sex was found to be associated with program completion, and the multivariable regression showed that being female increased odds of completion. In sixteen studies that reported on gender, twelve (75%) did not find a significant association between sex and attrition, three (16%) reported there was higher attrition in women, and finally, one (6%) study reported that men are at increased likelihood of prematurely withdrawing from a program. The findings from this study showed that men, who were also the minority in this intervention (28%) were more likely to drop out. It is difficult to ascertain why there was a higher rate of attrition in men. This study contributes to the conclusion of other researchers examining retention and demographic variables in that there are inconsistencies in the ability to predict attrition based on sex (31).

Minimal studies have examined the relationship between ethnicity and attrition. This study found that being Non-Hispanic increased the odds of completion. Of four studies (32-

35) examining ethnicity as a factor for attrition two studies (32, 33) found that being non-white or African American increased the likelihood of dropping out of a program while the other two studies (34, 35) did not find ethnicity to be an associated factor for attrition (19).

Lower baseline BMI was associated with increased odds of completion. Perhaps co-morbidity related to higher BMI may play a role. The literature has not shown a clear link between baseline weight and program completion with 5 of the 27 of the studies in a systematic review on attrition, showing no association between baseline weight and completion rates. Higher baseline weights, however, were positively associated with attrition in 5 of the studies (31).

Considering that there were higher rates of dropout among younger participants, the program could consider modifying or adding program elements to increase engagement among younger adults. In a study assessing 139 young adults with an average age of 19.6 (SD= 1.4), it was found that weight loss program features that were desired included individual activities, demonstrations, and individual competitions (36). Perhaps more emphasis is needed on marketing activities, cooking demonstrations, and the sticker cards used to track participation in exercise classes.

The factor that had the most significant impact on completion was participating in a group. Receiving text message support also improved retention. From these predictors, it can be inferred that social support is crucial to retaining participants. Reviews of the literature have shown that incorporating social support in weight loss programs improves outcomes (37, 38). In The Challenge, participants who enrolled as part of a group often did so with family members, close friends, and work colleagues. This provided the opportunity for participants to encourage each other in multiple settings, including participating together in

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physical activity and changing the home and workplace environment and norms to promote weight loss.

The logistic regression showed that participating in a large group (11-20 participants) provided the highest increase in odds for completing the program. Considering the positive effect of receiving text message support and group participation on program completion, it may be beneficial to make more of a push towards encouraging participants to accept text-message support and join as part of a group. It is vital to continue to work on increasing completion rates to enhance the effectiveness of community weight loss programs.

The strengths of this study include that this is a representative sample of the community. Moreover, the analyses reported here were repeated among the full sample (i.e., including individuals of normal weight) and identified the same factors associated with successful completion of a community intervention to promote weight loss among a US-Mexico border region. Limitations include the nature of the study design, which is volunteer-based, observational and has no temporal sequence allowing us to draw conclusions on causation. Furthermore, it would have been instrumental in assessing other variables that may contribute to attrition, including eating behaviors (food addiction), physical activity, and personality attributes.

In conclusion, there were significant differences between completers and non-completers concerning sex, age, ethnicity, receiving text message support, group participation, and baseline BMI. The following increased the odds of program completion: increased age, being female, non-Hispanic, receiving text message support, a lower baseline BMI and participating in a group. Participating in a small or large category had the highest level of influence on program completion. Emphasis on the positive influence of social

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support and participating in a group could help to increase completion rates and enhance the effectiveness of community weight loss programs.

Acknowledgments

Table 1. Factors Associated with Completion of a Community Weight-Loss program Among Overweight and Obese Participants (n=6,225)

	All (n=6,225)	Completers (n=1,308)	Non-completers (n=4947)	p-value
Sex				
Male	1,747 (28)	307 (23)	1,440 (29)	<0.001
Female	4,508 (72)	1,001 (77)	3,507 (71)	
Age	39.29 (12.1)	40.15 (11.4)	39.06 (12.3)	<0.01
Ethnicity				
Hispanic	4901 (94)	1,046 (92)	3855 (94)	<0.05
Non-Hispanic	311 (6)	82 (8)	229(6)	
Language Preference				
English	4809 (79)	994 (78)	3815 (80)	0.07
Spanish	1,241 (21)	285 (22)	956 (20)	
Text Message Support				
Yes	4709 (81)	991 (83)	3,718(80)	<0.01
No	1,120 (19)	196 (17)	924 (20)	
Participation Category				
Individual	2,534 (40)	360 (27)	2,174 (44)	<0.001
Small-Group	2,548 (41)	519 (40)	2,029 (41)	
Large-Group	1,173 (19)	429 (33)	744 (15)	
Body Mass Index	35.02 (7.1)	34.29 (6.8)	35.21 (7.2)	<0.001
Blood pressure categories				
Normal	1,053 (18)	211 (17)	842 (18)	0.77
Elevated	832 (14)	178 (14)	654 (14)	
High BP	4,069 (68)	845 (69)	3,224 (68)	

Table 2. Logistic Regression: Effect of Demographic and Participation Characteristics on Program Completion among Overweight and Obese Participants (n=5,282)

Characteristic (Ref)	Odds Ratio	95% CI	P-Value
Sex (Male)	1.22	1.03, 1.44	0.02
Age (Years)	1.01	1.00, 1.01	0.03
Ethnicity (Non-Hispanic)	0.69	.52, .92	0.01
Language (English)	1.22	1.03, 1.45	0.03
Text Message Support (No)	1.23	1.02, 1.49	0.03
Category			
Individual (Ref)	1.00		
Small-Group	1.60	1.35, 1.88	<0.001
Large-Group	3.28	2.73, 3.94	<0.001
BMI	.99	0.98, 1.00	0.01

Ref: reference value

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Title of Journal Article (Motivation For Weight Loss Among Completers Of A Free Community Weight Loss Program In A Us-Mexico Border Region: A Self-Determination Theory Perspective)

Name of Journal Proposed For Article Submission (Journal of Health Psychology)

Miriam Martinez, MPH

Cindy Salazar-Collier PhD

Jessica Pena, MPH

Anna V Wilkinson, PhD

Enmanuel A Chavarria, PhD

Belinda M Reininger, DrPH

University of Texas School of Public Health,

Health Science Center at Houston in Brownsville

Department of Health Promotion and Behavioral Sciences

Brownsville, Texas

SPH - RAHC Building

One West University Blvd.

Brownsville, Texas 78520

ABSTRACT

Research on the effect of motivation as a factor in behavioral interventions to reduce

overweight or obesity is lacking. Additionally, data are lacking for Hispanics in lifestyle

interventions. This study aims to explore the perceptions and motivation of participants who

completed a free community-based weight loss program in a predominantly Hispanic and

low-income region along the US-Mexico border using a Self-Determination Theory (SDT)

perspective.

Individual semi-structured interviews were conducted with 20 participants (80%,

n=16 female) who completed a community weight-loss intervention to assess motivation for

participating, and the role of social support and self-efficacy. A directed content analysis

approach was used with SDT guiding the questions and subsequent themes. A deductive

approach was used to elucidate motivation types and the constructs of competence and

relatedness/social support from the participants' experiences.

The findings showed the perspectives of participants as they related to 8 themes. The

regulation types and constructs related to SDT included: non-regulation, external regulation,

introjected regulation, identified regulation, integrated regulation, and intrinsic regulation as

well as competence and relatedness. Participants mentioned external sources of motivation,

such as preventing adverse health outcomes, wanting to improve their physical appearance,

and motivation due to financial incentives. Fewer participants said intrinsic motivators,

which the literature suggests are more likely to create lasting change and improved health

behaviors. Understanding the motivation for behavior change and completion of weight loss

programs is essential to help participants reach their goals effectively. A greater emphasis on

the motives for individuals to lose weight may help improve outcomes in weight-loss

interventions. Additionally, increasing strategies targeted at enhancing intrinsic motivation for weight loss may be beneficial.

Introduction

Obesity is an epidemic with a dire need for public health solutions (Nestle, Jacobson 2000, Friedrich 2017, Mann, Tomiyama et al. 2015). Although there are a variety of weight management interventions available, the success of participants is contingent on several factors including program completion, social support, and motivation for behavior change (Elfhag, Rössner 2005a, Ortner Hadžiabdić, Mucalo et al. 2015, Teixeira, Pedro J., Carraça et al. 2015)

Self-determination theory (SDT) suggests that motivation, defined as psychological energy aimed at a specific goal, can be linked to autonomous or external influences. Autonomous regulation is internally driven and refers to behaviors originating from self. This may include core values and personal interests. In contrast, controlled regulation is externally driven and motivated by sources such as respect and admiration of others, monetary incentives, and favorable evaluations. Health behaviors are influenced by intrinsic and extrinsic motivation and overlap with three primary needs established by SDT: autonomy, competence, and relatedness. Autonomy refers to feeling in control of individuals' behavior. Competence involves the belief in individuals' skills, mastery, and ability to accomplish a particular task or action. Finally, relatedness is the need to feel a sense of belonging, connectedness with others, and social support (Ryan, Patrick et al. 2008).

The types of motivation seen in SDT are part of a continuum that can range from nonself-determined to self-determined (Figure 1). Further, there can be multiple types of motivation, driving a particular behavior. Along a continuum with nonself-determined

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motivation on the left of the continuum and self-determined motivation on the right, amotivation with non-regulation would present on the left with an impersonal source of motivation. The least internalized form of regulation is external regulation, which is engaging in a behavior to gain a reward or avoid a punishment. Introjected regulation is another type of extrinsic motivation that involves a response to prove something to oneself or others, or from feeling guilt or obligation to engage in a specific behavior.

Further towards internalized regulation is identified regulation where an individual believes that a particular behavior is important to him/her. Integrated regulation is the type of extrinsic motivation closest to internalized regulation along the motivation continuum. Integrated regulation is behaving in a manner that is consistent with personal values and other goals. Furthest right on the motivation continuum is intrinsic motivation, which is self-determined. This type of regulation is associated with personal interest, enjoyment, and inherent satisfaction in engaging in a particular behavior. It is important to note that in health behavior, forms of regulation are not always exclusive but rather may coexist within the same behavior and change over time and in different contexts (Deci, Ryan 1985, Deci, Ryan 2000).

SDT was developed to inform social science and was first applied in the context of education and the effect of rewards systems on intrinsic motivation. Applications of SDT have since progressed to health outcomes in physical and mental illness such as physical activity, tobacco cessation, medication adherence, weight loss, quality of life, depression, and anxiety (Ryan, Patrick et al. 2008). An application of SDT is seen in a weight loss program for patients with morbid obesity. This program involved weekly group sessions and 13 weeks of low-calorie liquid diet followed by gradual reintroduction of healthy foods over the next

13 weeks. Outcomes showed that participants with greater autonomous self-regulation had increased reductions in their BMI as well as increased program attendance (Williams, Grow et al. 1996).

As referenced by SDT behavior is influenced by different types of motivation, including autonomous motivation and motivation that is externally driven. Several studies have explored the motivation for weight loss (Elfhag, Rössner 2005b, Teixeira, P. J., Going, Sardinha, and Lohman 2005a, Klem, Wing et al. 1997a, Dalle Grave, Calugi et al. 2005, LaRose, Leahey et al. 2012). Motivators for weight loss may include health, physical appearance, social life, mood (Dalle Grave, Calugi et al. 2005, LaRose, Leahey et al. 2012), and the desire to improve self-esteem and confidence through weight loss (LaRose, Leahey et al. 2012). Review articles have shown that predictors of successful weight control include self-motivation and internal motivation to lose weight (Elfhag, Rössner 2005a, Teixeira, P. J., Going, Sardinha, and Lohman 2005b). Reasons for weight loss may also vary by age and sex. The most extensive prospective study investigating successful weight loss maintenance assessed men in the National Weight Control Registry found that a health or medical concern was the most common motivator for starting the weight loss journey (Klem, Wing et al. 1997b).

Lemon and colleagues (2014) conducted a latent class analysis examining subgroups of adults concerning weight loss motivations. The study was one of the first studies to identify classes of adults based on motivation for weight loss and the association of the individuals' characteristics with class membership. The study examined a cross-sectional survey of 414 overweight/obese employees in twelve high schools in Massachusetts. The average age of the participants was 45.3 years, 69.8% were female, 95.6% were white, and

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72.5% had at least a college degree. The following reasons for trying to lose weight were identified: improving health, mood, self-esteem, appearance, social life, job performance, and fitting into clothes, as well as being a better parent/spouse and serving as a positive role model. The latent class analysis revealed three classes for weight loss motivators: class 1 defined as improving health status only (31%); class 2 defined as improving health status, mental health, and appearance (52.4%); and class 3 defined as improving health status, mental health, appearance, and promoting personal/social life (16.4%). It was found that those in the second class (appearance and health) were more likely to be younger and females. The individuals in class 3 were more likely to be female, young, but also perceived themselves as very overweight (Lemon, Schneider et al. 2014). A limitation of this study is its lack of generalizability to non-white populations.

Cultural attitudes and norms among minority racial and ethnic groups can impact health behaviors differently than what has been examined between perceived susceptibility and health behaviors in White individuals with higher socioeconomic status (Bennett, Wolin 2006, Jones, Roche et al. 2009). Literature reviews revealed a dearth of information and published studies on motivational factors for weight loss among Hispanics, racial/ethnic minorities, and low-income populations. Tamers and colleagues (2014) completed a study assessing the relationship between worry of developing diseases associated with obesity and its role in motivating behavior change for physical activity and weight management. The study population was mostly Hispanic and non-Hispanic Black with an average age of 44 years and mainly with a high school education or less and living below the poverty line. Findings from the study showed that individuals who are more concerned about the medical implications of being overweight or obese will have a higher intention to change and will be

more likely to participate in health promotion programs (Tamers, Allen et al. 2014). A review of the literature has shown that research on the effect of motivation as a factor in behavioral interventions to reduce overweight or obesity is lacking (Wing, Tate et al. 2006, Lemon, Schneider et al. 2014). Additionally, data are lacking for Hispanics in lifestyle interventions (West, Prewitt et al. 2008). This study aims to explore the perceptions and motivation of participants who completed a free community-based weight loss program in a predominantly Hispanic and low-income region along the US-Mexico border.

METHODS

Design and Participants

A free community-based weight loss program has helped adults in the South Texas region become more aware of the benefits of weight loss through lifestyle changes related to improved dietary habits and physical activity. This three-month community-weight loss intervention, The Challenge, has demonstrated weight loss or maintenance in the majority of participants who complete the program (13), The Challenge was an annual voluntary program open to adults who were at least 18 years old, not pregnant, and free of medical conditions for which weight loss would be contraindicated. Participants were not required to be overweight to participate. The registrations for The Challenge were held at community locations and worksites. Consent forms, participant information, and measures of adiposity were collected by trained staff at the beginning and end of each annual event. Participants were linked to free resources in the community, such as nutrition classes, exercise classes, text message support, and health coaching throughout the Challenge. Participants were encouraged to attend the final weigh-in, which was offered after approximately 14 weeks.

Participants and teams with the highest percentage of weight lost received monetary prizes (Funk, Lee et al. 2019).

Participants who completed the 2019 Challenge were invited for an interview. Following the aim of this study, the sampling included participants who attended the registration, and final weigh-in regardless of whether they met their weight loss goal. A table was set up by the researchers to recruit participants who completed The Challenge at the last event in April 2019. Participants were invited to participate, and if they agreed, they provided their e-mail address and phone number to be contacted to set up an interview. Additionally, e-mails were sent to 'completers' to invite them to participate in the study. For the participants recruited through e-mail, e-mails were sent to the potential participants to explain the research and ask them to join. Once contact was established, and if the participant agreed to participate, they were contacted to set an interview date. Verbal consent was obtained to record interviews. All necessary IRB and university approvals were obtained prior to recruitment and conducting interviews.

Data Collection

Individual semi-structured interviews were conducted with participants who completed a community weight-loss Challenge in 2019 to assess motivational factors and their perception of determinants of their completion of The Challenge. Twenty participants completed interviews. The topic guide (Table 1) was developed based on the self-determination theory, which has been used to assess motivation for behavior change. Flexibility within the topic guide was allowed for participants to provide further insight into their experience with motivation, and aspects of the self-determination theory as part of The Challenge. Interviews were conducted in the participants' preferred language (English or Spanish). Spanish

transcripts were translated into English for analyses and disseminating findings. Interviews were audio-recorded and transcribed verbatim.

Analysis

A directed content analysis approach was used for data analysis because it allows a theory to guide the research question and subsequent constructs related to the theory (Hsieh, Shannon 2005). A deductive approach was used to elucidate motivation types and the constructs of competence and relatedness/social support from the participants' experiences. The motivation types related to the self-determination theory included: non-regulation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic regulation.

Transcripts were analyzed using ATLAS.ti 8 software. Coding and categorizing protocols were developed by two researchers (MM & CS) who have studied SDT. Initially, they coded the same five transcripts independently, compared code allocation, and met to discuss and reconcile codes for subsequent transcripts. Following this reconciliation, the two researchers individually coded the transcripts and met after every five interviews (4 meetings) to triangulate the data, enhance codes to more clearly address the research question and examine emerging themes. Discrepancies in the codes were solved through discussion and consensus between MM & CS. At the final meeting, the researchers selected the quotes that were most representative of the participants' experiences as they related to the SDT.

RESULTS

A total of 20 participants were interviewed between April and early June 2019, with interviews lasting between 20 to 50 minutes. The demographic characteristics of the interviewees are presented in Table 2. The majority of participants interviewed (80%, n =16) were women and ranged in age from 28 to 60 years, with an average age of 41.5 (SD 10.5).

Similarly, to the demographic makeup of the region, 95% of interviewees (n=19) identified as Hispanic. Most of the participants had participated in The Challenge more than once (70%, n=14), and an equal percentage were overweight and obese (45%, n=9) at the beginning of The Challenge. Of the respondents, 30% (n=6) were able to lose 5% or more of their initial weight. Eight themes that were in accordance with SDT emerged from the participants' experiences. The themes were related to competence, relatedness, and six types of motivation represented in SDT (Table 3).

Competence

Competence refers to the belief in the ability to accomplish a goal or intended behavior change. The Challenge started in 2010, and participants can repeatedly enroll throughout the years. Of the participants interviewed, 70% had previously participated. Participants also had the option of participating in a small group of 2-10 people (45%, n=9) or a large group of 11-20 people (15%, n=3). Previous participation in The Challenge and being part of a group helped some individuals to feel more confident, "I was confident because not only had I done it before I knew I had a team to support me." (Female, 42 years old)

Participation in The Challenge in prior years or previous experiences with weight loss could both boost and diminish competence based on the results of previous attempts. Not all of the participants who complete or participate in The Challenge or other weight loss attempts are able to meet their weight loss goals. Not being able to lose weight in previous years successfully became a source of doubt for some of the participants: "I didn't know if I was going to be able to lose weight because I've been going through several years that I have not been able to." (Female, 51 years old). Thus, prior experiences could affect competence, both positively and negatively.

Along with free exercise and nutrition classes, The Challenge offers a Mid-Point Weigh-In along with a 5K run. This event serves to provide encouragement, a family-friendly activity, and an opportunity to assess progress. One participant shared how she was able to complete the 5K run.

I have this particular running song that helps me when I run a 5K, and I'm having a hard time. And I was in my head. Singing the song in my head. And I said, "I can do it. I can do it." So, I ran it, and I felt such an accomplishment. To me, that was one of the motivators of The Challenge. (Female, 42 years old)

This participant used an affirmation rooted in her sense of competence. Earlier in her interview, she had mentioned that she was feeling ill but that she had been looking forward to the run, especially since she participated with her whole family, and her team was going to be there. She stated her goal was to at least walk, but after encouraging herself with affirmations of competence, she was able to run the entire 5K.

Relatedness

Relatedness refers to the need for social support, connectedness, and a sense of belonging. Participants found motivation through the support provided to them by their friends and families. Support was provided through verbal encouragement and providing accountability as well as through accompaniment in being physically active. One participant described, "My husband. He wouldn't let me quit. He would say, 'you're going.' And my niece goes with me [to exercise] too, so that's another motivation" (Female, 43 years old)

Participating in The Challenge as part of a group helped participants find encouragement and support to continue with their healthy behaviors. Having a group was especially important for participants during the more difficult times of their weight-loss

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journey. A participant describes the mutual support provided through her group, "When I had downfalls, my friends would pick me up. And when they had discouragement, I would pick them up. We would take turns, so it was very important for them to be part of the group." (Female, 31 years old)

The Challenge and its pervasiveness in the city helped participants recognize that becoming healthier and losing weight is a common goal. For example, participants discussed how the Challenge brings many people together to lose weight, and that action was motivating to see.

I really like that everyone is on the same page. You see thousands of people registered trying to get healthy. And I think talking to these people and talking about how difficult it is for everyone and how it's not easy, everyone being on the same page is the biggest motivation. I think that's one of the coolest things. (Female, 28 years old)

A sense of connectedness through sharing a common goal can contribute to the need for relatedness. Other participants also talked about the "hype" of The Challenge and how it was exciting to see others also making an effort to improve their lives.

Non-regulation

Non-regulation refers to the lack of motivation or intention to act. This program was voluntary, and only people who completed The Challenge participated in this study; thus, the frequency of expressed non-regulation is less than might be expected from the general population or from those that register for The Challenge but do not complete it. Only one interviewed participant expressed thoughts that are consistent with non-regulation. From the beginning he stated that he had felt a sense of obligation to participate, saying, *"Ugh, my wife kind of pressured me to do it"* (Male, 28 years old)

He reported that following setbacks in team progress with weight loss and feeling that his team wouldn't win the competition that it was no longer worthwhile to continue with the program, their behavioral change attempts, or their intention to lose weight.

> On our team, we didn't lose any weight. I lost maybe 10 pounds, and then the rest of my team didn't lose anything. So I was just like you know what 'screw it we're not going to win the Team Challenge so might as well stop' (Male, 28 years old)

This same participant also mentioned that a similar sentiment was felt at his workplace where there were other teams. The participant's employer organized a smaller competition within the larger program. He mentioned that one of the other teams was performing much better and that the chances of his team winning were minimal, so this made him feel that it was not worth continuing to try to win through losing more weight.

External Regulation

Many participants mentioned an external source as their motivation for participating in the program and for wanting to lose weight and pursue a healthier lifestyle. External sources of motivation included: avoiding poor health outcomes, improving physical appearance and receiving compliments, not disappointing others, and a desire to win the competition and prizes.

Participants were motivated to make lifestyle changes based on health results from their doctors' visits. The physician that this patient describes also respects the participants' need for autonomy by providing suggestions and leaving the participant to make the decision about what course to take to prevent further elevation of his blood pressure.

> I had gone to the doctor last year. And he says, look, man, your blood pressure is kind of getting high. You're getting really borderline. We can do one of two things: we can

give you medication for diabetes and blood pressure, or you can change your lifestyle. Change your diet. However, you want to do it. It's up to you. And basically, I said I'm going to change my lifestyle (Male, 49 years old)

A few participants mentioned that the reason that they participate in The Challenge is due to concern about developing diseases commonly found among their families. One participant said that she has been making positive progress in controlling her blood sugar and lost two of her siblings to complications from diabetes. "I've been seeing the progress that I've been making, and my A1c right now is at 5.6 so, it's good, but I have to make that change because you know family history is really bad…I lost two brothers who were on dialysis. (Female, 58 years old) Thus wanting to prevent the progression of poor health outcomes serves as a motivation for participants of The Challenge.

Participants were motivated not just by how losing weight made them look better; they also liked that others started to notice and compliment them on their physique. One participant put it as "I started looking thinner and looking better. People were saying, "Oh, you look good." So that kind of kept me going. The results. So the results after two weeks. I kept going, and I was feeling stronger" (Female, 34 years old). Another participant mentioned that her main motive for wanting to lose weight, "had to be cosmetic at first and I think especially because I was younger at the time. I was pretty young, and there weren't any health issues. Health was not the first thing on my mind, so it was all cosmetic. Trying to get into certain sizes, look a certain way." (Female, 28 years old) This quote exemplifies wanting to lose weight to improve personal appearance and fit in with society's' standards of beauty.

The group winners of The Challenge were determined by calculating the cumulative team progress. Participants expressed that they were motivated by their desire to be

dependable and not let their teammates down. A participant who had previously participated as an individual indicated that it was an essential part of her success to be on a team because of the accountability it provided. She stated, "But this time around [entering the Challenge] because it was other coworkers, I didn't want to let them down either. And I didn't want to be the one who didn't lose any weight or didn't attempt to make a difference." (Female, 44 years old)

There was a strong sense of being accountable to other members of the team. It was expressed that if you registered to be part of a team that it was important to take it seriously because your performance affected the group as a whole: "If you're part of a team you know like you're not just letting yourself down you're letting the team down. I think that's worse than you not doing it." (Male, 28 years old) Thus the perception of the importance of dependability and accountability was a motivation source for participants.

The Challenge also had an incentive component. The participants that had the highest weight loss percentage qualified for cash prizes. Some participants mentioned that their motivation was winning the competition, "We are in it to win it. We didn't win it, but that was our motivation." (Female, 44 years old). Another participant mentioned that she was excited at the prospect of winning prizes.

> "I really like the way they do the Challenge. The hype they put into it. It's just really exciting. I just love the whole hype. You know how they promoted it and everything. The prizes are very exciting." (Female, 42 years old)

There were also gift cards awarded for every 5% body weight loss of their initial body weight or had been involved in program activities such as exercise classes. Involvement in activities was measured using stickers that were provided by partnering gyms and

organizations. Other participants found it motivating to see the progress they were making through the stickers they had collected.

> "Those stickers kind of reminded me of how many classes I had been to, where my journey started and where I was heading. So physically seeing the sticker, even if I wasn't winning anything. Just knowing that little sticker was making sense, that every day I put something on that sheet. I was doing something. It kind of affirmed what I was doing for me." (Female, 34 years old)

External motivators were highly cited as influencers to be involved in The Challenge. Participants mentioned their health, their desire to improve their physical appearance and the associated compliments, the importance of accountability from their team, and the prizes associated with successfully losing weight.

Introjected Regulation

Introjected regulation is rooted in enhancing self-worth or avoiding guilt. Improving self-worth was consistent with mental health benefits and improved self-esteem. Participants found that after exercising and eating well, they also started to feel better about themselves, thus positively contributing towards their mental health A participant who began regularly exercising during The Challenge stated,

> "I noticed that when I eat well and when I work out, I feel good…a lot of it has to do with self-esteem, like physically, emotionally when I'm eating clean and when I work out, I feel good, and my clothes fit better, and that just makes me feel more at peace with myself." (Female, 28 years old)

> "In contrast, a few participants were more concerned with avoiding guilt as one participant stated she would "feel guilty on days that I didn't exercise*"* (Female, 44 years old).

Another participant said that she would tell herself, "Okay, you gotta do this, cause you can't go back. You'll look […] that you didn't lose anything, or you gained." (Female, 34 years old) So, while participants were aiming to improve their self-esteem, others were acting to avoid more negative self-talk and feeling guilty due to not exercising or losing weight.

Identified Regulation

Integrated regulation is behaving in a manner that is consistent with personal values and other goals. Participants found personal value and importance in engaging in healthy behaviors. Participants mentioned that they were engaging in behavior changes not only for the duration of The Challenge but for the rest of their lives. A participant expressed, "One of the motivations was that I was getting results and he [husband] was getting results. So that's an incentive… and we see it short term for The Challenge, but really this is our way of life." (Female, 57 years old)

One participant mentioned that "After the Challenge is done, there is nothing you are going to win but be healthy" (Female, 44 years old). Another participant elaborated on choosing to participate in The Challenge as something that she values and does for herself. She said, "When I did this Challenge, one of my goals was to eat healthier for myself and to exercise on a regular basis for myself." (Female, 42 years old). This expression demonstrates that participants find it worthwhile and valuable to engage in healthy behaviors.

Integrated Regulation

This type of motivation demonstrates how behavior changes to achieve a healthier life can be in harmony with other values and personal goals, such as taking responsibility for one's own health and being around for their family. The priority in these cases was to be able to live long and well enough to meet their grandchildren and to be around for other important

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moments in their families' lives. One patient was looking forward to the birth of her grandchildren. She said,

"I'm also going to be a grandma in two weeks. So, I thought this was the best opportunity to get healthy. Because I want to be around longer because now I have grandkids coming into the world. That's a big reason to motivate me now to be healthier." (Female, 44 years old)

Achieving a healthier life is important for other participants because it could potentially allow them to bear witness to the marriages and graduation of their children. There were references made to preventing adverse health outcomes such as amputations and blindness, but this was mostly in the context of avoiding these medical problems to be able to enjoy their families longer and more fully. One participant stated,

I want to see my children graduate from college and hopefully get married. I want to be around for them when I'm older, and that's not going to happen if I go back to my [unhealthy] lifestyle. If I go back, I'm going to die young. I'm not going to see 60 or 70 or whatever. Or I'm going to be amputated with a leg or whatever or lose my eyesight. (Male, 49 years old)

In some cases, it was essential to engage in healthy habits in order to improve the health of their entire family. The value that was emphasized in this next quote was caring for her family and changing the habits of her children as well. This mother shared, "I wanted to include my children in my healthy habits. This year, I wanted not only to eat healthy for myself but to cook healthier meals for my kids, to limit their sugars and to include more exercise in their routine." (Female 42 years old) This demonstrates integrated regulation in that the participant valued taking care of her family and fostering a healthy environment for

her children. Her behavior change was in harmony with her serving as a role model and providing her children with nutritious meals and an active life.

Intrinsic Regulation

This type of motivation refers to behaviors and activities that are described as enjoyable or inherently satisfying. Intrinsic regulation can be seen when participants mentioned that they became physically active because it became something that they enjoyed doing. For some, it provided a pleasant time with their loved ones. This woman described going out with her husband, "We go hiking every morning and then every evening, we just do stuff. And if there's other parks nearby, we go to the other parks. That kind of stuff, and we enjoy ourselves very much." (Female, 57 years old). She mentioned in her interview that she and her husband were able to enjoy nature and the scenic areas when they went on their hikes.

Several participants expressed that engaging in physical activity became something that their family started doing together for fun.

> You know it definitely helped that he [husband] came with us… we went on walks on the weekends or bike rides, and he would come with us. It was encouraging to have it become a family fun thing. That's what it became, something to do as a family for fun. (Female, 42 years old)

Another participant expressed that she was *"very scared about the exercise part of it, and it ended up being the easiest thing for me because I found something that I actually enjoy."* (Female, 28 years old) In this case, it was no longer just exercising as part of creating a calorie deficit for weight loss but rather something that she found fulfilling because it was enjoyable.

DISCUSSION

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This qualitative study elucidated how the Self-Determination Theory was reflected in the experiences of participants who completed a free community weight-loss program. Considering that not only did interviewees sign-up up for the program but also completed it, it could be said that there was a strong sense of motivation among this group of participants. This study helps in identifying the different types of motivation utilized in losing weight during a weight loss program, as well as the role of competence and relatedness in participation and behavior change.

Self Determination Theory showcases that motivations to engage in a behavior is done through internal motivation, where the motivation is mostly from within the individual, and external motivation, where the motivation is a response to external pressures. Our study confirms previous research demonstrating higher internal regulation and engaging in behaviors that are inherently satisfying and autonomously regulated is positively associated with more significant weight loss and improved weight loss maintenance (Ng, Ntoumanis et al. 2012, Th⊘ gersen-Ntoumani, Ntoumanis et al. 2010). Behavior change motivated by external factors such as feelings of guilt or disappointing others is not self-determined and is more prone to dissuasion following negative experiences and perceived failures (Deci, Ryan 1987).

The forms of regulation and intrinsic and extrinsic motivation are not mutually exclusive but rather may coexist within the same behavior and change over time and in different contexts (Deci, Ryan 1985, Deci, Ryan 2000). For example, participants mentioned that they wanted to improve their health, secondary to their worry about the adverse consequences of an unhealthy life. Participants mentioned worry about blindness,

amputations, early death, and dialysis. Taken by itself, wanting to avoid an adverse health outcome may be classified as external regulation, which is further away on the continuum of self-determined behavior. However, there was a repeating theme of also wanting to maintain health and avoid health complications in order to spend more time with family and enjoy the milestones in their families' lives, such as graduations and weddings. This regulation was seen in integrated regulation where the goal of maintaining health was in harmony with valuing time with family. Integrated regulation is closer than external regulation to self-determination and autonomous behavior when examined along a continuum.

The literature has provided a glimpse into the reasons that individuals decide to lose weight. This study supports previous findings that motivators for weight loss include worries pertaining to health conditions (Cheskin, Donze 2001). To the authors' best knowledge, the current study is the first to document worry about developing a health condition amongst adult Hispanics as the motivator for joining a community weight-loss program. The literature suggests that individuals who feel susceptible to diseases commonly attributed to obesity may be more likely to exercise and maintain a healthy weight (Renner, Spivak et al. 2007). This is in accordance with the magnitude of worry or concern about disease susceptibility and the link to perceived risk (Loewenstein, Mather 1990, Beebe-Dimmer, Wood Jr et al. 2004) Worry and concern about susceptibility can have a positive effect through motivating individuals to engage in behaviors protective of their health (Stephan, Boiche et al. 2011). Although this is not an explicit construct of the SDT, perceived risk is a core component of other health behavior theories, including the Health Belief Model and Protection Motivation

Theory. In our study, we found that health worry and concern were a major theme in the desire to lose weight and adopt healthy behaviors.

Wanting to improve physical attractiveness was another motivator for participants. Societal standards of attractiveness include thinness for women and increased muscularity for men (Thompson, Stice 2001). Attempts to conform to these standards through weight loss is seen more often in women with an increased motivation to exercise to manage weight, and enhance their attractiveness (Strean, Mehaffey et al. 2003). Among the four men interviewed, there was no mention of wanting to lose weight or participate in The Challenge to increase their physical appearance. Female participants in this study who mentioned gaining confidence in their appearance also cited improved mental health benefits. The dual nature of the benefits reflected the introjected and intrinsic regulation constructs.

Striving for social approval and feelings of shame are also not helpful in improving healthy eating behaviors, such as increasing fruit and vegetable consumption and reducing intake of foods with added sugar. Rather than improving eating behaviors, it is more likely that these motivators may put individuals at a higher likelihood of engaging in risky practices such as intense fasting to control weight (Verstuyf, Patrick et al. 2012). Only a few participants mentioned that they felt guilty when they did not exercise.

This program had built-in social support provided through community events, group participation, social media, and text messaging. Social support was an important component of the weight loss and behavior change experience for many of the participants. This is consistent with what is shown in the literature that group support is more conducive to weight loss (Stubbs, Lavin 2013, Heshka, Anderson et al. 2003) Participants mentioned that

they felt supported by the members in their team and that they would provide encouragement to one another. Other participants expanded on the social support offered by their family members. While social support can be beneficial, loss of self-determination, such as continued pushing by a spouse or significant other to lose weight, may negatively influence the internalization of weight loss as an autonomous health goal (Ryan, Deci 2000). For the 43-year-old female participant that stated that her husband "wouldn't let me quit," she said that she found his support to be helpful. The 28-year-old male that mentioned his wife had pushed him into registering for The Challenge had more expressions consistent with amotivation and thus less behavior internalization.

Participants in this study endorsed financial incentives as a source of motivation. Evidence supports that weight loss outcomes are improved with the addition of financial rewards (John, Loewenstein et al. 2011, Volpp, John et al. 2008). In a study examining the treatment of obesity in lower-income women, it was found that women in an internet intervention modeled after Diabetes Prevention Program principles plus small financial incentives for self-monitoring and losing weight lost approximately three times more weight than completing the internet program alone. This shows that modest financial incentives can improve weight loss in women from financially disadvantaged backgrounds (Leahey, LaRose et al. 2018). Participants also mentioned they were motivated by the prizes and financial incentives offered as part of The Challenge.

Our study found many similarities with what has previously been described in the literature regarding reasons for weight loss motivation. These included: health outcomes, physical appearance, valuing health and healthy behaviors, and the prospect of winning

financial incentives from provided by weight-loss interventions. A significant source of motivation and link with SDT that has not been previously documented in the literature is the multiple ways in which family affects regulation in this predominantly Hispanic population.

Relatedness and social support were provided to participants by their family members, and there was mention of involving the whole family in making healthier food decisions and engaging in physical activity together. In the different types of regulation, there were references to the importance of family. In external regulation, there was mention of not wanting to suffer from health conditions that had affected their family members. There were also expressions of sadness to losing family from conditions brought on by poor health status. Integrated regulation was also in harmony with wanting to improve health to be around for important family events as well as the value of providing a healthy environment and example for their children. Finally, family was also present in intrinsic regulation as participants mention that they ended up finding physical activity to be enjoyable because it was something that they could do together as a family for fun. This emphasis on family is consistent with the strong orientation towards family, or familism (Diaz, Niño 2019). Although this value is found in other cultures it is very relevant among Hispanics cultures (Steidel 2005). Studies have shown that involving families and incorporating lifestyle changes that can be implemented at home are effective at helping Mexican Americans lose weight (Rivera, Burgos 2012). Overall, family is a consistent motivator present in different regulation types of the Self-Determination Theory.

A strength of this study is the rich narrative provided by participants that allow for the expansion of studies focusing on measuring and characterizing motivation quantitatively.

This study also had a predominantly Hispanic population. Researcher triangulation helped to ensure that the quotes selected were representative of the themes and constructs found in SDT. Limitations include potential selection, social desirability, and researcher bias.

The study sample was comprised of participants who completed a weight loss program for which they self-enrolled. Considering that not only did interviewees sign-up up for the program but also completed it, it could be said that there was a strong sense of motivation among this group of participants, thus contributing to selection bias. The findings may not be as generalizable as they would have been if non-completers of The Challenge had also been interviewed. It would be helpful in future studies to interview participants at the beginning of The Challenge and stratify participants in analyses by completion status. This would help to determine the characteristics of the SDT in this population that may be more conducive to completing The Challenge and accomplishing weight loss.

Given that participants were interviewed by the researchers, they may be more inclined to provide responses that they may perceive as desirable. Researcher bias may have also influenced information provided by the participants and interpretation of this data. The biases mentioned above are inherent in this type of research and can result from the questions that are asked, how data is analyzed, coded, and interpreted. Bias was also reduced by triangulating data.

This study explored the perceptions and motivation of participants who completed a free community-based weight loss program in a predominantly Hispanic and low-income region along the US-Mexico border. Many participants mentioned external sources of

motivation, such as preventing adverse health outcomes, wanting to improve their physical appearance, and being motivated by financial incentives. Fewer participants mentioned intrinsic motivators, which are more likely to create lasting change and improved health behaviors. Understanding the motivation for behavior change and completion of weight loss programs is essential to help participants reach their goals effectively. A greater emphasis on the motivations for individuals to lose weight may help improve outcomes in weight-loss interventions. Additionally, increasing strategies targeted at improving intrinsic motivation for weight loss may be beneficial.

Figure 1. Self-Determination Theory Psychological Needs and the Motivation Spectrum
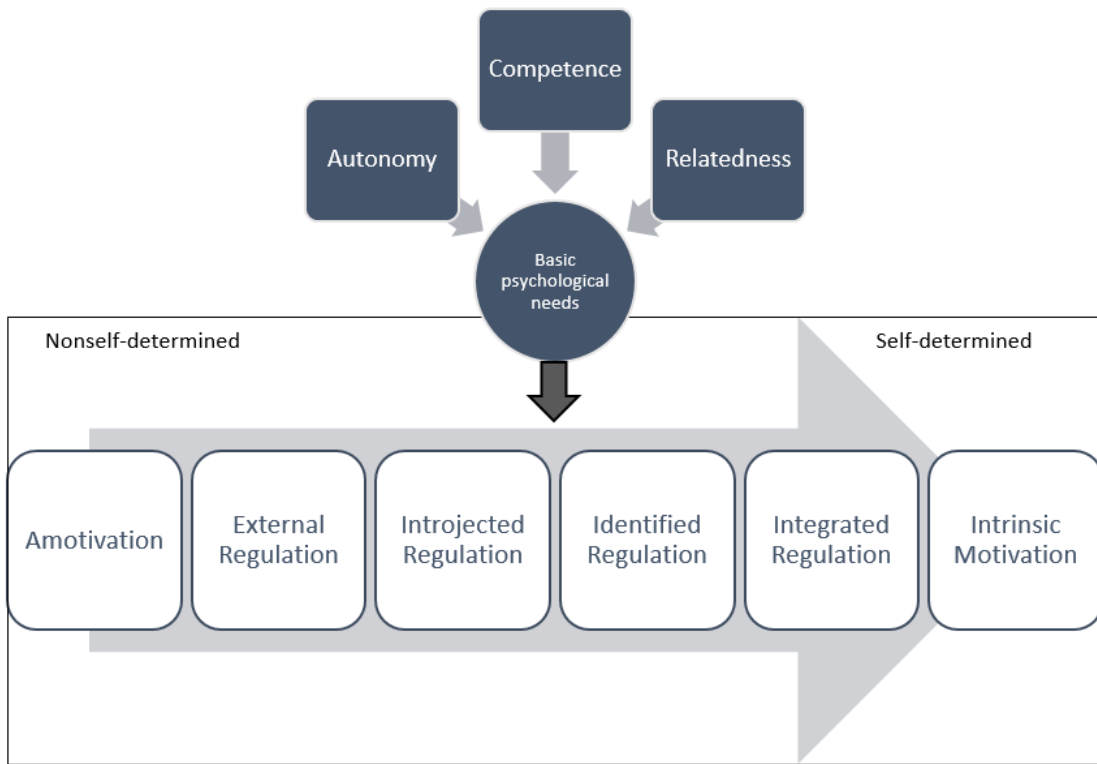
Table 1. Interview Topic Guide

Construct	Question
Autonomy-Intrinsic vs. Extrinsic Regulation	What were your reasons for joining the Challenge? Reasons for wanting to lose weight?
	How did you stay motivated? Overcome lack of motivation?
Competence	How did you feel about your ability to complete the Challenge?
	How do you feel about your ability to engage in behaviors that could help you lose weight (healthy eating, physical activity, etc.)?
Relatedness	How important was it for people you knew to also participate in the Challenge?
	How important was it for others to support you in your weight loss journey?

Table 2. Demographic Characteristics of Study Participants (N=20)

Variables		n (%)
Age (years)		
	18-29	3 (15)
	30-39	6 (30)
	40-49	7 (35)
	50-59	3 (15)
	60-69	1 (5)
	≥70	0
Sex	Female	16 (80)
Ethnicity	Hispanic	19 (95)
Participation Category	Individual	8 (40)
	Small	9 (45)
	Large	3 (15)
Participated in previous Challenge	Yes	14 (70)
Weight Category/BMI		
	normal	2 (10)
	overweight	9 (45)
	obese	9 (45)
Loss >5%	Yes	6 (30)
	No	14 (70)

Table 3. Identified themes per Self-Determination Theory

Theme	Competence	Relatedness	Amotivation	Extrinsic motivation		Autonomous regulation		Intrinsic motivation
				Controlled regulations				
			Non-regulation	External regulation	Introjected regulation	Identified regulation	Integrated regulation	Intrinsic regulation
Description	Belief in the ability to accomplish goal/change behavior	Support from others in accomplishing behavior	Lack of motivation or intention	Behavior to gain reward or avoid punishment	Behavior to enhance worth or avoid guilt	Behavior personally important or valued	Behavior in harmony with values	Behavior inherently satisfying

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PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	19
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	20
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	21
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	23
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	24
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	24
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	24
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	24
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	25
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	26
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	26
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	26
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	25
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I²) for each meta-analysis.	N/a

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	27
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	N/a
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	27
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	27
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	28
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	28
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	N/a
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	28
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	N/a
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	31
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	34
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	34
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	N/a

QUALITY ASSESSMENT TOOL FOR QUANTITATIVE STUDIES

EPHPP
Effective Public Health Practice Project

COMPONENT RATINGS

A)   SELECTION BIAS

(Q1)   Are the individuals selected to participate in the study likely to be representative of the target population?
1   Very likely
2   Somewhat likely
3   Not likely
4   Can't tell

(Q2)   What percentage of selected individuals agreed to participate?
1   80 - 100% agreement
2   60 – 79% agreement
3   less than 60% agreement
4   Not applicable
5   Can't tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

B)   STUDY DESIGN

Indicate the study design
1   Randomized controlled trial
2   Controlled clinical trial
3   Cohort analytic (two group pre + post)
4   Case-control
5   Cohort (one group pre + post (before and after))
6   Interrupted time series
7   Other specify _____
8   Can't tell

Was the study described as randomized? If NO, go to Component C.
No   Yes

If Yes, was the method of randomization described? (See dictionary)
No   Yes

If Yes, was the method appropriate? (See dictionary)
No   Yes

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

C) CONFOUNDERS

(Q1) **Were there important differences between groups prior to the intervention?**
  1 Yes
  2 No
  3 Can't tell

  The following are examples of confounders:
  1 Race
  2 Sex
  3 Marital status/family
  4 Age
  5 SES (income or class)
  6 Education
  7 Health status
  8 Pre-intervention score on outcome measure

(Q2) **If yes, indicate the percentage of relevant confounders that were controlled (either in the design (e.g. stratification, matching) or analysis)?**
  1 80 – 100% (most)
  2 60 – 79% (some)
  3 Less than 60% (few or none)
  4 Can't Tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

D) BLINDING

(Q1) **Was (were) the outcome assessor(s) aware of the intervention or exposure status of participants?**
  1 Yes
  2 No
  3 Can't tell

(Q2) **Were the study participants aware of the research question?**
  1 Yes
  2 No
  3 Can't tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

E) DATA COLLECTION METHODS

(Q1) **Were data collection tools shown to be valid?**
  1 Yes
  2 No
  3 Can't tell

(Q2) **Were data collection tools shown to be reliable?**
  1 Yes
  2 No
  3 Can't tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

F)   WITHDRAWALS AND DROP-OUTS

(Q1)   Were withdrawals and drop-outs reported in terms of numbers and/or reasons per group?
    1   Yes
    2   No
    3   Can't tell
    4   Not Applicable (i.e. one time surveys or interviews)

(Q2)   Indicate the percentage of participants completing the study. (If the percentage differs by groups, record the lowest).
    1   80 -100%
    2   60 - 79%
    3   less than 60%
    4   Can't tell
    5   Not Applicable (i.e. Retrospective case-control)

RATE THIS SECTION	STRONG	MODERATE	WEAK	
See dictionary	1	2	3	Not Applicable

G)   INTERVENTION INTEGRITY

(Q1)   What percentage of participants received the allocated intervention or exposure of interest?
    1   80 -100%
    2   60 - 79%
    3   less than 60%
    4   Can't tell

(Q2)   Was the consistency of the intervention measured?
    1   Yes
    2   No
    3   Can't tell

(Q3)   Is it likely that subjects received an unintended intervention (contamination or co-intervention) that may influence the results?
    4   Yes
    5   No
    6   Can't tell

H)   ANALYSES

(Q1)   Indicate the unit of allocation (circle one)
    community   organization/institution   practice/office   individual

(Q2)   Indicate the unit of analysis (circle one)
    community   organization/institution   practice/office   individual

(Q3)   Are the statistical methods appropriate for the study design?
    1   Yes
    2   No
    3   Can't tell

(Q4)   Is the analysis performed by intervention allocation status (i.e. intention to treat) rather than the actual intervention received?
    1   Yes
    2   No
    3   Can't tell

GLOBAL RATING

COMPONENT RATINGS
Please transcribe the information from the gray boxes on pages 1-4 onto this page. See dictionary on how to rate this section.

A	SELECTION BIAS	STRONG	MODERATE	WEAK	
		1	2	3	
B	STUDY DESIGN	STRONG	MODERATE	WEAK	
		1	2	3	
C	CONFOUNDERS	STRONG	MODERATE	WEAK	
		1	2	3	
D	BLINDING	STRONG	MODERATE	WEAK	
		1	2	3	
E	DATA COLLECTION METHOD	STRONG	MODERATE	WEAK	
		1	2	3	
F	WITHDRAWALS AND DROPOUTS	STRONG	MODERATE	WEAK	
		1	2	3	Not Applicable

GLOBAL RATING FOR THIS PAPER (circle one):

1	STRONG	(no WEAK ratings)
2	MODERATE	(one WEAK rating)
3	WEAK	(two or more WEAK ratings)

With both reviewers discussing the ratings:

Is there a discrepancy between the two reviewers with respect to the component (A-F) ratings?

     No   Yes

If yes, indicate the reason for the discrepancy

1	Oversight
2	Differences in interpretation of criteria
3	Differences in interpretation of study

Final decision of both reviewers (circle one):

	1	STRONG
	2	MODERATE
	3	WEAK

Dear XXXXXXXXX,

Congratulations on completing the 2019 Challenge!

My name is Miriam Martinez and I am a student of UTHealth Brownsville Regional Campus. I am working on a research project related to your experience participating in The Challenge.

We spoke at the Challenge Finale Weigh-In at Central Library on Friday April 5, 2019.

We would like to thank you again for agreeing to participate.

I'm e-mailing to set up an interview. The interview will be voice recorded and will take about 30-45 minutes of your time for which you will receive a $20 Walmart Gift card for your time and insight. Your name will not be used with any recordings.

You mentioned that 4 pm to 8 pm works best for you.

Would it be possible to meet this coming week at Central Library?

Please let me know.

Thank you again!

Miriam Martinez

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