CHAPTER SEVEN

Body weight improvements associated with a nutritional intervention for adults with IDD living in group homes: A randomized controlled trial

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Abstract

Background. Adults with intellectual and developmental disabilities (IDD) experience higher rates of overweight and obesity (OW/OB) compared to their neurotypical peers. For community-dwelling adults with IDD living in group homes, high staff turnover and a lack of food preparation and nutrition training among staff can exacerbate weight

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issues. This study explores how the MENU-AIDDs nutritional intervention, which is not a weight loss program but was developed specifically to address the nutritional needs of adults with IDD living in group home settings, effects body weight of OW/OB adults with IDD. *Methods*. Group homes in New York ($n = 13$) and North Carolina ($n = 15$) were randomly assigned to either a treatment or control condition. Treatment homes received training on the MENU-AIDDs system and implemented the program in their homes. Control homes continued their regular food services. Weight data were collected from residents at baseline, 6, and 12 months. *Results*. NY OW/OB treatment home residents lost significantly more weight and had reductions in functional limitations due to weight compared to their control home peers. In NC, however, OW/OB treatment home residents lost weight, but did not differ significantly from their control home peers. *Conclusion*. This study found mixed results related to MENU-AIDDs' effect on changes in body weight among OW/OB adults with IDD. We attribute these mixed findings to cultural differences, rurality, and program fidelity issues. Future research is needed to understand these differences and make appropriate modifications to the MENU-AIDDs intervention.

1. Background

Over seven million Americans have an intellectual or developmental disability (IDD) (National Disability Navigator Resource Collaborative, 2020). Developmental disabilities occur between birth and 21 years of age, typically continuing indefinitely, and substantially limiting one's ability to function in three or more major life activities including self-care, receptive/expressive language, learning, mobility, self-direction, and ability to live independently. Developmental disabilities include a range of diagnoses, such as autism spectrum disorder, Down syndrome, cerebral palsy, and fetal alcohol syndrome. Many individuals with developmental disabilities need life-long, individualized, and coordinated systems of care and assistance. As a result, many adults with IDD reside in community-based group home settings which provide support and assistance with activities of daily living, including meal planning and preparation.

Unfortunately, previous research has found that adults with IDD experience poorer health compared to the general population, including higher rates of obesity, complex health conditions, and limited access to quality healthcare (Grumstrup & Demchak, 2017; Havercamp, Scandlin, & Roth, 2004; Li, Fujiura, Magaña, & Parish, 2018; Slater, Baxter, & Kerr, 2019). Compared to their neurotypical peers, adults with IDD have a higher prevalence of being overweight/obese (Grumstrup & Demchak, 2017; Li et al., 2018). For instance, Hsieh, Rimmer, and Heller (2013) found that

adults with IDD had higher rates of obesity (38.3% vs 28%) as well as morbid obesity (7.4% vs 4.2%) compared to the general population. Compared to their peers who fall within the normal weight range, adults with IDD who are overweight or obese are at increased risk of experiencing limitations in daily life (Seekins, Traci, Bainbridge, & Humphries, 2005), decreased quality of life (Fontaine & Barofsky, 2001; Kushner & Foster, 2000; Moonseong, Allison, Myles, Zhu, & Fontaine, 2003), and increased mortality (Calle, Rodriguez, Walker-Thurmond, & Thun, 2003; Flegal, Graubard, Williamson, & Gail, 2007; Hamilton, Hankey, Miller, Boyle, & Melville, 2007).

The increased risk of overweight and obesity among adults with IDD is associated with poor dietary quality and nutritional deficiencies (Hamzaid, O'Connor, & Flood, 2020; Ptomey, Goetz, Lee, Donnelly, & Sullivan, 2013), decreased physical activity (Hsieh, Heller, Bershadsky, & Taub, 2015; Stancliffe & Anderson, 2017), and the use of medications that cause weight gain (Hamzaid et al., 2020; Robertson et al., 2000), all of which are common in this population. Using the Healthy Eating Index-2005 (HEI-2005), Ptomey et al. (2013) found that compared to the general population, overweight/obese community-dwelling adults with IDD had lower HEI scores. Adults with IDD had very low intakes of fruit, whole grains, and vegetables, and their diets were deficient in fiber, vitamins A, D, and E, folate, and potassium among other things. Likewise, in a study of dietary intake among individuals with IDD living in group homes, Hamzaid et al. (2020) found dietary quality to be poor, with participants consuming less than half of the daily recommended servings of vegetables, women consuming less than half the recommended servings of dairy, and with many participants low in magnesium, calcium, iodine, and zinc. Poor dietary quality and nutritional deficiencies can, in turn, result in weight issues.

In addition to increased risk of poor dietary quality and nutritional deficiencies, compared to the general population, adults with IDD engage in significantly less physical activity (Hsieh et al., 2015; Stancliffe & Anderson, 2017), which can result in weight gain. For instance, Stancliffe and Anderson (2017) found that only 13.5% of adults with IDD met the U.S. Physical Activity Guidelines compared to 30.8% of the general population. Certain subsets of individuals with IDD are at increased risk for poor physical activity, including individuals with more severe disability or mobility impairments, Down syndrome, mental illness, obesity, and/or no access to exercise in their community.

Further, common medications used among adults with IDD, such as anti-depressants, often have side effects including weight gain (Robertson

et al., 2000). Additionally, specific conditions (i.e., Prader Willi syndrome) can increase an individual's appetite (Pereira, Schalk, & Geraghty, 2009; Sinnema et al., 2011), while other conditions may affect an individual's ability to chew and swallow or tolerate certain textures, all of which can affect dietary intake and weight.

Importantly, the home environment of adults with IDD can also contribute to weight issues. Most adults with IDD live in the community with their family or foster family, in a group home, or independently (Burke et al., 2017; Hewitt, Hamre, Nye-Lengerman, Hall-Lande, & Hallas-Muchow, 2016). Each of these community-based living arrangements require additional supports to improve household nutrition and avoid issues with both overweight and underweight (Bryan, Allan, & Russell, 2000; Humphries, Traci, & Seekins, 2009; Rimmer, Braddock, & Fujiura, 1993; Simila & Niskanen, 1991; Yamaki, 2005).

Group homes, which are the focal residential setting for this study, typically consist of four to eight unrelated individuals with disabilities living in a residential home with direct supervision and habilitation services provided by paraprofessional staff. Group homes are typically managed by a community-based service agency licensed by their state to provide 24-h on-site supervision. The number of adults with IDD living in small residential group homes has increased significantly as large institutional settings are eliminated throughout the United States (Larson & Lakin, 2012). According to the Residential Information Systems Project (Larson et al., 2017), the number of individuals with IDD living in group home settings increased by 1900% between 1977 and 2015 (Houseworth, Tichá, Smith, & Ajaj, 2018).

Despite many positive features, the group home environment can exacerbate weight issues among adults with IDD for a variety of reasons. Nutritional systems in group homes are often more complicated than those within single-family homes due to high staff turnover (Bainbridge & Seninger, 2004; Dixon-Ibarra, Driver, Vanderbom, & Humphries, 2017) and a lack of food preparation and nutritional knowledge and training among staff (Hamzaid, Flood, Prvan, & O'Connor, 2018; Humphries, Traci, & Seekins, 2004). Humphries et al. (2004) assessed the food systems of group homes in Montana and found that group home managers and staff received little or no training in basic nutrition, menu planning, or creating healthy food environments. This lack of training and nutritional knowledge led to poor nutritional quality among community-dwelling adults with IDD, with diets high in fat and low in fruits, vegetables, whole grains, and dairy (American Dietetic Association, 2004; Draheim, Stanish,

Williams, & McCubbin, 2007; Hamzaid et al., 2020; McGuire, Daly, & Smyth, 2007; Seekins et al., 2005).

The general lack of nutritional knowledge among group home staff is especially problematic for adults with IDD who often experience barriers to accessing and understanding public health campaigns as well as nutrition or weight management programs designed for the general population (Hamilton et al., 2007; Krahn, Hammond, & Turner, 2006). These barriers to prevention and intervention efforts contribute to an increased reliance on staff and caregivers to meet the nutritional needs of adults with IDD. This reliance is compounded by a general lack of transportation, social support, and access to regular exercise, all of which can further increase risk of weight problems among group home residents.

2. The MENU-AIDDs nutritional intervention for adults with IDD

The Materials supporting Education and Nutrition for Adults with Intellectual or Developmental Disabilities (MENU-AIDDs) system was the result of over 4 years of conversations and collaborations between researchers at the University of Montana, led by Dr. Humphries, and adults with IDD and their support providers in the community. Community members voiced their concern with the poor nutritional quality in the group home setting, the need for increased group home staff training related to food preparation and nutrition, and high staff turnover which made a clear system and procedures for resident nutrition a necessity (Humphries, 2008). To address these gaps, Humphries, Traci, and Seekins (2008) developed MENU-AIDDs.

MENU-AIDDs is a nutritional intervention developed specifically to address the nutritional needs of adults with IDD living in group home settings. MENU-AIDDs uses an environmental approach, implementing policies and procedures to structure the food system within group homes while still allowing for flexibility and personal preference. MENU-AIDDs is not a weight management program; it was not designed nor intended to be an intervention to actively modify individual body weight; rather, MENU-AIDDs is based on the United States Department of Agriculture's Dietary Guidelines (2010). However, improving nutrition in the group home setting has great potential to prevent health issues related to poor nutritional intake and those associated with overweight and obesity. For instance, in a pilot study in group homes in Montana, MENU-AIDDs was found to

improve the nutritional adequacy of group home menus (Humphries, Traci, & Seekins, 2009) and the dietary intake of residents (Humphries & Rigles, 2014). As a result of improved home food systems, preliminary studies found that the MENU-AIDDs program also normalized group home residents' body weight (Humphries, Rigles, & Wilson, 2012). In other words, MENU-AIDDs reduced body weight of OW/OB individuals and increased body weight of underweight individuals.

The MENU-AIDDs system comes in an easy to use binder that can be kept in the group home. The binder includes procedures for each step in the food delivery system, from dietary and meal planning through food purchase and preparation, meal service, and safe food storage, to help achieve better alignment with the Dietary Guidelines. The MENU-AIDDs binder is organized in such a way that new or substitute group home staff can easily use it without training. The MENU-AIDDs binder includes step-by-step instructions on how to plan what foods need to be purchased, prepared, and served for each day of the week. Instructions guide group home staff on how to use the Basic, Flexible Menu (BFM) to plan and create three nutritious meals and a snack for each day of the week in alignment with the USDA Dietary Guidelines. The BFM indicates the number of servings of each food group that should be included with each meal (breakfast, lunch, dinner, and snack) for each day of the week. For example, the BRM indicates that on average, breakfast should include one serving of fruit, dairy, and protein, and two servings of whole grains. The BFM allows for flexibility in group home nutritional systems by allowing group home staff to accommodate for the cultural, ethnic, geographic, and special dietary needs of their specific group home and individual residents. Group home staff follow the BFM to plan each meal of the week by incorporating a variety of healthy foods to meet the Dietary Guidelines, while also having the flexibility to add foods residents enjoy and avoid foods that residents cannot consume due to allergies, ability to chew and swallow, personal preference, etc.

To support the weekly menu process, the MENU-AIDDs binder includes Weekly Menu Sheets for staff to plan weekly meals and snacks, Grocery Shopping List forms to help organize shopping lists, recipes, Special Dietary Needs sheets for each resident to track individual allergies and intolerances, as well as a Favorite Food List form that can be completed for each resident. In addition to the menu building tools and recipes, the MENU-AIDDs binder includes space for group homes to include their state's applicable regulations, service provider agency policies and procedures, the USDA Dietary Guidelines, and Nutrition Standards of Care

for adults with IDD. For staff who are interested in learning more, the binder also provides basic nutritional education and resources.

This chapter discusses the process used to implement a randomized controlled efficacy study of the MENU-AIDDs intervention in group homes in two states over a 12-month period. Findings related to changes in weight, body mass index (BMI), and functional limitations due to weight among adults with IDD living in group homes who had a BMI of 25 or greater (i.e., who were overweight or obese (OW/OB)) at baseline are discussed.

3. Methods

3.1 Study sites and participants

Two non-profit, human service agencies in different states participated in this study. To protect the identities of group home residents and staff, pseudonyms are used for the agencies: Northglen Homes in New York and Sunset Homes in North Carolina. Northglen is licensed by the State of New York to provide a variety of residential and support services to individuals with IDD, especially individuals with IDD from diverse ethnic or cultural backgrounds. Sunrise is a Council on Quality and Leadership-accredited agency that also provides a range of residential and support services to individuals with IDD, mental illness, and substance abuse throughout North Carolina.

Northglen and Sunrise leadership determined which of their group homes would participate in the study and notified the research team of these selections. Group homes were then randomized into either the treatment or control condition by the research team using SPSS statistical software. In all, 28 group homes (15 designated as treatment homes and 13 designated as control homes) participated in the project, including a total of 133 consenting adults with IDD. In New York, 13 group homes (7 treatment, 6 control) participated, including 51 consenting adults with IDD. However, after a sudden change in leadership, one treatment home only provided data at baseline and 6 months.

Originally in North Carolina, 17 group homes (8 treatment, 9 control) were enlisted to participate. At the end of the project, however, a manager of two control homes admitted to borrowing MENU-AIDDs materials from a treatment home. As it was impossible to gauge how much of the program was implemented in these control homes, they were excluded from our analyses (leaving 8 treatment and 7 control homes in North Carolina). In all, 82 consenting adults with IDD from North Carolina participated in the project.

The University of Montana Institutional Review Board approved study activities prior to participant recruitment. All participants, and/or their legal guardian, signed consent and HIPAA privacy forms prior to participation in the study. Group home staff assisted residents in reading and completing an assent or consent form if the resident was interested in participating. Legal guardians were mailed informed consent forms to sign and return. Consent and assent forms were written using clear and concise language at roughly a 5th grade reading level. Pictures were also included as possible to help increase resident understanding. Additionally, residents could choose which assessments they consented to and which they did not consent to (e.g., weight collection, gastro-intestinal diaries, functional limitations due to weight, and so on). If a resident did not consent to a particular assessment, that data was not collected for the individual. All group home residents in the participating homes were eligible to participate in this study.

3.2 Procedures and data collection

The MENU-AIDDs efficacy study was conducted over a 12-month period. Group home managers assigned to the treatment condition were provided with an in-person training on how to implement the MENU-AIDDs program in their home as well as a variety of tools and resources to support the program. Control home managers were asked to continue their home's nutritional services as is and were provided with the MENU-AIDDs training and materials after the completion of the efficacy study (at 12 months). Comprehensive health data was collected at baseline, 6-months, and 12-months from all participating residents in treatment and control homes. The initial 6 months of the MENU-AIDDs intervention was designed to be more intensive and supported by the research team. After the first 6 months, support from the research team was reduced in order to assess how the treatment homes maintained the program on their own. The resources, training, and support provided to the group homes is described below.

3.2.1 MENU-AIDDs training

Treatment home managers completed an 8-h MENU-AIDDs training and brought the program back to their group home(s). The day-long in-person training included information and examples on how to use the MENU-AIDDs program and how to tailor the program to meet the nutritional needs of specific group homes and residents. The trainings focused on concepts of nutritional awareness, tools, and skill building, as well as increasing the nutritional self-efficacy and motivation of group home staff and residents.

Managers were asked to implement each program component as fully as possible. Managers were responsible for training group home staff members on how to use the MENU-AIDDs program, and for encouraging resident involvement. Field coordinators in both New York and North Carolina provided assistance to the managers during monthly home visits and bi-monthly phone calls for the first 6 months of the project.

3.2.2 MENU-AIDDs materials

Treatment home managers were given a variety of products and resources to use in their homes as they implemented the MENU-AIDDs system. Each manager received a MENU-AIDDs binder, access to a MENU-AIDDs website, a hanging organizer with food cards for menu planning with residents, and a set of Spoodles™ (serving utensils that double as measuring cups). Managers also received monthly tip sheets and recipes for the duration of the study.

As described above, the MENU-AIDDs binder includes information on how and why to use the MENU-AIDDs system, the Basic Flexible Menu, menu planning tools, a recipe book, relevant federal, state, and provider regulations and guidelines, nutrition education on a variety of topics, weekly menu tear sheets, and a shopping list pad. The foundation of the MENU-AIDDs system is the Basic, Flexible Menu, which lists the number of servings from each food group that should be included on the daily menu for three meals and a snack, based on a 2000 kcal diet. Caloric adjustments can be made using the additional resource materials provided in the binders. The Basic, Flexible Menu, allows group home staff to plan specific menus that meet the unique needs of the individuals who live in the home. This includes allowing residents and staff to choose specific food items for food group targets, which creates variety and meets individual preferences while maintaining adherence to health guidelines. The MENU-AIDDs website provided an extension of the materials in the binder, and included additional recipes and nutrition tips, as well as a forum for discussion of the MENU-AIDDs program.

Hanging meal planning organizers were created for this study to encourage resident participation in the menu planning process. Organizers included a column for breakfast, lunch, snack, and dinner; and rows for each meal's grains, vegetables, fruits, dairy, and protein. Food cards (i.e., photos of food) were provided with the organizers, and managers were encouraged to add photos of favorite foods to their card inventories as needed. The idea behind the hanging meal planning organizers was to engage adults with IDD in the

weekly meal planning process by allowing them to choose the type of foods (using food picture cards) they wanted at each meal.

Finally, managers were given a tip sheet each month for the first 6 months of the program and bi-monthly for the last 6 months of the program. Each tip sheet covered a different nutritional topic, including making colorful meals, whole grains, healthy vs unhealthy fats, food safety, beverages, sodium, budget shopping, cultural diversity in menu planning, and supporting residents' healthy nutrition choices in and out of the home. Home managers were encouraged to display these tip sheets in the home for staff and residents to learn from.

3.2.3 MENU-AIDDs in-person assistance

In addition to the variety of products treatment home managers had access to, a field coordinator in each state was available to provide assistance in person and via phone and email. Both field coordinators were Registered Dietitian nutritionists. For the first 6 months of the intervention, the field coordinator visited each treatment home monthly to conduct a menu review with the manager and to deliver and discuss that month's nutritional tip sheet. Field coordinators assisted managers with menu planning, helped problem solve when MENU-AIDDs related issues arose among staff or residents, and provided encouragement and nutrition education. Field coordinators also monitored resident safety (as related to the MENU-AIDDs program) through bi-monthly phone calls with managers.

3.2.4 Assessment trainings

Roughly 1 month prior to receiving the MENU-AIDDs training, all group home managers (both treatment and control) attended a 3-h training on how to complete assessment forms for the project. This was an important step in the process because most group home managers and staff had not participated in a research project previously. The research team also encouraged the group home managers to involve the residents in the data collection process as much as possible. For instance, pictures and smiley face rating scales were included on assessment tools whenever possible to help solicit resident input in addition to manager/staff ratings. Managers at Northglen received this training in September 2011 for baseline assessments, and had shorter review trainings in April 2012 for the 6-month assessments and October 2012 for the 12-month assessments. Trainings were conducted via Skype with the research team in Montana with the field coordinator on-site to assist as needed.

Managers at Sunrise received their initial assessment training in March 2012 for baseline assessments. At Sunrise, the initial assessment training was conducted in-person by the research team. Sunrise was also provided with shorter assessment review trainings in October 2012 for the 6-month assessments and April 2013 (for the 12-month assessments) via Skype with the research team in Montana and the field coordinator on-site.

Each manager was given an assessment binder at each data collection period (baseline, 6-months, and 12-months), which contained directions, copies of each assessment form, and due dates. Managers were asked to complete all forms for each consenting individual living in their group home and return the materials to the research team within 2 weeks. When possible, managers were asked to work with residents and include resident feedback on the assessment forms. In New York, the field coordinator arranged a collection time with each manager and picked up completed assessment materials from the group homes. The NY field coordinator then mailed all assessment forms to the research team in Montana. Due to the distance of the homes from the field coordinator in North Carolina, managers were given pre-paid boxes to ship their completed assessment forms to the research team in Montana.

3.3 Measures

3.3.1 Outcome variables

The outcomes of interest for this study included OW/OB group home residents' change in weight, body mass index (BMI), and functional limitation due to weight over the 12-month intervention period. Body weight data was collected by the field coordinator in each state at baseline, 6, and 12-months. Participants were weighed using a Siltec WS500L large platform ($15'' \times 15''$) digital scale. For individuals using a wheelchair, weights were collected from their most recent doctor's appointment. Participants were weighed dressed, without shoes.

Participant weights at baseline, 6, and 12 months were compared in several ways. First, participant's change in weight and percent change in weight between each assessment period was calculated. To examine change over time, we calculated the difference from 0 to 6 months, 6–12 months, and 0–12 months. Positive values are associated with weight gain, while negative values are associated with weight loss. Second, participant BMI scores and percent change in BMI scores were calculated and compared at each time point. BMI is calculated using an individual's height (m^2) and weight (kg), where BMI = kg/m^2. A BMI of 18.5–24.9 is considered to be within

the normal or healthy weight range, while a BMI below 18.5 is considered to be underweight, a BMI between 25.0 and 29.9 is overweight, and a BMI of 30.0 or greater is considered to be obese. Similar to weight, BMI difference measures were constructed for each of the three time intervals (0–6, 6–12, and 0–12 months). Positive values are associated with an increase in BMI, while negative values are associated with a decrease in BMI.

Finally, weight improvement (WIS) and weight deviation scores (WDS) were calculated. The WDS is calculated as the number of BMI points that one is above or below the normal BMI range (i.e., <18.5 or >25.0). For example, the WDS for those who are underweight are negative, while the WDS for those who are overweight/obese are positive. Individuals within the normal BMI range have a WDS of zero. The WIS essentially provides a longitudinal version of the WDS. For instance, for individuals who went from underweight to normal, the WIS tells us how many BMI points the individual gained to move into the normal BMI range. For those who went from normal to underweight, the WIS is negative and tells us home many BMI points they dropped below 18.5. For those who stayed with the normal BMI range at both timepoints, the value is zero. For those who went from a normal BMI to overweight/obese, the measure is negative and tells us how many BMI points they gained above 25.0. Finally, for those who went from an overweight/obese BMI toward a normal BMI, the value tells us how many BMI points were lost to get into normal range. Essentially, a positive WIS indicates that the respondent was getting closer to the normal BMI range (whether from underweight or overweight/obese), while a negative score indicates that the respondent was moving away from normal BMI range. If a person gained or lost weight within the normal BMI range, they received a score of zero.

In addition to official weight data, managers were asked to provide a subjective rating of each resident's functional limitation due to weight at baseline, 6- and 12-months. Limitations were defined as weight problems that impacted the individual's daily living, work, or recreational activities. Managers rated each resident on a scale of 0–3, where "0" = "no limitation due to weight problems"; "1" = "mild or infrequent limitation of activity due to weight problems"; "2" = "moderate or occasional limitation of activity due to weight problems"; and "3" = "significant or chronic limitation due to weight problems." These ratings were then dichotomized so that "0" = "no limitation due to weight problems" and "1" = "limitations due to weight problems." Finally, observational data from research team visits to the group homes was collected through a note-taking process.

3.4 Analysis

Descriptive statistics were calculated for all participating residents, and additional bivariate analyses were performed on only those individuals who had a BMI of 25 or greater (i.e., individuals who were OW/OB) at baseline. In order to examine cross sectional differences at each time point, we calculated mean values of weight, BMI, and WDS for treatment and control groups at baseline, 6- and 12-months. Differences in means were compared using independent two-sample *t*-tests. Additionally, we calculated the proportion of individuals with functional limitations due to weight at each time point and compared the differences using independent two-sample *Z*-tests. To examine change over time, we calculated mean values for weight differences, BMI differences, and WIS for 0–6 months, 6–12 months, and 0–12 months. These means were once again compared using independent two-sample *t*-tests.

All analyses were stratified by study site. To deal with missing data, we utilized multiple imputation by chained equations. This allowed us to preserve our sample size, while relying on a more plausible set of assumptions than listwise deletion (Royston, 2009; Rubin, 1987). All analyses were performed using Stata 15.1.

4. Results

4.1 Demographics

Participating group homes were large houses in residential or mixed business/residential neighborhoods. Group homes in NY housed between three to six adults with IDD. Forty (of the total 51 participants) provided demographic information. Of those, 68% were male and 32% were female. Participants ranged in age from 20 to 72, with an average age of 38. They were primarily non-Hispanic White (73%) and non-Hispanic African American (23%). All participants had a diagnosed cognitive disability, 55% of whom had a co-occurring disability including mental health impairments (33%), physical disabilities (23%), visual disabilities (8%), hearing disabilities (5%), and/or a substance abuse issue (3%). At baseline, the majority of Northglen Home residents were obese (40%) or overweight (35%), followed by normal weight (20%), and underweight (5%).

Group homes in NC also housed between three to six adults with IDD. Of the 82 participating adults in NC, 76 provided demographic information.

Of these, 57% were female and 43% were male. Participants ranged in age from 22 to 71, with an average age of 49 years. Participants were non-Hispanic White (83%) and non-Hispanic African American (17%). Like the NY participants, all NC had a diagnosed cognitive disability, 59% of whom had a co-occurring disability including mental health impairments (54%), hearing disabilities (4%), visual disabilities (4%), physical disabilities (3%), and substance abuse issues (1%). At baseline, residents in NC were primarily obese (42%) or overweight (32%), followed by normal weight (19%), and underweight (6%). Table 1 reports descriptive statistics for NY and NC.

Table 1 Descriptive statistics.

	New York ($N = 51$)	North Carolina ($N = 82$)
Female	0.32	0.57
Age	38.46	48.97
Race/Ethnicity		
Non-Hispanic white	0.73	0.83
Non-Hispanic black	0.23	0.17
Hispanic	0.05	0.00
Multiple disabilities	0.55	0.59
Physical disability	0.23	0.03
Visual disability	0.08	0.04
Hearing disability	0.05	0.04
Mental disability	0.33	0.54
Substance disability	0.03	0.01
BMI category at baseline		
Underweight	0.05	0.06
Normal weight	0.20	0.19
Overweight	0.35	0.32
Obese	0.40	0.42

Note: Descriptive statistics are provided for all participating residents regardless of baseline BMI.

4.2 Weight changes

4.2.1 New York

Looking at OW/OB participant weight cross-sectionally at each time point, Treatment participants lost weight over the intervention period with an average weight at baseline being 193.63 pounds and dropping to 187.69 pounds at 6 months, and then to 186.05 pounds at 12 months. The average weight of Control home participants trended in the opposite direction, starting at 188.94 at baseline and ending at 189.06 at 12 months. Longitudinally, compared to their peers in Control homes, Treatment home residents in NY saw significant improvements in their overall weight change in pounds from baseline to 6 months (Treatment mean = −5.93 pounds, Control mean = −0.04 pounds, $p < 0.10$) and in their overall weight change in pounds from baseline to 12 months (Treatment mean = −7.57, Control mean = 0.12, $p < 0.10$). In other words, OW/OB individuals receiving the MENU-AIDDS intervention lost an average of 5.93 pounds in the first 6 months of the program and an average of 7.57 pounds in the first year of the program.

4.2.2 North Carolina

Examining OW/OB participant weight cross-sectionally, both Treatment and Control participants lost weight over the intervention period, with the average Treatment resident weight at baseline being 180.35 pounds, dropping to 179.78 pounds at 6 months, and to 177.74 pounds at 12 months. The average weight for Control home residents started at 189.64 pounds and fell to 186.29 pounds at 6 months and to 183.98 pounds at 12 months. Unlike NY, residents in NC Treatment homes did not differ significantly on overall weight loss compared to their peers in the Control homes. On average, OW/OB residents in both Treatment and Control homes lost weight over the intervention year, and the amount lost did not differ significantly based on whether the individuals were receiving the MENU-AIDDS intervention or proceeding as usual.

Table 2 shows all weight-related data and Fig. 1 shows average changes in weight for OW/OB Treatment and Control participants in NY and NC.

4.3 BMI changes

4.3.1 New York

Longitudinally, OW/OB participants in NY Treatment homes saw significant improvements in BMI scores from baseline to 6 months (Treatment mean = −1.24 points, Control mean = −0.11 points, $p < 0.05$) and in BMI scores

Table 2 Change in weight, BMI, WDS, and WIS for NY and NC Group Home Residents.

	New York			North Carolina		
	Treatment mean (SD)	Control mean (SD)	t-value	Treatment mean (SD)	Control mean (SD)	t-value
Overall Weight Change (pounds)						
0–6 months	−5.93 (10.67)	−0.04 (11.82)	−1.54+	−0.58 (7.34)	−3.35 (14.54)	0.92
6–12 months	−1.64 (12.40)	0.16 (10.62)	−0.39	−2.04 (5.16)	−2.31 (7.38)	0.15
0–12 months	−7.57 (12.85)	0.12 (15.18)	−1.48+	−2.62 (10.19)	−5.66 (16.60)	0.81
Percent Weight Change						
0–6 months	−3.22 (5.96)	0.61 (7.01)	−1.72*	−0.11 (3.96)	−0.90 (6.48)	0.54
6–12 months	−0.29 (7.17)	−0.23 (6.16)	−0.02	−1.16 (2.87)	−1.49 (4.25)	0.31
0–12 months	−3.72 (6.12)	0.36 (8.94)	−1.36+	−1.23 (5.52)	−2.39 (7.40)	0.62
Overall BMI Change (BMI points)						
0–6 months	−1.24 (1.44)	−0.11 (1.75)	−1.86*	0.18 (3.59)	−0.48 (2.17)	0.64
6–12 months	0.23 (1.75)	0.42 (1.35)	−0.29	−0.38 (0.95)	−0.35 (1.14)	−0.11
0–12 months	−1.02 (1.68)	0.30 (2.24)	−1.63+	−0.20 (3.53)	−0.83 (2.39)	0.60
Percent BMI Change						
0–6 months	−4.15 (4.90)	−0.22 (5.58)	−2.06*	−0.11 (3.96)	−1.17 (5.87)	0.79
6–12 months	1.40 (6.56)	1.46 (4.10)	−0.03	−1.16 (2.87)	−1.11 (3.54)	−0.06
0–12 months	−2.99 (5.02)	1.24 (7.08)	−1.84*	−1.23 (5.52)	−2.28 (6.59)	0.62
Weight Improvement Score (BMI points)						
0–6 months	0.68 (0.80)	0.15 (1.84)	0.95	0.09 (1.12)	0.46 (2.20)	−0.80
6–12 months	−0.08 (1.23)	−0.51 (1.21)	0.88	0.32 (0.88)	0.25 (1.09)	0.24
0–12 months	0.61 (1.09)	−0.33 (2.28)	1.30	0.46 (1.68)	0.67 (2.37)	−0.37

One-tailed *t*-tests: + $P < 0.1$, * $P < 0.05$; Note: Data is provided only for participants who had a baseline BMI of 25 or higher.

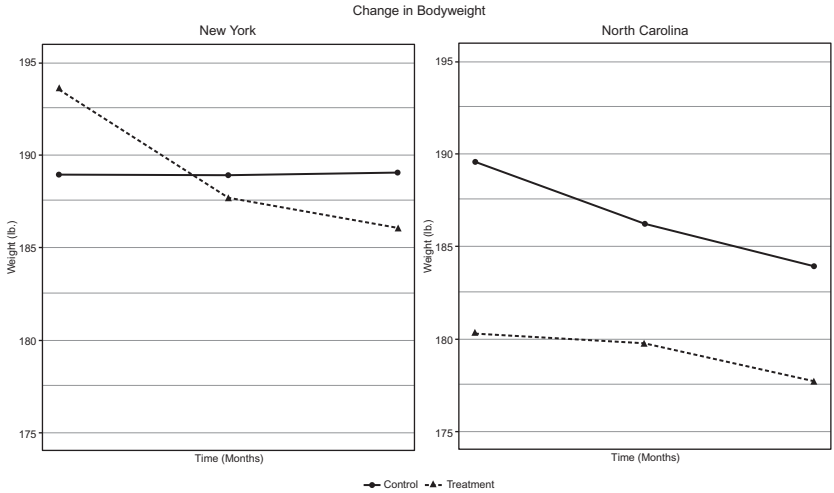

Fig. 1 Change in bodyweight for NY and NC Group Home Residents. Note: Data is provided only for participants who had a baseline BMI of 25 or higher.

from baseline to 12 months (Treatment mean = −1.02 points, Control mean = 0.30 points, $p < 0.10$) compared to their peers in the Control homes. In other words, on average, OW/OB Treatment residents lowered their BMI score by 1.24 points in the first 6 months and essentially maintained that decrease throughout the first year. Although average BMI scores remained in the obese category for Treatment residents throughout the first year, they were trending down. On average, the BMI of OW/OB Treatment home residents at baseline was 32.16, dropping to 30.92 at 6 months, and then increasing to 31.14 at 12 months.

4.3.2 North Carolina

Longitudinally, OW/OB participants in NC Treatment homes did not experience significant improvements in BMI scores from baseline to 6 months (Treatment mean = 0.18 points, Control mean = −0.48 points) or from baseline to 12 months (Treatment mean = −0.20 points, Control mean = −0.83 points) compared to their peers in the Control homes. OW/OB Treatment home residents did decrease their average BMI by 0.20 point at the end of the 12-month period, but Control home residents actually saw a 0.83 point decrease in their BMIs over this same time period. Although average BMI scores remained in the obese category for OW/OB Treatment residents throughout the first year, they were trending down.

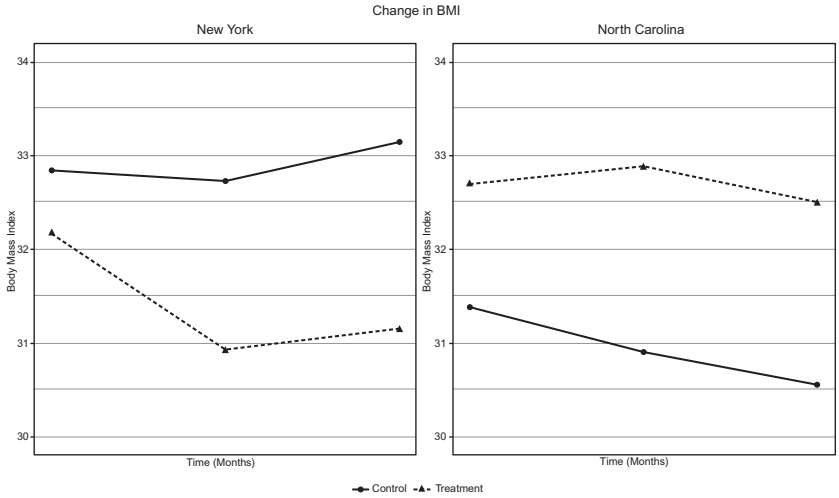

Fig. 2 Change in BMI among NY and NC Group Home Residents. Note: Data is provided only for participants who had a baseline BMI of 25 or higher.

On average, the BMI of OW/OB Treatment home residents at baseline was 32.70 and dropped to 32.49 at 12 months.

Fig. 2 presents changes in average BMI scores for OW/OB participants in NY and NC graphically.

4.4 Weight deviation and weight improvement scores

4.4.1 New York

Cross-sectional data showed that among OW/OB Treatment home residents, average weight deviation scores were 9.92 at baseline, dropped to 9.11 at 6 months, and remained at 9.11 by 12 months. In contrast, OW/OB Control home residents started with lower WDS at baseline (7.84) but ended with higher WDS at 12 months (8.15). In other words, on average, the OW/OB Treatment home residents were trending in a positive direction (e.g., toward the normal weight BMI category), while OW/OB Control home residents were trending away from the normal weight BMI category.

Longitudinally, weight improvement scores were not significantly different for OW/OB NY Treatment vs Control participants from baseline to 6 months, but did differ significantly from baseline to 12 months (Treatment mean = 0.61, Control mean = −0.33, $p < 0.10$). In other words, OW/OB Treatment home participants moved toward the normal BMI range by an average of 0.61 BMI points, while OW/OB Control home

participants moved further away from the normal BMI range by an average of 0.33 BMI points between baseline and 12 months.

4.4.2 North Carolina

Cross-sectional WDS data showed that among OW/OB Treatment home residents, average WDS were 7.91 at baseline, increased to 8.13 at 6 months, and then dropped to 7.76 at 12 months. In contrast, OW/OB Control home residents started with lower WDS at baseline (7.03), dropped to 6.59 at 6 months, and ended at 6.32 at 12 months. This means that, on average, OW/OB Treatment and Control home residents were both trending in a positive direction (i.e., toward the normal weight BMI category).

Longitudinally, weight improvement scores were not significantly different for NC OW/OB Treatment vs Control participants throughout the study. The weight improvement scores of OW/OB Treatment home participants increased over the 12-month study period (mean at 6 months = 0.14, mean at 12 months = 0.46), indicating that on average, residents moved toward the normal BMI range.

Fig. 3 depicts changes in WDS for OW/OB participants in NY and NC graphically.

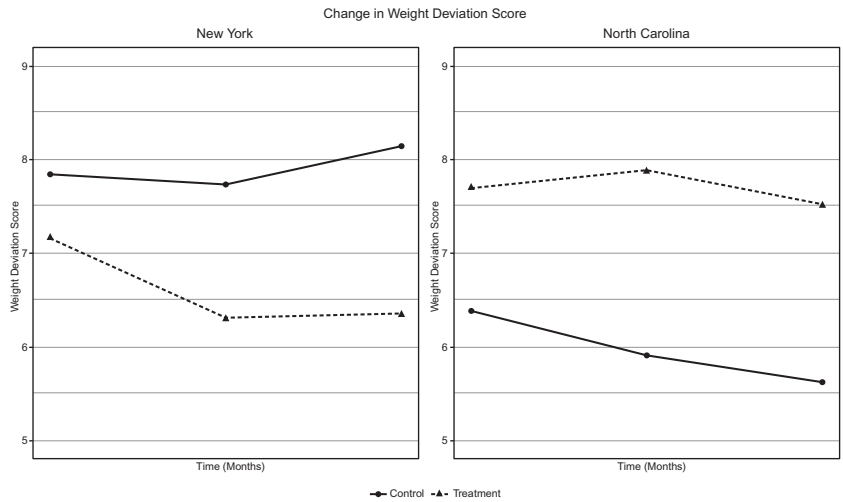

Fig. 3 Weight deviation scores for NY and NC Group Home Residents. Note: Data is provided only for participants who had a baseline BMI of 25 or higher.

4.5 Functional limitation due to weight

4.5.1 New York

Cross-sectional data showed that the proportion of OW/OB residents with any functional limitations due to weight (FLW) decreased for Treatment home residents throughout the intervention year. At baseline, 27% of OW/OB residents had FLW, but by 12 months, only 17% had FLW. On the other hand, the proportion of OW/OB Control home residents who experienced FLW increased over the 12-month period. Twenty-one percent (21%) of OW/OB Control home residents had FLW at baseline, but by 12 months, the percentage of participants with FLW had increased to 28%.

4.5.2 North Carolina

Cross-sectional data showed that the proportion of OW/OB residents with FLW decreased for Treatment home residents throughout the year. At baseline, 16% of residents had FLW, and by 12 months, this dropped to 10% with FLW. The percentage of OW/OB Control home residents with FLW increased over the 12-month period, however. At baseline, 15% of OW/OB Control home residents had FLW and by 12 months 21% had FLW.

Fig. 4 depicts the proportion of OW/OB residents with FLW at each time point for NY and NC graphically.

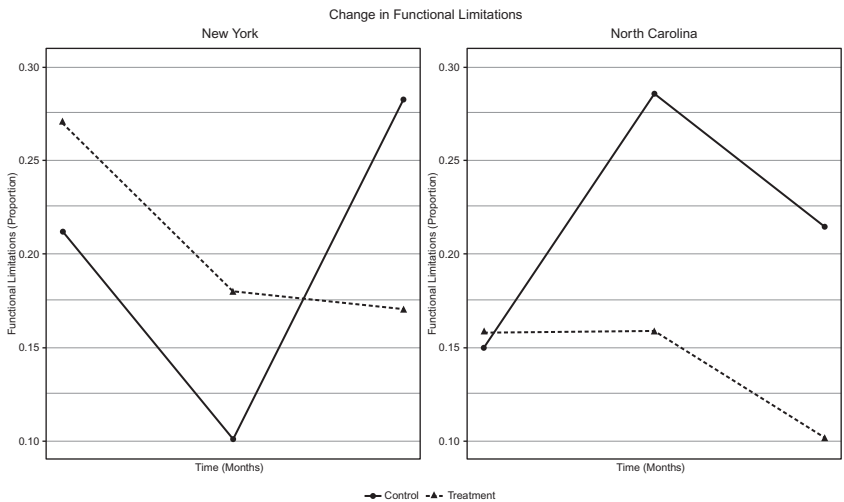

Fig. 4 Change in proportion of residents with functional limitations due to weight for NY and NC Group Homes. Note: Data is provided only for participants who had a baseline BMI of 25 or higher.

4.6 Discussion

The primary goal of the MENU-AIDDs program is to provide a flexible system for use in group homes to increase dietary quality among adults with IDD. Previous studies on MENU-AIDDs found that MENU-AIDDs was successful in improving the nutritional adequacy of group home menus (Humphries, Traci, & Seekins, 2009) and the dietary intake of residents (Humphries & Rigles, 2014). The focus of this study was on secondary goals of the program, including weight loss (or individuals approaching their goal weight) and reductions in functional limitations due to weight among adults with IDD. The findings from this study yielded mixed results. In NY, Treatment home residents experienced significantly greater weight loss and decreases in BMI compared to their peers in Control homes. NY Treatment home residents also saw positive trends in their weight deviation scores and the proportion of residents with functional limitations due to weight decreased. The majority of the weight loss and BMI improvements occurred in the first 6 months of the MENU-AIDDS intervention and appeared to slow between 6 and 12 months. We attribute this finding to the increased support and in-person assistance provided by MENU-AIDDs team during the first 6 months. It may be that having a person who is knowledgeable about nutrition to check in and assist with questions or issues as they arise is a needed service to improve group home food systems. It is also likely that after the first 6 months, the initial enthusiasm of participating in the MENU-AIDDS program wore off, and home managers and staff began to revert to their old nutritional systems.

As described previously, MENU-AIDDs is not designed to be a weight-loss or weight management program. Rather, MENU-AIDDs promotes a healthy, balanced diet, which early research showed can improve body weight status in individuals. While findings in NY supported these preliminary findings of weight improvements among OW/OB residents using the MENU-AIDDs system, results in NC were mixed. On average, residents in NC Treatment homes lost some weight, experienced slight improvements in their BMI scores and their weight deviation scores over the 12-month period, but these residents' weight improvements did not differ significantly from their peers in the Control homes. In fact, Control home residents, on average, lost more weight during the 12-month period than their peers in the Treatment homes. However, the proportion of residents with functional limitations due to weight decreased among Treatment residents over the intervention period, while the proportion of Control home residents with

functional limitations due to weight increased. It may be that improving the nutritional quality within the Treatment homes resulted in improved functioning through mechanisms other than weight loss. For instance, Treatment residents may have had improved energy, mood, and gastrointestinal health as a result of MENU-AIDDs, which in turn improved functioning level. Additional research is needed to understand these discrepancies, however.

We attribute the lack of clear or significant weight-related improvements in NC to several factors. First, we learned toward the end of the intervention period that some of the Treatment home managers had shared MENU-AIDDS materials with Control group managers. The two Control homes that were reported were excluded from these analyses. However, it is likely that this happened in more than the two homes that were identified, which may have led to mixed results. Relatedly, the MENU-AIDDs field coordinator in NC was unable to meet with the Treatment home managers as often as the field coordinator in NY due to the physical distance between group homes, which were located several hours apart. This physical distance led to differences in the extent and quality of support available to NC and NY homes from the research team staff. Therefore, it was more challenging to assess for cross-contamination issues in NC or provide consistent nutritional assistance.

Second, the nutritional support person for the NC homes was new to NC and was unfamiliar with the food culture and food systems of the area. We believe that this may have negatively affected their ability to anticipate issues in the group homes or come up with culturally appropriate solutions to food-related problems in the homes. This was in contrast to the nutritional support person in NY, who was from the area and was able to anticipate and troubleshoot needs in alignment with local cultural values. The cultural disconnect between the nutritional support person for NC homes and the group home staff may have resulted in staff feeling less engaged with MENU-AIDDs or feeling less supported during implementation.

Third, it may be that some of the Control home managers in NC were more ready to make nutritional changes than the Treatment home managers and took initiative to improve their food systems without the use of MENU-AIDDs. The MENU-AIDDs research team explained the project to all group home managers and asked that Control home managers continue providing their food services as is, but they may not have honored this request.

Finally, during visits to the group homes in NC, our research team noted a handful of treatment group home managers who were not interested in participating in the MENU-AIDDs program. While these individuals

conveyed that they wanted to provide good nutrition for their residents, they typically told us that they preferred the systems they had in place before MENU-AIDDs and did not think they needed to make changes. Although model fidelity was assessed through a group home manager survey at 6 and 12 months, all managers consistently indicated high levels of fidelity, which differed from our observations in some of the homes and our in-person conversations with some managers. The use of typical survey tools to measure model fidelity may not have been effective for this type of project. For instance, the fidelity surveys were not anonymous because they were tied to specific group homes, and group home managers may have felt pressured to indicate high levels of fidelity to the program because it was part of their job to implement MENU-AIDDs. In other words, some managers may have been concerned about repercussions from their supervisors if they indicated poor implementation of and adherence to the MENU-AIDDs program.

In our conversations with group home managers, many also expressed that time and budgetary constraints made it difficult to implement a new program. The decision to use MENU-AIDDs came from their parent organization, and some group home managers felt they were *told* to use MENU-AIDDs by their superiors rather than *asked* if MENU-AIDDs was a good fit for their homes. Being told what to do by their parent organization clashed with the culture of the NC group homes much more so than the NY homes. Our research team noticed that because NC group homes were more isolated geographically, they typically experienced little oversight from their parent organization, leaving group home managers feeling like they were on their own to figure things out, including the home's nutritional system. This more individual approach may have made implementing MENU-AIDDs more difficult for NC group home managers who were not as used to adapting to larger organizational changes. This was in contrast to our observations of the NY group home managers and staff who appeared to be more compliant to organizational changes and rules, likely related to the high level of oversight provided by their parent organization. The NY home staff operated at a fast pace and implemented the MENU-AIDDs program quickly. It was apparent that NY staff had been asked to make and adapt to changes at the organizational level previously, which the research team believes was beneficial in terms of their readiness and willingness to implement MENU-AIDDs. Despite these differences, our team believes that the NC group home managers still tried to implement MENU-AIDDs to the best of their abilities, but the enthusiasm and true

buy-in may have been lacking. This suggests that the MENU-AIDDs program may be most successful in group home environments where the management and staff are truly engaged and ready to make changes in the nutritional system. This may be especially true for group homes in more rural locations who likely receive less oversight from their parent organizations.

Overall, this project left us with several important lessons to consider for future nutrition-related research projects with adults with IDD and their care staff in the group home setting:

1. Ensuring group home manager buy-in and/or readiness for change prior to the intervention is key.
2. Establishing more protection against data contamination across homes is necessary. Performing randomized controlled trials in group homes that are used to working together and getting ideas from one another may be difficult. More training on the importance of keeping Treatment and Control homes separate as well as adding check-ins with Control home managers would be helpful.
3. Adding additional model fidelity measures, such as routine home observations conducted by the research team, and assuring group home managers that their fidelity information would be kept confidential from their organization/supervisors would be ideal.
4. Conducting post-intervention interviews with group home managers, staff, and residents would have been helpful for gaining a deeper understanding of how the program implementation and fidelity processes unfolded, as well as to understand the components of MENU-AIDDs that staff and residents liked the most and where there may be areas for improvement.
5. Providing support from a Registered Dietician who is familiar with the local culture, food ways, and food systems.

4.7 Limitations

This study has a variety of limitations. First, the small sample size and stratified nature of the data made it impossible to examine how individual characteristics, such as gender or race, were associated with weight changes. A larger study, including more individuals in more group homes, would be beneficial. The randomized controlled study design should account for these factors in exploring home-level changes, however.

Second, because we had two different states participating, we had two different on-site field coordinators assisting with implementation (one per state).

The knowledge base and interpersonal communication styles of these two individuals differed and may have impacted the intervention in ways that we were unable to measure. We provided the same training and orientation, as well as conducted weekly meetings with both field coordinators to help create consistency. We also asked the group home managers to provide feedback on the field coordinators at 6 and 12 months, all of which was positive.

Finally, the fidelity issues in NC are a significant limitation in this study. Despite our best efforts, we were unable to ensure that Treatment group home managers did not share MENU-AIDDs materials with Control group home managers. We discussed this issue with all of the group home managers at their initial MENU-AIDDs training and reviewed the study protocol with them at each data collection time point. We also excluded data from the known contaminated Control homes in North Carolina. On a positive note, the sharing of MENU-AIDDs materials with some Control homes may indicate that there was a genuine interest and need for this type of program.

4.8 Future research

Future research is needed for the MENU-AIDDs intervention. Larger sample sizes would be ideal for exploring how individual characteristics of group home residents affect their weight loss patterns. For instance, adults with Down syndrome experience higher rates of overweight and obesity compared to their peers (Havercamp et al., 2017), as do women with disabilities (Stancliffe et al., 2011). Therefore, it would be helpful to explore adaptations of the MENU-AIDDs program that might better address the needs of specific groups of residents.

Additionally, a longitudinal study of the MENU-AIDDs program would be beneficial. Following group homes for more than 12 months to assess how the MENU-AIDDs program works past the initial year of implementation would be telling. Our hope is that group homes using MENU-AIDDs make it their own, tailoring the program to work for their particular group of residents by including favorite foods and involving the residents in the meal planning process. It would be helpful to know if this is what happens after the research team is removed or if continued supports are needed to uphold the MENU-AIDDs system.

Finally, future studies should include assessments of staff readiness, organizational and state culture, and perceived barriers to implementing the MENU-AIDDS program prior to delivery. This information could help

inform additional supports, education, or training that could be provided to ensure staff and management are ready and engaged with the program. Additionally, determining ways in which to measure implementation fidelity in a meaningful way that would ensure protection of individual group home managers will be important for future studies.

5. Conclusion

MENU-AIDDs is currently the only nutritional intervention for adults with IDD living in group homes. It is based on the USDA's Dietary Guidelines and uses a Flexible Menu Planning system to help group home managers and staff hit nutritional and calorie targets for their residents while also ensuring that food tastes good and is enjoyable to the residents. Although MENU-AIDDs is not intended to be a weight loss program, previous studies reported preliminary findings of weight regulation of group home residents using the program.

This efficacy study of the MENU-AIDDs intervention found mixed results related to weight improvement and functional limitations due to weight. In New York, the MENU-AIDDS intervention appeared to work well and resulted in weight loss among OW/OB residents and improvements in functioning. However, in North Carolina, the MENU-AIDDS intervention did not appear to significantly impact weight loss among OW/OB residents. More research on the MENU-AIDDS program is necessary to understand these discrepancies.

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