Psychometric Assessment of an Adapted Social Provisions Survey in a Sample of Adults with Prediabetes

Kathryn E. Wilson (kwilson141@gsu.edu)
Georgia State University https://orcid.org/0000-0001-5847-5461

Tzeyu L. Michaud
University of Nebraska Medical Center

Cynthia Castro Sweet
Omaha Health, Inc

Jeffrey A. Katula
Wake Forest University

Fabio A. Almeida
University of Nebraska Medical Center

Fabiana A. Brito
University of Nebraska Medical Center

Robert Schwab
University of Nebraska Medical Center

Paul A. Estabrooks
University of Nebraska Medical Center

Research Article

Keywords: social support, perceived support, diabetes prevention, factorial validity, measurement invariance

Posted Date: May 12th, 2023

DOI: https://doi.org/10.21203/rs.3.rs-966071/v2

Psychometric Assessment of an Adapted Social Provisions Survey in a Sample of Adults with Prediabetes

Abstract

The relevance of social support for weight management is not well documented in people with prediabetes. An important consideration is the adequate assessment of social provisions related to weight management. We aimed to assess the factor structure and measurement invariance of an adapted Social Provisions Scale specific to weight management (SPS-WM). Participants of a diabetes prevention trial (n = 599) completed a demographic survey and the SPS-WM. Confirmatory analyses tested the factor structure of the SPS-WM, and measurement invariance was assessed for gender, weight status, education level, and age. Removal of two items resulted in acceptable model fit, supporting six correlated factors for social provisions specific to weight management. Measurement invariance was supported across all subgroups. Results support score interpretations for these scales reflecting distinct components of social support specific to weight management in alignment with those of the original survey.

Keywords: social support, perceived support, diabetes prevention, factorial validity, measurement invariance

Introduction

The development of translatable weight-loss and diabetes prevention programs is a public health priority (Centers for Disease Control and Prevention, 2020; Wadden et al., 2002; World Health Organization, 2011) as an estimated one in three US adults have prediabetes and are therefore at risk for developing type 2 diabetes (Centers for Disease Control and Prevention, 2020). Modest weight loss resulting from lifestyle modification can substantially improve risk associated with diabetes and other obesity-related illnesses (Diabetes Prevention Program Research Group, 2002, 2009). An important consideration for behavioral interventions is assessing the impact of relevant psychosocial factors predictive of or related to successful behavior change. One such psychosocial factor that is related to health and successful behavior change is perceived social support (Song et al., 2017; Uchino et al., 2018).

Generally, social support can be viewed as a multidimensional construct reflective of “the comfort, assistance, and/or information one receives through formal or informal contacts with individuals or groups” (Wallston et al., 1983, p. 369). Studies demonstrate that higher levels of social support have a positive impact on clinical outcomes, such as a reduced glycated hemoglobin (HbA1c), as they are related to improved physical activity and dietary behaviors, medication adherence, health-care decision-making, motivation, and glucose monitoring among patients with diabetes (McMahon et al., 2017; Song et al., 2017; Stopford et al., 2013; Strom and Egede, 2012; Zhou et al., 2017). Cumulatively, the evidence supports a moderate association between social support and overall self-care among patients with type 1 and type 2 diabetes (Song et al., 2017), though less work has been done to quantify these effects in patients with prediabetes. Moreover, scales designed to measure social support are often generic, lacking specificity for the target behavior or outcome of behavioral interventions. An important preliminary step to assessing the effect of social support for weight management outcomes in this and other special populations is the confirmation of factorial validity and measurement invariance of scales designed to capture component factors of social support for weight management.

The original Social Provisions Scale (Cutrona and Russell, 1987) was developed to assess the dimensions of social support postulated in R. S. Weiss's (1974) theoretical model: 1) Guidance (advice or information), 2) Reliable Alliance (the assurance that others will provide assistance when needed), 3) Reassurance of Worth (the sense that one is viewed as competent and that their skills are valued by others), 4) Opportunity for Nurturance (the sense that others rely on oneself for their wellbeing), 5) Attachment (a sense of security derived from emotional closeness with another), and 6) Social Integration (a sense of belonging with others that share similar interests). Each of the six scales includes four items (two of which are positively worded and two of which are negatively worded) and asks people to indicate their degree of agreement with each statement on a four-point Likert-type scale (4 – Strongly agree, 3 – Agree, 2 – Disagree, 1 – Strongly disagree). The scales are published in full as an appendix to Cutrona and Russell (1987).

The scores of the original Social Provision Scale have demonstrated evidence of reliability and predictive and convergent validity (Cutrona and Russell, 1987). However, internal consistency reliability coefficients are, in some cases, marginal and the latent factor structure has been a topic of some controversy (Perera, 2016). Initial factor analyses supported the presence of six strongly correlated factors reflective of the unique provisions targeted by these scales and the possibility that strong inter factor correlations reflect a higher order factor for general social support (Cutrona and Russell, 1987). This is the structure reflected by the scoring paradigm published with the scales themselves. There is also some evidence that the scales capture variance related to four unique factors rather than six (Mancini and Blieszner, 1992). Mancini and Blieszner (1992) were unable to fit a six-factor model to their data from a sample of older adults. Upon examining inter-item correlations, they collapsed items from the Reliable Alliance, Guidance, and Attachment scales into a single “Intimacy” factor and found acceptable model fit (Mancini and Blieszner, 1992). Most recently, however, a bi-factor solution was supported, indicating that items load onto a general social support factor independent of their unique variance reflective of individual subscales (Perera, 2016). It is possible that differences in latent factor structure reflect sample differences or shifting societal norms.

Currently, there are no tests of the latent factor structure of the Social Provisions Scale among samples undergoing diabetes prevention efforts. Moreover, scale items have not yet been contextualized to the assessment of social support specifically for weight management outcomes, which may be particularly relevant for populations undergoing behavioral interventions for weight loss. An investigation of the factor structure of such a scale adaptation in a relevant population is an important precursor to examining the role of social provisions in diabetes prevention programs.

The purpose of the current investigation was to assess the underlying factor structure of an adaptation of the Social Provisions Scale in a sample of adults with prediabetes enrolled in a digital diabetes prevention program. Items of the Social Provisions Scale were contextualized to weight management paradigms, and a cross-sectional design was used to test the factor structure of the survey. Models testing whether each of the six scales reflect independent (i.e., orthogonal), correlated, or first-order factors subordinate to a single higher-order factor were compared to each other and a model specifying the alternative factor structure reported by Mancini and Blieszner (1992). Tests of measurement equivalence/invariance according to gender, age, education level, and BMI status, as well as bivariate associations between scale scores and behavioral outcomes, were also conducted. Commensurate with the original assessment of survey factor structure (Cutrona and Russell, 1987), it was expected that the factor structure of the adapted survey would reflect a hierarchical model with a single second-order factor of generalized perceived social support related to weight management reflected by six first-order factors representative of the survey subscales for social provisions. It was also expected that measurement invariance would be supported across demographic subgroups, supporting the continued use of the adapted Social Provisions Scale in similar clinical samples.

Methods

Scale Adaptation

Items of the Social Provisions Scale (SPS; Cutrona and Russell, 1987) were carefully revised to focus on social provisions specific to weight management for use in the PREventing Diabetes with dIgital health and Coaching for Translation and Scalability (PREDICTS) trial, a parent hybrid effectiveness/implementation trial delivered through the Nebraska Medicine System. An interdisciplinary team of investigators (n = 8) with expertise in primary care, social work, psychology, kinesiology, biostatistics, and health services research, and over 20 years of experience delivering behavioral physical activity, nutrition, and weight-loss intervention trials conducted a revision of the original Social Provisions Scale over a 2-day investigator meeting. The adaptation aimed to provide a survey that assesses the components of social provisions proposed by Weiss (1974) with the contextualization of items to weight management specifically. Items were closely worded to those presented in the original scale (Cutrona and Russell, 1987), with slight adjustments to focus on social provisions related to weight management. The entire scale is presented in the Appendix.

Sample

A total of 599 adult patients with prediabetes provided informed consent and were enrolled in the PREDICTS trial. Recruitment and intervention protocols are described elsewhere (Almeida et al., 2020). Eligibility extended to patients who were overweight and obese (Body mass index [BMI] $\geq$ 25 kg/m^2), $\geq$ 19 years old, with a HbA1c blood test result in the prediabetes range (5.7%-6.4%). Individuals with a diagnosis of Type 1 or 2 diabetes, who were identified as medically unstable or having contraindications to physical activity or weight loss as indicated by their primary care physician, were pregnant or planning to become pregnant, did not speak English, or were diagnosed with congestive heart failure, coronary artery disease, chronic obstructive pulmonary disease, pulmonary hypertension, dementia, Alzheimer's disease, chronic kidney disease, or were in active cancer treatment were excluded from participation. Exclusion criteria were delineated for the purpose of the parent randomized clinical trial (RCT). It is not expected, however, that these exclusions would impact our observations of the psychometric qualities of the adapted SPS for a sample with prediabetes. Informed consent was provided by all participants.

Procedure

This study was part of a RCT for which procedures are described elsewhere (Almeida et al., 2020). Procedures were approved by the Western and University of Nebraska Medical Center Institutional Review Boards. All data used in this assessment was obtained at the baseline visit of the trial.

Measures

Demographic information (i.e., gender, age, race, and education level) was gathered by self-report survey.

Social Provisions

The adapted SPS, the weight management social provisions scale (SPS-WM; see Appendix), was used to assess six weight management related perceived provisions: Guidance, Reassurance of Worth, Social Integration, Attachment, Nurturance, and Reliable Alliance. Each scale was composed of four items, rated using a 4-point forced answer scale ranging from (1) strongly disagree to (4) strongly agree, in alignment with the original scale format (Cutrona and Russell, 1987). Summary scores for the SPS-WM component scales were calculated by summing all four items on each scale.

BMI

A calibrated scale and stadiometer were used to objectively assess body weight and height at the baseline visit, which were used to calculate BMI (kg/m^2).

Physical Activity

Typical weekly engagement in strenuous, moderate, or mild exercise was assessed by the four-item Godin-Shepard Leisure Time Physical Activity Questionnaire (Godin, 2011) which is supported for use as a classification tool for individuals who are active vs inactive according to national recommendations by assessments of concurrent validity with objective measures of fitness (partial η^2 = .11, 95% CI [0.02, 0.23] and fitness center attendance (partial η^2 = .13, 95% CI [0.03, 0.25] (Amireault and Godin, 2015). Additionally, this tool demonstrates moderate to strong agreement (kappa ~ 0.40-.0.70) with more detailed self-report measures of physical activity while minimizing participant burden, further supporting its use in large clinical trials (Dishman et al., 2010). An index score for physical activity was calculated in accordance with the published standard. A score of 24 or higher is considered sufficiently active for health benefits according to national guidelines (Amireault and Godin, 2015; Garber et al., 2011; Godin, 2011).

Dietary Intake

Eating patterns of study participants were indexed using the 8-item “Starting the Conversation” Brief Dietary Assessment screening tool designed to detect dietary behaviors within the context of diabetes self-management (Paxton et al., 2011). This measure assesses frequency of consumption of fast food, fruits and vegetables, sugar-sweetened beverages, lean protein, and foods high in fat, sugar, and salt, corresponds well with more in-depth food frequency questionnaires, and is supported in the assessment of overall healthiness of an individual's dietary behaviors (Beck et al., 2018). Further, change in the Starting the Conversation summary score were significantly correlated to change in calories consumed from fat ($r = 0.22$, $p < .05$) during a 4-month practical efficacy study among patients with diabetes (Paxton et al., 2011). The Starting the Conversation interview is championed by the American Association of Diabetes Educators and included as an assessment tool in the national standards for diabetes self-management and education (Beck et al., 2018). Lower dietary intake scores indicate a healthier diet than higher scores.

Statistical Analysis

All models were estimated with full information robust maximum likelihood estimation using Mplus 7.11 (Muthén and Muthén, 2012). Significance of relations between variables ($p < .05$) was assessed using critical z-scores (parameter estimate/SE).

Confirmatory Factor Analyses

An iterative process was used to assess factorial validity by comparing increasingly complex model specifications which align with theoretical postulates and empirical evidence of factor structure for the original scale. Models were specified using confirmatory factor analysis (CFA). The simplest model specification was the null model, which was used as a base of comparison and reflected the absence of systematic relationships between item responses which, if supported, would suggest that covariance observed between items is random. It was expected that the null model would demonstrate worse model fit than all other model specifications. Next, a single-factor model was specified to isolate the theoretical postulate of a single underlying factor of perceived social provisions while opposing the postulate of unique subcomponents of social provisions. If supported, this model would suggest that the scale measures social provisions without distinguishing between the factors intended in scale development (i.e., Guidance, Reassurance of Worth, Social Integration, Attachment, Nurturance, and Reliable Alliance). Support for the single-factor model would suggest that items supposed to measure provisions for different social needs (e.g., Guidance and Reassurance of Worth) covary just as strongly with items across scales as they do with items within scales. An orthogonal six-factor model was specified to isolate the postulate of six unique components of social provisions as intended, but in opposition to the postulate that social provision factors are related—rather correlations between factors were restricted to zero to reflect the absence of association between factors. A correlated six-factor model was specified in full alignment with the expectations of six unique and related components of social provision. Commensurate with the hypothesized factor structure of the original survey (Cutrona and Russell, 1987) a hierarchical model was specified such that items loaded onto their respective first-order factors, and those first-order factors loaded onto a single second-order factor for total perceived social provision. This model aligns with the intended structure of the scale as it was developed (Cutrona and Russell, 1987) and reflects both the specificity of social provision factors as well as their generalizability to overall perceived social support. Finally, a four-factor model reflective of the factor structure supported by Mancini and Bleiszner (1992) was fit to the data. Support for this model would indicate that the scales for Guidance, Attachment, and Reliable Alliance in fact capture variance from a single common construct, previously labeled “Intimacy”. It was not possible to estimate a bi-factor model with these data.

Measurement Equivalence/Invariance

Measurement invariance was also tested iteratively, beginning with an omnibus test of invariance of covariance matrices. Should equivalence of covariance matrices not have been supported, levels of invariance would have been tested in decreasing order of restrictiveness to identify the highest level of measurement equivalence/invariance reflected in these data (Vandenberg and Lance, 2000).

Tests of invariance were conducted for the following grouping variables: gender, age, education level, and BMI status. Insufficient cell sizes for race prohibited a corresponding test of measurement invariance. Age groups were stratified as follows: (1) those $\geq$ 1 standard deviation (SD) below the sample mean, (2) those < 1 SD from the mean, and (3) those $\geq$ 1 SD above the mean. Education level was categorized as (1) those with less than a 4-year college degree, (2) those with a 4-year college degree, and (3) those with postgraduate education. Finally, participants' obesity status was classified as 'obese class 1' (BMI of 30.0 to 34.9), 'obese class 2' (BMI of 35.0 to 39.9), or 'obese class 3' (BMI $\geq$ 40). Participants classified as overweight (i.e., BMI of 25 to 29.9 kg/m^2) were excluded from this analysis due to relatively low cell numbers (n = 73). It is not expected that the scale would perform differently for individuals with a BMI less than 30 kg/m^2.

Model Fit

Several fit indices were examined to evaluate model fit of the confirmatory factor analyses and measurement invariance tests. Absolute and relative model fit were assessed using the chi-squared (χ^2) statistic, comparative fit index (CFI), root mean square error of approximation (RMSEA) and its 90% confidence interval, and standardized root mean square residual (SRMR; Bollen, 1989; Hu and Bentler, 1999). Concurrent values ≥ 0.95 for CFI and ≤ 0.08 for SRMR reportedly provide optimal protection from type I and type II error rates (Hu and Bentler, 1999). Values of CFI approximating 0.90 are judged to be acceptable, while values > 0.95 indicate good fit, and values of the RMSEA ≤ 0.06 and ≤ 0.08 are commonly interpreted as indicating close and acceptable fit, respectively. The Bayesian Information Criterion (BIC), a relative fit statistic that approximates the Bayes factor and is conservative for comparing complex models, was also used to compare CFA models (Bollen et al., 2014). In the case of a non-positive definite covariance matrix, factor correlations and residual variances were scrutinized for specification problems. Modification indices were then examined for items with unspecified parameters that, if specified, would improve model chi-squared results the most. The item which demonstrated the greatest summative contribution to model misspecification, as indicated by modification indices, was removed from the factor model specification and model fit was re-assessed. Modification indices were further examined for additional items contributing to reduced fit when model estimation properly converged but model fit was observed to be marginal.

Bivariate Associations

Bivariate correlations between SPS-WM scale scores and the physical activity index score, dietary intake score, and body weight were assessed. In the case of item removal from any of the component scales during the preceding assessment of factor structure of the survey, scale scores were recalculated as the average of the retained items for the respective scale, and bivariate correlations were recalculated and reported herein.

Results

Descriptive statistics for demographic variables are reported in Table 1. The sample of adults (mean [SD] age = 55.8 [12.6] years) with prediabetes enrolled in a digital diabetes prevention program were predominantly non-Hispanic (96.3%), white (90.5%), females (61.3%), most of whom were classified as Obese category 1 (i.e., BMI between 30 to 34.9 kg/m^2; 41.7%) and had less than a four-year college education (43.9%). Additional sample details are available elsewhere (Wilson et al., 2021). Generally, compared to the patient population from which the sample was derived, participants were more likely to be obese (92% vs. 60%; $p < .01$), female (61% vs. 56%; $p < .01$), older (mean [SD] age 55.8 [12.6] vs. 49.0 [15.6]; $p < .01$), and Caucasian (90% vs. 83%; $p < .01$). The sample was less likely to be Black (7% vs. 11%; $p < .01$) than the patient population (Wilson et al., 2021).

Confirmatory Factor Analyses

Table 2 displays model fit statistics for all confirmatory factor analyses. Generally, model fit improved with increasing model complexity. As expected, the single-factor model demonstrated improved fit compared to the null model. However, the orthogonal six-factor model demonstrated worse fit compared to the single-factor model. The model specifying six correlated factors demonstrated a non-positive definite covariance matrix resulting from a correlation of greater than one between latent factors for Guidance and Reliable Alliance. Modification indices highlighted item 3 of the Guidance subscale (i.e., “There is no one I can turn to for guidance on managing my weight in times of stress”) as the greatest contributor to model misspecification. Upon re-specification of the model with removal of item 3, the model converged successfully and demonstrated marginal model fit. Re-examination of modification indices supported the removal of survey item 1 of the Reliable Alliance subscale (i.e., “There are people I know who will help me with managing my weight if I really need it.”). A second model re-specification removing item 1 resulted in acceptable model fit.

The hierarchical model and the four-factor model demonstrated poor model fit, though fit was better than that of the single-factor and null models. Unlike the observation of a non-positive definite covariance matrix observed in the correlated six-factor model, the hierarchical model and four-factor model converged normally. To assess comparative fit relative to the models specified with item removal for the correlated six-factor model, the hierarchical and four-factor models were each re-specified with the removal of item 3, then again with the additional removal of item 1. With each re-specification, the model fit for the hierarchical and four-factor models remained marginal.

Examination of the modification indices for the fully specified hierarchical model revealed that item 11 reflected unique variance from factors for Guidance, Worth Reassurance, and Reliable Alliance in addition to its reflection of Attachment. Removal of this item improved model fit compared to the fully specified hierarchical mode but not compared to the hierarchical model with item 3, or items 3 and

1 removed. Further examination of the modification indices highlighted similar cross-loading of item 2. However, removal of both items 11 and 2 would eliminate the Attachment subscale altogether, leaving only items 17 and 21 as factor loadings in the resultant model specification. This issue is addressed in the specification of the four-factor model, as it combines items across Attachment, Reliable Alliance, and Guidance factors into a single Intimacy factor. Inspection of the modification indices of the fully specified four-factor model highlighted possible cross-loading of item 17 from the combined factor, Intimacy, with the factors for Social Integration and Nurturance. Removal of this item improved model fit. Further inspection of the modification indices pointed to the same pattern of cross-loading for item 21. Subsequent removal of item 21 resulted in acceptable model fit.

Overall, model fit was best for the four-factor model after removal of items 17 and 21. Model fit was only slightly better than that of the correlated six-factor model after removal of items 3 and 1. Both models demonstrated acceptable model fit.

The final model parameter estimates for the correlated six-factor model and the hierarchical model after removing items 1 and 3 are illustrated in Figures 1 and 2, respectively. The final model parameter estimates for the four-factor model after removing items 17 and 21 are displayed in Figure 3. Item numbers are reflective of their presentation in the Appendix, which aligns with that of the original scale publication (see appendix of Cutrona and Russell, 1987), and parameter estimates reflect the standardized solution. Parameter estimates of models not displayed are available upon request to the corresponding author. Mean (SD) subscale scores, computed from raw data, are presented in Table 3 for full subscales as well as subscales after removal of items 3 and 1. Further, composite factor reliabilities for all factors in the correlated six-factor model after removal of items 3 and 1, and those in the four-factor model after removal of items 17 and 21 are presented in Table 3.

Measurement Equivalence/Invariance

Model fit for tests of equivalence of the covariance matrices supported measurement invariance for all subgroup analyses (i.e., between genders, age groups, education, and BMI status) for the full survey as well as after removing items 3 and 1, and separately after removing items 17 and 21. Model fit statistics for each test of measurement invariance of the covariance matrices are reported in Table 4.

Bivariate Associations

Bivariate correlations between component scale scores and weight, physical activity score, and dietary intake score are displayed in Table 5. Associations between component scores as well as between component scores and relevant outcomes were similar regardless to whether component scores were calculated with or without items 3 and 1 (in the case of Guidance and Reliable Alliance) and with or without items 17 and 21 (in the case of Intimacy). As was observed in the factor models, all component scores were significantly related to each other. Notably, Worth Reassurance was the only component score significantly related to all three outcomes of interest (weight $r = -.21$, $p < .01$; physical activity $r = .20$, $p < .01$; dietary intake $r = -.23$, $p < .01$). Physical activity and dietary intake were also significantly related to Social Integration (r's = .10 and –.12, respectively) and Nurturance (r's = .10 and –.15, respectively), while weight was related to Attachment ($r = .10$) and Reliable Alliance ($r = .10$ and .12, for the full and trimmed scale scores, respectively), as well as Intimacy ($r = .09$ for both the full and trimmed scales). Significant correlations between component scores and outcomes of interest were weak by conventional standards, but typical for individual psychological differences (Gignac and Szodorai, 2016). Guidance was not significantly related to any of the outcomes of interest.

Discussion

This study provides evidence on the factor structure of the Social Provisions Scale for Weight Management in a clinical diabetes prevention trial. Our results indicate that, after removing two items, the expected structure with six correlated first-order factors was supported with these data. Model fit was acceptable when allowing the six first-order factors to correlate freely, and was only slightly reduced when specifying a hierarchical, second-order factor structure. Further, a four-factor structure collapsing scales for Guidance, Reliable Alliance, and Attachment demonstrated comparable fit to the hierarchical model, and upon removing two different items than those trimmed from the six-factor model, model fit was acceptable and comparable to that of the trimmed, correlated six-factor model. This study also provides support for the measurement equivalence/invariance of the scales according to gender, age, education level, and BMI status in a large sample of adults with prediabetes participating in a hybrid effectiveness/implementation diabetes prevention trial. Bivariate correlations provide support that, except for Guidance, component scores from this scale relate to concurrently measured weight management related outcomes (i.e., body weight, physical activity, and dietary behavior).

Factor analyses were conducted to replicate and compare the expected factor structure with alternative model specifications observed for the original scale in previous literature (Cutrona and Russell, 1987; Mancini and Blieszner, 1992). As expected, the worst fitting model was the null model, which specified no interitem covariance. Model fit improved when testing a single-factor model, which specified that all 24 survey items covaried as a result of a single underlying factor in contrast of the theoretical postulate of multidimensional components of social support (Weiss, 1974). However, model fit was still poor for this specification.

The first model to test the multidimensional structure of social provisions was the orthogonal six-factor model, which, if supported, would have indicated that Guidance, Reliable Alliance, Reassurance of Worth, Social Integration, Nurturance, and Attachment are independent and unrelated constructs. Model fit worsened compared to the single-factor model, though fit did remain superior to the null model. Considering the expectation that the unique components of social provision are related to one another, this observation is justifiable. That is, the single-factor model aligns with this expectation in that all items are free to covary, as they are specified to be reflective of a single underlying factor. This is not the case in the orthogonal six-factor model; item covariances are restricted to zero for items that belong to different subscales (i.e., items on the Guidance subscale are restricted from covarying with items on any of the other five subscales, and so on for all item covariances across subscales). Only one fit statistic of the orthogonal six-factor model was improved compared to the single-factor model. The CFI, or comparative fit index, reflects the relative improvement in fit of the specified model compared to the null model (Kline, 2011). The slight improvement in the CFI for this model compared to the single-factor model therefore suggests that the orthogonal six-factor model specification is a better approximation of the covariance observed in these data than that of the single-factor model with respect to a model in which no item covariances were present. This observation favors the multidimensional nature of social provisions, but the improvement in this fit index is negligible, and overall model fit remained poor.

The expected structure of the survey was that of six correlated factors, based on observations made upon initial development and application of the original Social Provisions Scale (Cutrona and Russell, 1987). Our specification of a correlated six-factor model revealed a non-positive definite covariance matrix resulting from a latent factor correlation greater than one between Guidance and Reliable Alliance. Mancini and Blieszner (1992) reported collinearity between items of these component scales in the original survey. Perera (2016) reported strong inter-factor correlations and cross-factor item collinearity for Guidance and Reliable Alliance calling into question the discriminant validity of these two factors. In both cases, structural changes were applied rather than attempting to identify whether a single item or two might be responsible for model misspecification or extreme inter-factor correlations. Mancini and Blieszner (1992) respecified their model to collapse items from three scales into a single factor for “Intimacy” (as reflected in our specification of the four-factor model). On the other hand, Perera (2016) noted that despite strong inter-factor correlations and item-cross loadings, there are items from each scale that have substantial loadings per factor, supporting the scientific utility of retaining the intended factor structure of the survey. We found support for both approaches.

Modification indices from our correlated six-factor model specification indicated the items “There is no one I can turn to for guidance on managing my weight in times of stress” (item 3) and “There are people I know who will help me with managing my weight if I really need it” (item 1) were contributing heavily to model misspecification. Removal of these items supported the presence of six unique factors for social support. Likewise, modification indices led to the removal of two different items when the factor structure was amended to collapse items for Reliable Alliance, Guidance, and Attachment into a single factor, Intimacy. Item 17, “I feel a strong emotional tie with at least one other person who is working on weight management,” and item 21, “I do not have a feeling of closeness with anyone working on weight management,” were identified as those contributing most to model misspecification. Removal of these items from the four-factor model resulted in acceptable model fit that was comparable with that of the trimmed, correlated six-factor model.

It is difficult to decipher whether the six-factor or four-factor solution might be best given their comparable fit. Close examination of the modification indices, and the specific items identified as contributing to misspecification across the structural models tested provides additional context with which to consider the decision of how best to use these scales. Specifically, in considering the hierarchical model, model re-specifications led by modification indices were limited by the fact that the first and second items identified as the strongest contributors to misspecification were reflective of the same factor (Attachment). Given that each scale of the survey in its six-factor form is reflected by only four items, the removal of two items was precluded by the necessity to ensure a minimum of three items reflective of each latent factor. Model fit for the hierarchical model improved after removing one item, though it remained marginal. This is noteworthy, as the iterative re-specification of the four-factor model led to the removal of two items before model fit improved to an acceptable level—the two items removed from the four-factor model were specified as items reflective of Intimacy but belonged initially to the Attachment subscale of the survey in its six-factor form. Collectively, these observations suggest that the Attachment subscale of this survey could be problematic, as in two of the three complex factor structures examined, half of the items purported to reflect Attachment contributed to model misspecification. Conversely, Mancini and Blieszner (1992) collapsed subscales as a result of inter-factor correlations between Guidance and Reliable Alliance—not because of any issues with the Attachment factor. More work will be needed, as this may be a spurious result in a unique sample.

It should be emphasized that the use of modification indices to identify "problematic" items is a purely data-driven approach. This approach is limited by the observed covariances in the sample data analyzed. Therefore, it is entirely possible that the items identified for removal in this sample may not diminish model fit in the models estimated in a different sample. Rather than following the specific adjustments suggested by modification indices, we used modification indices to identify items that contribute heavily to model misspecification for removal. The prior would lack any theoretical foundation and capitalize on sample-specific variance, increasing the likelihood that model re-specifications would be incorrect. It is arguable, however, that our approach allowed us to retain the theoretical underpinnings of the survey's factor structure while accounting for sample-level variance.

Our observations corroborate earlier results questioning the presence of a salient second-order factor accounting for first-order factor correlations. Cutrona and Russell (1987) reported significant factor loadings of the six first-order factors of the original scale onto a general factor reflective of overall social support. They noted, however, that a substantial proportion of factor variances for most factors is not accounted for by a global, second-order factor of social support, suggesting that first-order factors are distinct and highly correlated beyond the influence of a general level of support available to the person. Though factor loadings did indicate a substantial amount of variance (R^2 ranged from 32% to 94%) from each first-order factor being accounted for by a global social support construct in the current investigation, model fit for six correlated factors remained superior, albeit marginally, to that of the hierarchical model and the four-factor model proposed by Mancini and Blieszner (1992) after corresponding item removal.

In contrast, Chiu et al. (2016) found close fit of their data to the hierarchical model in a sample of 292 individuals with multiple sclerosis (MS). Extreme inter-factor correlations and multicollinearity previously reported for the original scale (Cutrona and Russell, 1987; Mancini and Blieszner, 1992; Perera, 2016) were not observed in this sample. Other investigations have produced mixed results. Motl et al. (2004) found additional support for the hierarchical model tested here among a sample of White adolescent females, but only after specifying an orthogonal method factor to account for variance related to positive versus negative worded items within and between first-order factors of the original scale (Motl et al., 2004). On the other hand, in the same investigation, factor structure differed significantly for a sample of Black adolescent females such that a hierarchical model with four first-order factors (one factor generated by collapsing items from Attachment, Social Integration, and Reliable Alliance subscales), a single second-order factor and an orthogonal method factor fit best (Motl et al., 2004). We did not consider the specification of an orthogonal method factor, which may have improved model fit across models tested.

Perera (2016) conducted a bi-factor analysis of the original scale which parsed out common item variance prior to allowing items to load on their respective scale factors. This model would suggest that there are some general sources of common variance beyond that which is shared between items within factors. Perera (2016) conceptualized this as a global factor for social support, reflected by common variance across all items, leaving residual variance reflective of their unique factors. A post hoc confirmatory bi-factor model was specified for the data in this study but failed to converge upon an admissible solution. The use of bi-factor statistics is encouraged in future studies to better understand the structure of this instrument and the utility of an overall summary score for the total survey. It therefore remains unclear whether a global factor reflecting overall weight management related social support could be derived from this measure.

The single-factor model tested here speaks against the presence of a global factor accounting for shared variance across all items. The hierarchical model we tested also did not demonstrate close fit to our data. The amount of variance of each first-order factor that is accounted for by a second-order factor differs substantially in our samples compared to others. Second-order factor loadings of the original scale reported by Chiu et al. (2016) ranged from λ = .65 to .90, whereas in the current investigation factor loadings for the weight management specific scale ranged from λ = .57 to .97. Though this may seem negligible, the pattern of differences between samples with regard to specific factor loadings is a point of interest. For example, among adults with MS, Reassurance of Worth loaded onto the global factor for social support at λ = .90 (Chui et al., 2016), whereas in our sample, this parameter was only λ = .58. Variability of second-order factor loadings of these scales between samples suggests that the use of a summary score for global social support would require the application of a unique weighting coefficient to subscale scores. This is an impractical consideration, however, as factor analysis is beyond the scope of practice of many who would use this scale in smaller samples in applied settings. Taken in the context of other factor analyses of the Social Provisions Scale, these analyses demonstrate the utility of using scale scores independently rather than summing or averaging scale scores to reflect a global indicator for social support related to weight management.

Encouragingly, analyses of the measurement equivalence/invariance of this SPS-WM survey according to gender, age, education level, and BMI provide support for its use in similar samples of adults with prediabetes. Tests supported equivalence of covariance matrices provide the most rigorous assessment of measurement invariance (Vandenberg and Lance, 2000) and indicate that subgroups interpret the survey items in similar ways. These results provide confidence that any between group differences in scale scores in this sample are free of bias resulting from demographic characteristics. Generalizability to more diverse samples is limited, however, as our sample was relatively homogenous, and analyses according to BMI status were limited to those classified as obese.

Composite factor reliabilities indicate that there may be some problems with some items on subscales for Reassurance of Worth, Social Integration, and possibly Nurturance (range .661 to .718). Similar deficits were observed by Perera (2016), who reported internal consistency reliability of $\alpha = .710$ for Nurturance, $\alpha = .641$ for Reassurance of Worth, and $\alpha = .795$ for Social Integration. Considering that items aligned very closely with the original publication, perhaps this is not surprising. Cutrona and Russell (1987) reported internal consistency reliabilities between $\alpha = .653$ to .760 for the scales in the Social Provisions Scale. Nonetheless, factor loadings from our sample were moderate to strong ($\lambda = |.365|$ to $|.839|$) and statistically significant ($p < .001$). More work should be done to test the internal consistency of these scales; items should be scrutinized for content validity and amended to improve internal consistency of the scales.

Conclusion

Overall, analyses provided support for the intended first-order factor structure of the measure. More work is needed to determine whether the Attachment scale should be revised, or if combining the Guidance, Reliable Alliance, and Attachment scales to capture a more general factor is warranted. The issue of whether a higher-order factor reflective of global social support related to weight management can be derived from scores for the first-order factors remains unclear. Factor loadings for the hierarchical model allow for a weighted solution for computing global social support in this sample but are not recommended for use more generally. More work is needed to assess the proper weighting of scale scores for the derivation of a global social support score in the general population. Measurement invariance was strongly supported for the SPS-WM in the sample of patients with prediabetes, extending support for this scale as being interpreted uniformly across demographic subgroups. Finally, bivariate correlations suggest that these scales are relevant for understanding behaviors related to weight management, and support continued use of this measure in clinical trials to assess predictive validity related to weight loss and management.

Though this scale was not designed to be clinically specific to people with prediabetes, evidence provided preliminary support for the psychometric quality of these scales in people with prediabetes engaged in community-based weight-loss trials. Continued assessment of the psychometric performance of this survey in samples of adults with and without prediabetes of varying size and diversity is encouraged to confirm or refute these factorial observations and to corroborate the applicability of these scales across clinical and demographic subgroups. Cross-validation and tests of convergent and discriminant validity with other supported measures of social provisions in diverse samples are recommended to assess whether this is the most appropriate measure to capture component factors of social support related to weight management.

Statement of Interests: The study was preregistered at clinicaltrials.gov (NCT03312764). Omada Health, Inc. provided the funding for this trial through contracts with Wake Forest University and the University of Nebraska Medical Center. This included investigator time, travel for investigator meetings, data management, trial implementation, analysis and quality control, and manuscript preparation. Dr. Castro Sweet was employed by Omada Health during the trial period and received salary and stock options.

Acknowledgements: We would like to acknowledge the entire UNMC and Wake Forest School of Medicine research team who has been instrumental in the development and implementation of the PREDICTS trial, including Amir Alexander, Jennifer Alquicira, Kathryn Aquilina, Ashley Boggs, Priyanka Chaudhary, Patty Davis, Emily Dressler, Carrie Fay, Destiny Gamble, Kumar Gaurav, Tristan Gilmore, Cody Goessl, Caitlin Golden, Kalynn Hamlin, Rachel Harper, Lea Harvin, Haydar Hasan, Xiaolu Hou, Markisha Jackson, Amanda Kis, Carol Kittle, LuAnn Larson, Emiliane Pereira, Gwenndolyn Porter, Tiffany Powell, Ashley Raposo-Hadley, Kaylee Schwasinger, Camia Sellers, Sharalyn Steenson, Mariam Taiwo, Lindsay Thomsen, Jessica Tran, Akou Vei, Thomas Ward, and Norah Winter.

References

Almeida, F. A., Michaud, T. L., Wilson, K. E., Schwab, R. J., Goessl, C., Porter, G. C., Brito, F. A., Evans, G., Dressler, E. V., Boggs, A. E., Katula, J. A., Sweet, C. C., & Estabrooks, P. A. (2020). Preventing diabetes with digital health and coaching for translation and scalability (PREDICTS): A type 1 hybrid effectiveness-implementation trial protocol. *Contemporary Clinical Trials*, *88*, 105877. https://doi.org/https://doi.org/10.1016/j.cct.2019.105877

Amireault, S., & Godin, G. (2015). The godin-shephard leisure-time physical activity questionnaire: Validity evidence supporting its use for classifying healthy adults into active and insufficiently active categories. *Perceptual and Motor Skills*, *120*(2), 604–622. https://doi.org/10.2466/03.27.PMS.120v19x7

Beck, J., Greenwood, D. A., Blanton, L., Bollinger, S. T., Butcher, M. K., Condon, J. E., Cypress, M., Faulkner, P., Fischl, A. H., Francis, T., Kolb, L. E., Lavin-Tompkins, J. M., MacLeod, J., Maryniuk, M., Mensing, C., Orzeck, E. A., Pope, D. D., Pulizzi, J. L., Reed, A. A., … Wang, J. (2020). 2017 national standards for diabetes self-management education and support. *The Diabetes Educator*, *44*(1), 35–50. https://doi.org/10.1177/0145721718754797

Bollen, K. A. (1989). A new incremental fit index for general structural equation models. *Sociological Methods and Research*, *17*(3), 303–316.

Bollen, K. A., Harden, J. J., Ray, S., & Zavisca, J. (2014). BIC and alternative bayesian information criteria in the selection of structural equation models. *Structural Equation Modeling: A Multidisciplinary Journal*, *21*(1), 1–19. https://doi.org/10.1080/10705511.2014.856691

Centers for Disease Control and Prevention. (2020). *National diabetes statistics report, 2020*. Centers for Disease Control and Prevention, US Department of Health and Human Services.

Chiu, C.-Y., Motl, R. W., & Ditchman, N. (2016). Validation of the social provisions scale in people with multiple sclerosis. *Rehabilitation Psychology*, *61*(3), 297–307.

Cutrona, C. E., & Russell, D. W. (1987). The provisions of social relationships and adaptation to stress. *Advances in Personal Relationships*, *1*(1), 37–67.

Diabetes Prevention Program Research Group. (2002). Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *New England Journal of Medicine*, *346*(6), 393–403.

Diabetes Prevention Program Research Group. (2009). 10-year follow-up of diabetes incidence and weight loss in the diabetes prevention program outcomes study. *The Lancet*, *374*(9702), 1677–1686.

Dishman, R. K., Rooks, C. R., Thom, N. J., Motl, R. W., & Nigg, C. R. (2010). Meeting U.S. healthy people 2010 levels of physical activity: Agreement of 2 measures across 2 years. *Annals of Epidemiology*, *20*(7), 511–523. https://doi.org/10.1016/j.annepidem.2010.04.004

Garber, C. E., Blissmer, B., Deschenes, M. R., Franklin, B. A., Lamonte, M. J., Lee, I.-M., Nieman, D. C., & Swain, D. P. (2011). Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: Guidance for prescribing exercise. *Medicine and Science in Sports and Exercise*, *43*(7), 1334–1359. https://doi.org/10.1249/MSS.0b013e318213fefb

Gignac, G. E., & Szodorai, E. T. (2016). Effect size guidelines for individual differences researchers. *Personality and Individual Differences*, *102*, 74–78.

Godin, G. (2011). The godin-shephard leisure-time physical activity questionnaire. *The Health and Fitness Journal of Canada*, *4*(1), 18–22.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55.

Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed.). Guilford Press.

Mancini, J. A., & Blieszner, R. (1992). Social provisions in adulthood: Concept and measurement in close relationships. *Journal of Gerontology*, *47*(1), 14–20. https://doi.org/10.1093/geronj/47.1.P14

McMahon, S. K., Lewis, B., Oakes, J. M., Wyman, J. F., Guan, W., & Rothman, A. J. (2017). Assessing the effects of interpersonal and intrapersonal behavior change strategies on physical activity in older adults: A factorial experiment. *Annals of Behavioral Medicine*, *51*(3), 376–390. https://doi.org/10.1007/s12160-016-9863-z

Motl, R. W., Dishman, R. K., Saunders, R. P., Dowda, M., & Pate, R. R. (2004). Measuring social provisions for physical activity among adolescent black and white girls. *Educational and Psychological Measurement*, *64*(4), 682–706.

Muthén, L., & Muthén, B. (2012). *Mplus: Statistical analysis with latent variables* (Version, 7).

Paxton, A. E., Strycker, L. A., Toobert, D. J., Ammerman, A. S., & Glasgow, R. E. (2011). Starting the conversation: Performance of a brief dietary assessment and intervention tool for health professionals. *American Journal of Preventive Medicine*, *40*(1), 67–71.

Perera, H. N. (2016). Construct validity of the social provisions scale: A bifactor exploratory structural equation modeling approach. *Assessment*, *23*(6), 720–733. https://doi.org/10.1177/1073191115589344

Song, Y., Nam, S., Park, S., Shin, I.-S., & Ku, B. J. (2017). The impact of social support on self-care of patients with diabetes: What is the effect of diabetes type? Systematic review and meta-analysis. *The Diabetes Educator*, *43*(4), 396–412. https://doi.org/10.1177/0145721717712457

Stopford, R., Winkley, K., & Ismail, K. (2013). Social support and glycemic control in type 2 diabetes: A systematic review of observational studies. *Patient Education and Counseling*, *93*(3), 549–558.

Strom, J. L., & Egede, L. E. (2012). The impact of social support on outcomes in adult patients with type 2 diabetes: A systematic review. *Current Diabetes Reports*, *12*(6), 769–781.

Uchino, B. N., Bowen, K., Kent de Grey, R., Mikel, J., & Fisher, E. B. (2018). Social support and physical health: Models, mechanisms, and opportunities. In E. B. Fisher, L. D. Cameron, A. J. Christensen, U. Ehlert, Y. Guo, B. Oldenburg, and F. J. Snoek (Eds.), *Principles and Concepts of Behavioral Medicine: A Global Handbook* (pp. 341–372). Springer. https://doi.org/10.1007/978-0-387-93826-4_12

Vandenberg, R. J., & Lance, C. E. (2000). A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research. *Organizational Research Methods*, *3*(1), 4–70. http://ejournals.ebsco.com/direct.asp?ArticleID=MPHED21WCGM0LC6C87P1

Wadden, T. A., Brownell, K. D., & Foster, G. D. (2002). Obesity: Responding to the global epidemic. *Journal of Consulting and Clinical Psychology*, *70*(3), 510–525.

Wallston, B. S., Alagna, S. W., DeVellis, B. M., & DeVellis, R. F. (1983). Social support and physical health. *Health Psychology*, *2*(4), 367–391. https://doi.org/10.1037/0278-6133.2.4.367

Weiss, R. S. (1974). The provisions of social relationships. In Z. Rubin (Ed.), *Doing Unto Others* (pp. 17–25). Prentice Hall.

Wilson, K. E., Michaud, T. L., Almeida, F. A., Schwab, R. J., Porter, G. C., Aquilina, K. H., Brito, F. A., Golden, C. A., Dressler, E. V., Kittel, C. A., Harvin, L. N., Boggs, A. E., Katula, J. A., & Estabrooks, P. A. (2021). Using a population health management approach to enroll participants in a diabetes prevention trial: Reach outcomes from the PREDICTS randomized clinical trial. *Translational Behavioral Medicine*, *11*(5), 1066–1077. https://doi.org/10.1093/tbm/ibab010

World Health Organization. (2011). *Global status report on noncommunicable diseases 2010*.

Zhou, G., Gan, Y., Hamilton, K., & Schwarzer, R. (2017). The role of social support and self-efficacy for planning fruit and vegetable intake. *Journal of Nutrition Education and Behavior*, *49*(2), 100–106.e101. https://doi.org/https://doi.org/10.1016/j.jneb.2016.09.005

Table 1

Descriptive Statistics of the Study Sample

	M(sd)
Age (yrs)	55.8(12.6)
BMI (kg/m^2)	36.0(6.4)
	N(%)
Female	367(61.3)
Age groups	
<43 years old	108(18.0)
43-68 years old	395(65.9)
>68 years old	96(16.0)
Education groups	
<4 yr degree	263(43.9)
4 yr degree	185(30.9)
Advanced degree	149(24.9)
BMI Status	
Overweight	73(12.2)
Obese class 1	250(41.7)
Obese class 2	141(23.5)
Obese class 3	135(22.5)
Race	
African American	39(6.5)
American Indian/Native Hawaiian	2(0.3)
Asian	6(1.0)
Unknown	10(1.7)
White	542(90.5)
Ethnicity	
Hispanic	19(3.2)
Non-Hispanic	577(96.3)
Unknown	3(0.5)

Note. M(sd): mean and standard deviation; N(%): number and percentage. Two participants did not report education level.

Table 2

Model fit Statistics for all Models

	N	χ^2 (df)	RMSEA (90% CI)	CFI	SRMR	BIC
CFAs						
Null model	598	4993.430(276)	0.169(0.165, 0.173)	<0.001	0.336	33283.249
Single factor	598	1302.319(252)	0.083(0.079, 0.088)	0.777	0.073	28180.214
Six orthogonal factors	598	1385.526(242)	0.089(0.084, 0.093)	0.758	0.206	28355.091
Six correlated factors	*598*	--	--	--	--	--
Six correlated factors[a]	598	669.446(215)	0.059(0.054, 0.065)	0.896	0.062	26475.553
Six correlated factors[b]	**598**	**603.978(194)**	**0.059(0.054, 0.065)**	**0.900**	**0.061**	**25258.044**
Hierarchical model	598	877.616(246)	0.066(0.061, 0.070)	0.866	0.067	27647.106
Hierarchical model[a]	598	773.666(224)	0.064(0.059, 0.069)	0.874	0.066	26553.317
Hierarchical model[b]	598	704.591(203)	0.064(0.059, 0.070)	0.878	0.066	25333.069
Hierarchical model[c]	598	790.032(224)	0.065(0.060, 0.070)	0.873	0.069	26632.605
Four correlated factors	598	870.723(246)	0.065(0.061, 0.070)	0.868	0.064	27642.499
Four correlated factors[a]	598	776.946(224)	0.064(0.059, 0.069)	0.873	0.064	26562.233
Four correlated factors[b]	598	711.158(203)	0.065(0.060, 0.070)	0.876	0.064	25346.147
Four correlated factors[d]	598	683.097(224)	0.059(0.054, 0.064)	0.892	0.062	26501.857
Four correlated factors[e]	**598**	**587.699(203)**	**0.056(0.051, 0.062)**	**0.901**	**0.060**	**25427.627**

Note. CFAs: Confirmatory Factor Analyses; df: degrees of freedom; RMSEA: Root Mean Squared Error of Approximation; CI: Confidence interval; CFI: Comparative Fit Index; SRMR: Standardized Root Mean Square Residual; BIC: Bayesian Information Criteria. Italics indicate model specifications with a non-positive definite covariance matrix. Bolded values reflect the models with the acceptable fit to these data. [a]Item 3 removed. [b]Items 3 and 1 removed. [c]Item 11 removed. [d]Item 17 removed. [e]Items 17 and 21 removed.

Table 3

Baseline Values of Social Provision Scale Scores from the Full and Trimmed Scales

	M(sd)	Composite factor reliability	
		Six-factor model	Four-factor model
Guidance	12.65(2.52)/**9.39(1.92)**	.842	
Worth reassurance	10.10(2.12)	.661	.663
Social integration	11.61(2.05)	.681	.680
Attachment	11.98(2.60)	.813	
Nurturance	9.36(2.39)	.718	.716
Reliable alliance	12.62(2.40)/**9.40(1.87)**	.810	
Intimacy	37.17(7.00)/**31.34(5.83)**		.921

Note. M(sd): mean and standard deviation; n(%): number and percentage. Bolded scale scores reflect the mean score of scales after removal of item 3 for Guidance, 1 for Reliable Alliance, and 17 and 21 for Intimacy. Composite factor reliability was calculated for the scales after item removal.

Table 4

Model fit Statistics for Analyses of Invariance of the Covariance Matrices According to Demographic Characteristics for the Full Scale and the Trimmed Scale

	X^2(df)	RMSEA(90% CI)	CFI	SRMR
Full Scale				
Gender	359.676(300)	0.026(0.013, 0.035)	0.988	0.072
Age	896.894(600)	0.050(0.043, 0.056)	0.947	0.078
Education	818.117(600)	0.043(0.035, 0.050)	0.960	0.075
BMI status	651.738(600)	0.022(<0.001, 0.033)	0.989	0.071
Items 3 and 1 Removed				
Gender	306.067(253)	0.027(0.013, 0.037)	0.988	0.072
Age	745.738(506)	0.049(0.041, 0.056)	0.951	0.079
Education	685.269(506)	0.042(0.034, 0.050)	0.962	0.077
BMI status	538.304(506)	0.019(<0.001, 0.032)	0.992	0.071
Items 17 and 21 Removed				
Gender	507.480(256)	0.058(0.050, 0.065)	0.938	0.123
Age	982.559(509)	0.068(0.062, 0.075)	0.898	0.129
Education	945.134(509)	0.066(0.059, 0.072)	0.904	0.127
BMI status	755.435(509)	0.052(0.044, 0.060)	0.937	0.127

Note. df: degrees of freedom; RMSEA: Root Mean Squared Error of Approximation; CI: Confidence interval; CFI: Comparative Fit Index; SRMR: Standardized Root Mean Square Residual; BMI: Body mass index.

Table 5

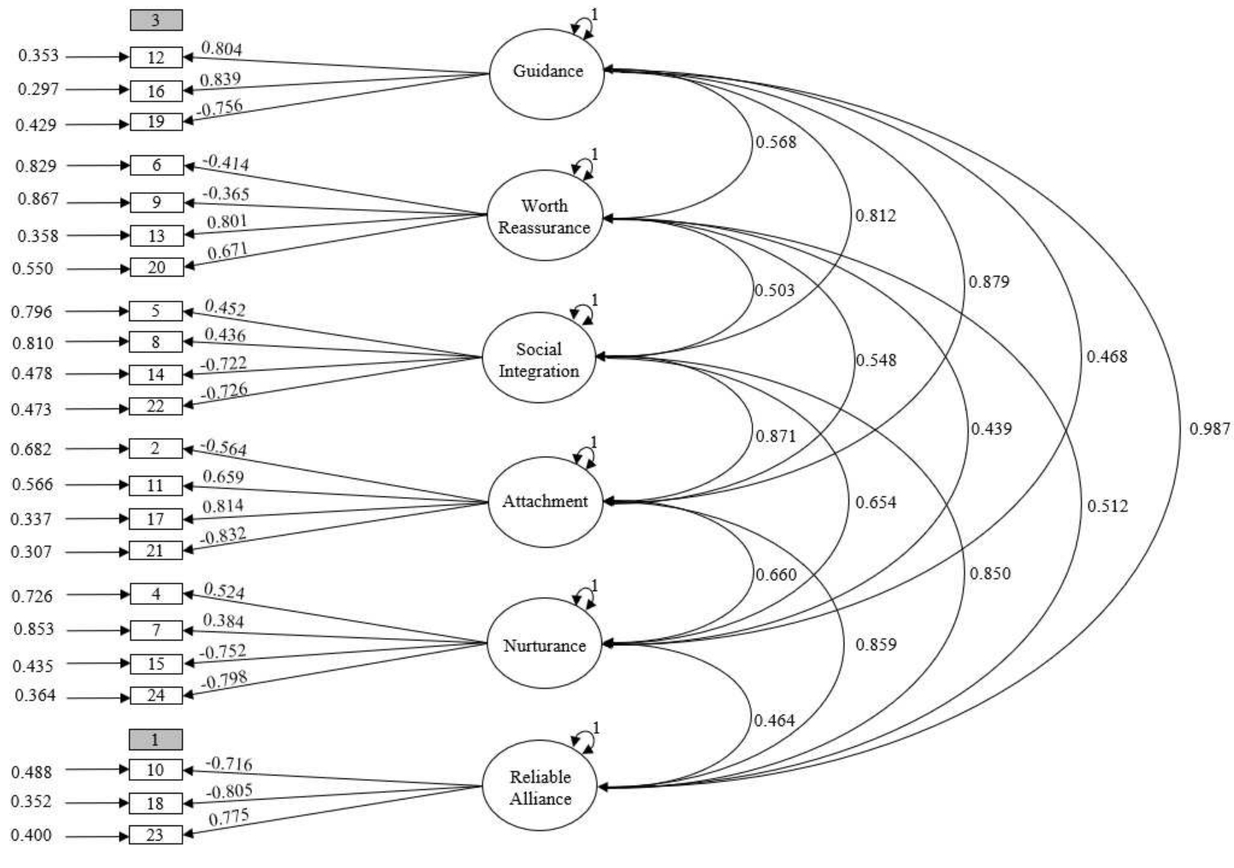
Bivariate Correlations Between Social Provision Component Scores From the Full and Trimmed Scales and Outcome Variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Guidance	--	.42**	.63**	.78**	.34**	.86**		.07	.04	-.04
2. Worth Reassurance	.42**	--	.36**	.38**	.31**	.39**	.43**	-.21**	.20**	-.23**
3. Social Integration	.60**		--	.66**	.42**	.60**	.67**	.03	.10*	-.12**
4. Attachment	.75**			--	.48**	.74**		.10*	.03	-.03
5. Nurturance	.33**				--	.33**	.41**	.00	.10*	-.15**
6. Reliable Alliance	.81**					--		.12**	.03	-.03
7. Intimacy		.43**	.64**		.35**		--	.09*	.05	-.03
8. Weight	.06					.10*	.09*	--	-.15**	.17**
9. PA Score	.03					.03	.05		--	-.14**
10. Dietary Intake	-.01					-.01	-.03			--

Note. * $p \leq .05$; ** $p \leq .01$. PA: Physical activity. 1. Guidance; 2. Worth Reassurance; 3. Social Integration; 4. Attachment; 5. Nurturance; 6. Reliable Alliance; 7. Intimacy; 8. Weight; 9. PA score; 10. Dietary Intake. Correlations above the diagonal are correlations for the full scales, below the diagonal are correlations using the trimmed scales.

Figure 1

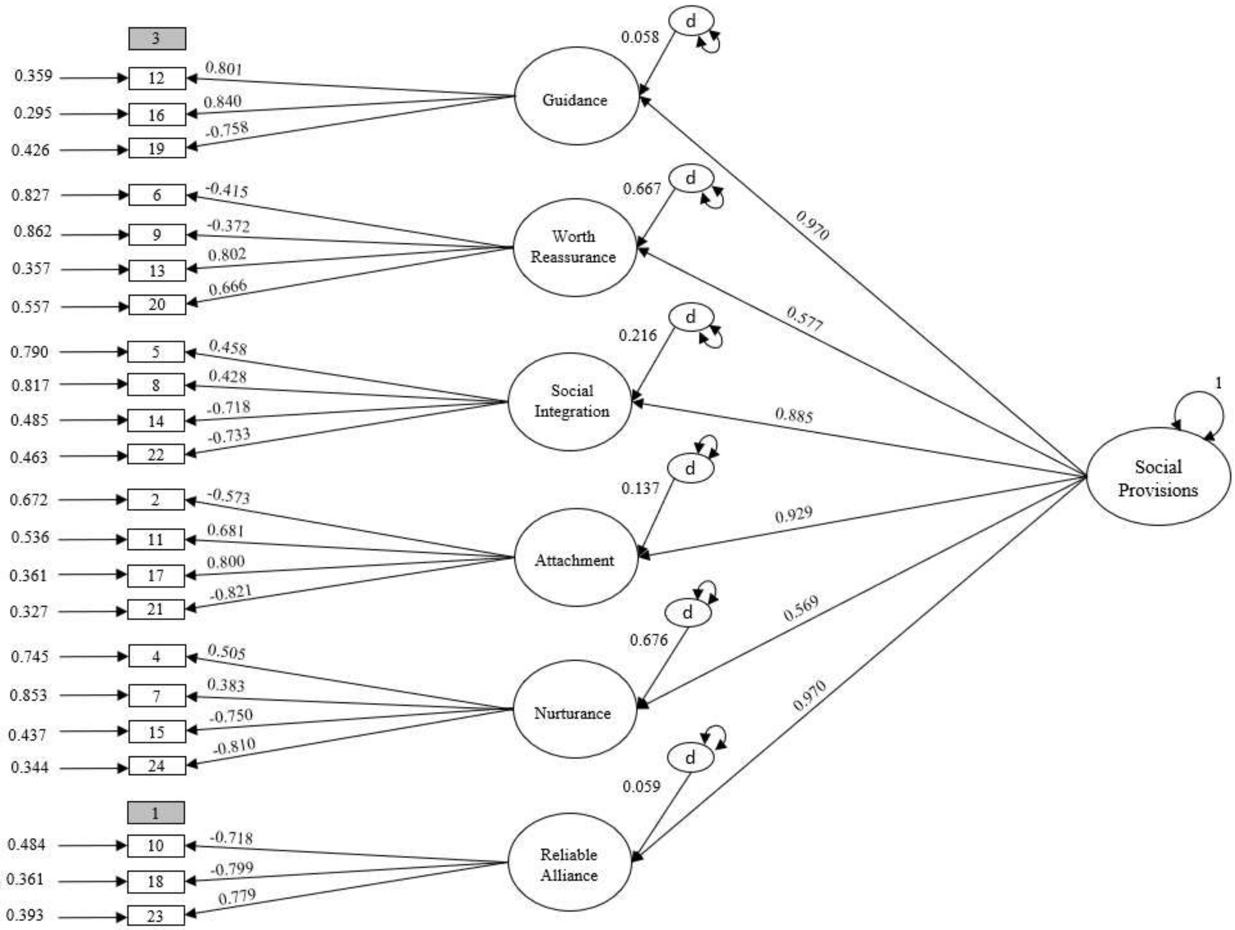
Illustration of the Six Correlated Factor Model After Removing Items 3 & 1



Note. Item numbers are reflective of survey presentation in the Appendix which aligns with the original scale publication (Cutrona and Russell, 1987).

Figure 2

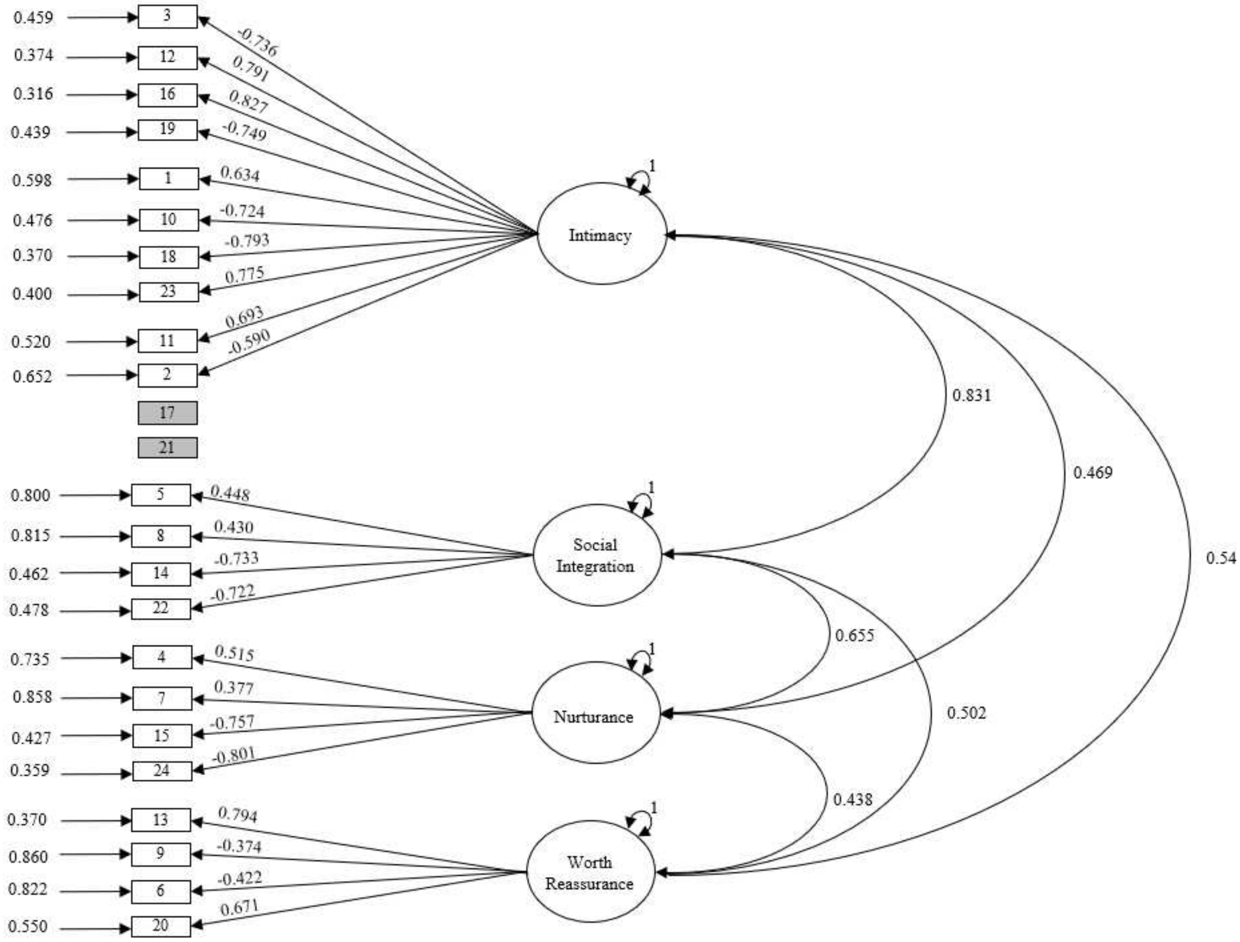
Illustration of the Hierarchical Model After Removing Items 3 & 1



Note. Item numbers are reflective of survey presentation in the Appendix which aligns with the original scale publication (Cutrona and Russell, 1987).

Figure 3

Illustration of the Four-Factor Model After Removing Items 17 & 21.



Note. Item numbers are reflective of survey presentation in the Appendix which aligns with the original scale publication (Cutrona and Russell, 1987).

Appendix
The Weight Management Related Social Provisions Scale

Instructions to participants: This questionnaire is about you and your relationships with other people. It is focused on weight management. Weight management is about either trying to lose weight or maintain a healthy weight. Please indicate how much you agree or disagree with each statement.

If you feel a statement is VERY TRUE you would mark Strongly Agree. If you feel a statement REALLY does not describe your relationships, you would answer Strongly Disagree.

Rating Scale:

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

1. There are people I know who will help me with managing my weight if I really need it.
2. I do not have close personal relationships with other people interested in my weight management goals.
3. There is no one I can turn to for guidance on managing my weight in times of stress.
4. There are people who call on me for help managing their weight.
5. There are people who watch their weight that enjoy the same social activities that I do.
6. Other people do not think I am good at managing my weight.
7. I feel responsible for taking care of someone else who is working on getting to a healthy weight.
8. I am with a group of people who think the same way I do about managing their weight.
9. I do not think other people respect how I work on managing my weight.
10. If something went wrong, no one would help me with my weight management goals.
11. I have close relationships that make me feel good about managing my weight.
12. I have someone to talk to about weight management decisions in my life.

13. There are people who value my weight management skills and abilities.
14. There is no one who has the same weight management interests and concerns as me.
15. There is no one who needs my help managing their weight.
16. I have a trustworthy person to turn to it I have problems with managing my weight.
17. I feel a strong emotional tie with at least on other person who is working on weight management.
18. There is no one I can count on for help with my weight management goals if I really need it.
19. There is no one I feel comfortable talking about weight management problems with.
20. There are people who admire my weight management talents and abilities.
21. I do not have a feeling of closeness with anyone working on weight management.
22. There is no one who likes to do the things that I like to do to manage my weight.
23. There are people I can count on when sticking with my weight management goals gets really tough.
24. No one needs me to help them with their weight management goals.

Scoring:

A summary score for each component is calculated such that a high score indicates that the individual is receiving that provision. Items that are asterisked should be reverse scored before summing. Sum the following items to derive the respective component score:

Guidance: 3*, 12, 16, 19*

Reassurance of Worth: 6*, 9*, 13, 20

Social Integration: 5, 8, 14*, 22*

Attachment: 2*, 11, 17, 21*

Nurturance: 4, 7, 15*, 24*

Reliable Alliance: 1, 10*, 18*, 23