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# The Use of Support People to Improve the Weight-Related and Psychological Outcomes of Adults with Obesity: A Randomised Controlled Trial

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**Running title:** Support people for weight management

**Disclosure statement:** ER, JT and IC designed the study. ER and JT developed the intervention manuals and provided supervision to the trial clinicians. KM managed the data file and undertook the statistical analyses. All authors reviewed and provided input into successive drafts of the manuscript.

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## Abstract

**Objectives:** To investigate whether training individuals from the personal networks of adults with obesity in the skills of motivational interviewing enhances the anthropometric and psychological outcomes of a cognitive-behavioural weight loss intervention.

**Methods:** Adults with obesity ($N$ = 201) were randomised to participate in 26 sessions of cognitive behaviour therapy (CBT) for weight loss either alone (CBT-A) or with the addition of a support person (CBT-SP). Outcomes were assessed at the end of the 12-month intervention and at a follow-up one year later.

**Results:** Analyses indicated negligible additive effect for the CBT-SP versus the CBT-A condition, although the quality of the patient's relationship with their support person predicted the anthropometric outcomes. Across conditions, significant improvements were observed for all anthropometric (weight, body mass index, and waist circumference) and psychological (self efficacy, weight-related quality of life, weight satisfaction, and binge eating) variables between baseline and post-treatment, and baseline and the follow-up.

**Conclusions:** The benefits of the cognitive-behavioural weight loss program were found to extend to psychological variables. Yet the lack of evidence for the additive benefits of including support people in treatment suggests a need to develop more effective training programs for support people in weight management.

**Trial Registration:** anzctr.org.au Trial ID: ACTRN12611000509965


**Keywords:** obesity treatment; social support; motivational interviewing; cognitive behaviour therapy

## Introduction

Traditional behavioural programs for adults with obesity have been successful in producing weight loss, although this is typically followed by weight regain after treatment cessation (Butryn, Webb, & Wadden, 2011). In an attempt to improve outcomes, these programs have been augmented by the inclusion of cognitive components designed to target the dysfunctional cognitions related to unhealthy weight control behaviours. While still few in number, combined cognitive-behavioural interventions for adults with obesity have yielded some promising results. For example, cognitive treatment has been found to enhance certain outcomes attained by a behavioural approach such as greater reductions in shape and weight concerns and binge eating (Nauta, Hospers, Kok, & Jansen, 2000; Nauta, Hospers, & Jansen, 2001). In terms of weight-related outcomes, Werrij et al. (2009) found that a cognitive-behavioural program resulted in a significant reduction of 1.36 BMI points at the end of treatment, with this reduction fully maintained one year later. Other cognitive-behavioural programs, however, have not resulted in sustained weight loss. For instance, while Cooper et al. (2010) found that the majority of their participants (greater than 70%) attained a clinically-meaningful amount of weight loss at the end of a 24-session, 44-week, one-to-one cognitive-behavioural program, these initial weight losses were followed by weight regain in the period after treatment, with a regain of almost 90% of lost weight three years after treatment.

Thus, while promising, investigating modifications to cognitive-behavioural interventions for adults with obesity is warranted to not only improve their effectiveness (especially in terms of consistently yielding weight-loss maintenance over the long-term) but also their scalability so that they can be made available to wider sections of the affected population. Unfortunately, there is typically a trade-off between these requirements, with the most effective interventions in terms of long-term weight loss entailing highly intensive and/or extended interventions (Middleton, Patidar, & Perri, 2012). While ongoing patient-

provider contact has therefore been recommended as the most effective strategy for long-term weight management (Butryn, Webb, & Wadden, 2011), this does not provide a feasible solution to the obesity problem given the substantial demands this approach places on healthcare services.

Optimising the social support for weight management from non-professionals (such as family members, friends, colleagues, weight loss group members, and community members, referred to henceforth as 'support people') has the potential to improve both the effectiveness and scalability of weight loss programs. Specifically, utilising support people to augment the input provided by health professionals capitalises on the established effectiveness of social support for weight loss and maintenance (Greaves et al., 2011), without necessitating the intensive and long-term involvement of formal healthcare systems. Indeed, in certain circumstances support people can match (Leahey & Wing, 2013) or even exceed (Israel & Saccone, 1979) the outcomes attained through therapist contact. This may be due in part to the fact that support people can be present when and where most of the dynamics regarding eating and physical activity occur.

Despite the potential for support people to improve the effectiveness and scalability of lifestyle interventions for obesity, there are also limitations associated with such an approach. One limitation is specific to those interventions in which the support people themselves are seeking to lose weight. Here it has been found that the inclusion of support people only increases the weight-loss maintenance of individuals with obesity if the support people are themselves successful in losing weight (Gorin et al., 2005). Yet this strategy is of limited utility since only a minority of the participants with obesity in the Gorin et al. (2005) study had support people who were successful at weight loss, and not all available support people will be in need of weight loss themselves.

A more general limitation pertaining to the utilisation of support people to assist weight management is their use of strategies that may be ineffective or even exacerbate the individual's problems with weight control. For instance, one study found that the cluster of patients who did not experience a weight loss of at least 5% of initial body weight were differentiated from those who did on the basis of the former's *higher* involvement of friends in making dietary changes (Yank et al., 2014). Similarly, Wing and Jeffery (1999) found that higher family support for healthy eating, as well as for physical activity, predicted less weight loss from baseline to 10 months. Such findings are perhaps not surprising given that the use of ineffective strategies for supporting individuals with obesity in weight management has been found to be pervasive, while access to effective forms of support appears minimal. For instance, in a study by Zwickert and Rieger (2014), the vast majority of participants with obesity reported that members of their social support network utilised unhelpful strategies in relation to the participant's weight, such as engaging in controlling behaviours (e.g., offering unsolicited dietary advice or pressuring the individual to diet) that are known to interfere with the individual's motivation to manage their weight and success in doing so (Gorin, Powers, Koestner, Wing, & Raynor, 2014; Ryan & Deci, 2000; Silva et al., 2010; Silva et al., 2011; Teixeira, Silva, Mata, Palmeira, & Markland, 2012; Williams, Grow, Freedman, Ryan, & Deci, 1996). Also highlighting how the greater involvement of family and friends may actually hinder weight management are the results from a study by Kiernan et al. (2012) in which it was found that 90% of women with obesity rarely or never experienced effective support for healthy eating from their friends, with 78% reporting the same lack of access to effective support from their family. Thus, in their utilisation of ineffective forms of weight management support, and limited access to effective forms of support, the greater involvement of family and friends in weight management may actually exacerbate the individual's difficulties with weight control.

In contrast to ineffective forms of support for weight management, motivational interviewing is a form of interaction designed to build an individual's intrinsic motivation to change (Miller & Rollnick, 2013). A growing evidence base supports its effectiveness in obesity, with a meta-analysis of 11 randomised controlled trials finding that motivational interviewing demonstrated a medium effect size for weight loss over and above the control conditions, and that higher amounts of weight loss were seen in those trials which utilised motivational interviewing as an adjunct to group-based behavioural weight loss programs (Armstrong et al., 2011). However, to our knowledge, no previous research has addressed teaching motivational interviewing skills to the support people of individuals with obesity. Preliminary work suggests that interventions informed by motivational interviewing are helpful in the context of eating disorders. Specifically, interventions have been designed to teach the carers of individuals with eating disorders communication skills so that they can enhance the individual's motivation to recover (Goddard, Raenker et al., 2013). For instance, carers are taught to elicit intrinsic motivation for change through strategies such as developing a relationship based on warmth, acceptance, affirmation and emphasising autonomy; discussing the reasons for and against change; and building self-efficacy for change (for a more detailed description, see Table 1 in Goddard, Raenker et al., 2013). These carer interventions have been found to be generally well-received by individuals with anorexia nervosa who have positive attitudes towards involving carers in their care and believe this benefits their recovery (Goddard, Macdonald, & Treasure, 2010). This approach has also been found to result in significant reductions in carer distress (Hibbs, Rhind, Leppanen, & Treasure, 2015), with carer distress known to predict patient distress and eating disorder symptoms (Goddard, Salerno et al., 2013). Thus the present study investigates whether the weight loss and maintenance outcomes in adults with obesity participating in a cognitive-behavioural weight management program can be improved by including support

people trained in motivational interviewing strategies. It is anticipated that by employing a unique strategy to alter the social context of obese patients (i.e., producing motivationally-skilled support people), individuals with obesity will have the requisite support to more effectively manage their weight both during and after treatment.

In addition to assessing weight-related outcomes, a secondary aim of the present study is to investigate the psychological outcomes of patients with obesity. Lasikiewicz, Myrissa, Hoyland, and Lawton (2014) note in their systematic review of 36 studies focused on psychological outcomes that there has been less investigation of the potential psychological versus medical benefits of weight loss programs. Yet attention to psychological outcomes is paramount given that various indices of psychological distress (such as impaired health-related quality of life [Rieger, Wilfley, Marino, Stein, & Crow, 2005], poor body image [Schwartz & Brownell, 2004], and binge eating [de Zwaan, 2001]) are elevated in populations with obesity, and that psychological constructs (such as low self-efficacy [Elfhag & Rössner, 2005], poor body image [Haines, Kleinman, Rifas-Shiman, Field, & Austin, 2010], and binge eating [McGuire, Wing, Klem, Lang, & Hill, 1999]) are predictive of increases in weight. While previous research suggests that behavioural and cognitive-behavioural interventions for weight management can result in psychological benefits, these studies have generally addressed a limited range of psychological constructs (i.e., primarily health-related quality of life and depression) and longer-term follow-ups are lacking to determine if psychological improvements are maintained even with weight regain (Lasikiewicz et al., 2014). Moreover, some studies demonstrate either no benefit or even worse outcomes of behavioural weight loss programs for psychological functioning. For example, an investigation of the long-term effects of a behavioural weight loss program for overweight individuals with type 2 diabetes found that the program reduced the risk of progressing to mild or greater symptoms of depression and resulted in less deterioration in

physical functioning relative to an educational control condition but had no effect on the mental component of health-related quality of life (Rubin et al., 2014), while another study found a worse impact on various indices of health-related quality of life in the behavioural relative to the pharmacological or placebo conditions (Marrero et al., 2014).

The present study will compare the effectiveness of a cognitive-behavioural weight management program with and without the addition of support people trained in motivational interviewing strategies, on both weight-related and psychological outcomes. It is hypothesised that the cognitive-behavioural weight management program will result in significant improvements in weight-related and psychological outcomes at the end of treatment and a year after treatment cessation, and that these outcomes will be further improved by the addition of support people.

## Methods

### Trial Design

The study's methods have been described in detail elsewhere (Rieger, Treasure, Swinbourne, Adam, Manns, & Caterson, 2014). Briefly, the study comprised a two-site (Sydney and Canberra, Australia), two-arm, randomised controlled trial in which adults with obesity participated in a one-year cognitive behaviour therapy (CBT) weight management program either alone (CBT-A) or with the addition of support people (CBT-SP). Assessments were at baseline (beginning of treatment), 12 months (end of treatment), and 24 months (follow-up after a one-year period of no treatment).

All participants provided written consent. The study protocol was approved by the Human Research Ethics Committees of the Australian National University, the University of Sydney, and the Royal Prince Alfred Hospital, Sydney.

### Participants

Power calculations indicated that a sample of 100 participants, 50 in each condition, would be needed to detect differences between CBT-A versus CBT-SP at a .05 level of significance with a power of 80%. This power was computed based on a within-cell standard deviation of 10 units and an average CBT-SP effect of an additional 5kg weight loss at the one-year follow-up compared to CBT-A. Our pilot trial on CBT-A yielded an attrition rate of approximately 25% of patients at the point of the one-year follow-up (Rieger, Dean, Steinbeck, Caterson, & Manson, 2009) but since attrition rates for obesity trials can be substantially higher (Moroshko, Brennan, & O'Brien, 2011), we opted for a conservative attrition rate of 50%. Accordingly, a minimum of 200 participants (100 in each condition) was needed for the present study.

Participants were eligible for inclusion in the trial if they were 18-65 years old, had a body mass index (BMI $kg/m^2$) $\geq 30$, and had a member from their social network who was able to attend the program for support people. The latter were patient-selected, and comprised diverse relationships such as partners, siblings, adult children, parents, friends, and colleagues. Exclusion criteria for the patients included major psychiatric or medical conditions that would preclude full participation in the study, current treatment for obesity, current treatments known to affect eating or weight, and pregnancy.

Two-hundred and one patients were deemed to be eligible to participate on this basis and were randomised to one of the two intervention conditions using a computer-generated randomisation program. Using this randomised sequence, a research assistant at each site prepared sequentially-numbered, opaque envelopes that concealed condition allocation. The clinical psychologist undertaking the baseline assessments then assigned these envelopes to participants in the order they completed this assessment. Neither the clinicians running the intervention groups nor the participants were blinded to the intervention condition. Figure 1 shows the CONSORT diagram for the trial.

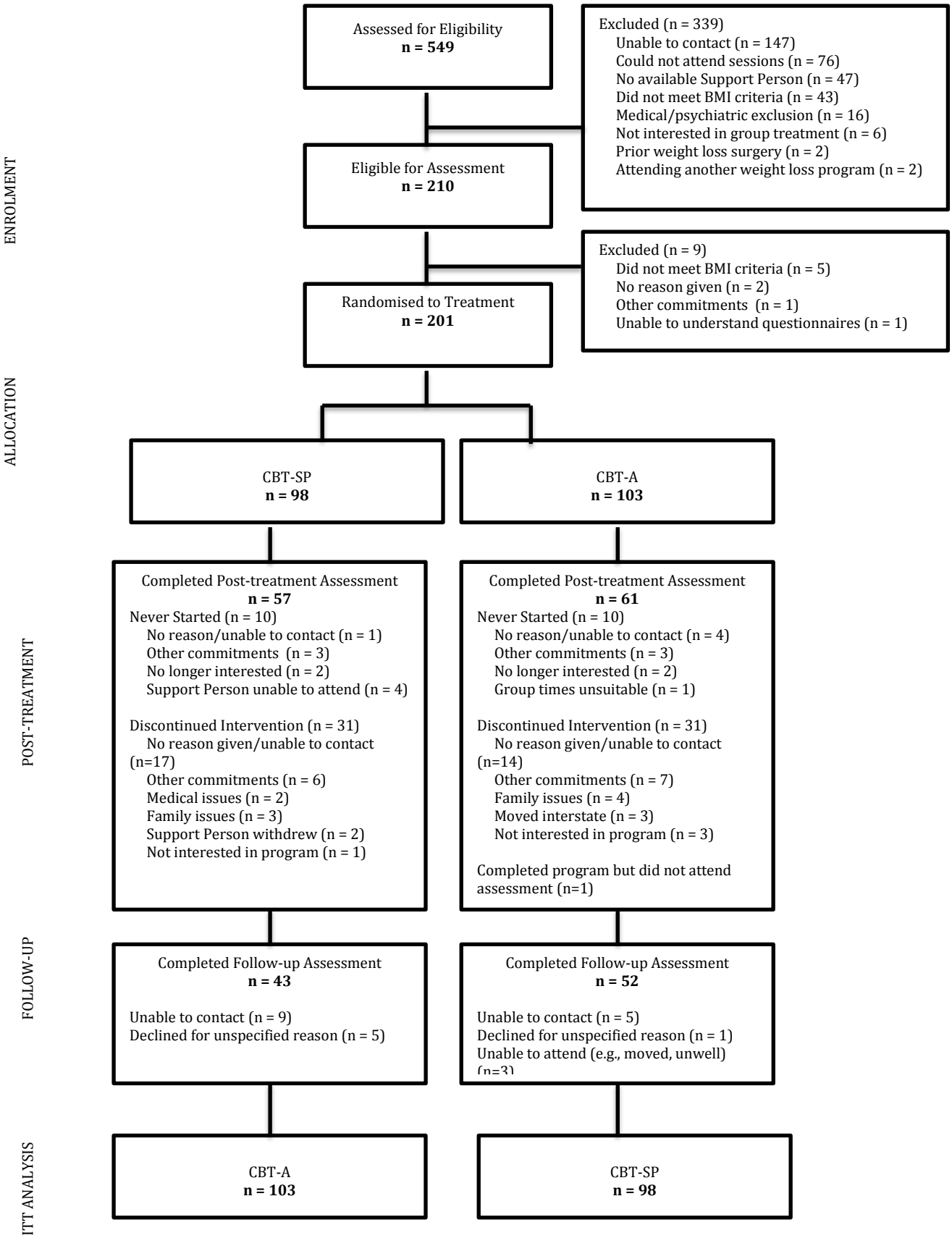


Figure 1. CONSORT diagram of flow of participants.

**Interventions**

Full details of the interventions for both the patients and their support people have been published elsewhere (Rieger et al., 2014).

**Intervention for patients.** All patients (CBT-A and CBT-SP) participated in 26, 90-minute group sessions comprised of eight weekly, 16 fortnightly, and two monthly sessions over 12 months, with 6-8 patients per group. Group membership was somewhat flexible in that if patients were unable to attend their usual group due to other commitments, they attended one of the other groups scheduled for that week to ensure that they received the session content. Nine (5%) of the patients who commenced treatment attended a group other than their allocated group during the course of the intervention, usually on only one occasion. Treatment was conducted in a series of cohorts, from August 2010 to November 2013, with the final assessment undertaken in November 2014.

The program was developed by the authors (ER and JT) on the basis of published manuals on cognitive-behavioural approaches for obese adults (Beck, 2007; Cooper, Fairburn, & Hawker, 2003) and motivational interviewing (Miller & Rollnick, 2013). It focused on teaching cognitive-behavioural skills for dietary modification and increasing physical activity, and included both a weight loss phase (the initial 8 months) and a weight maintenance phase (the final 4 months). The initial sessions entailed education regarding the recommended caloric intake, rate of weight loss, and structure of eating, as well as instituting daily self-monitoring of eating and physical activity. Subsequent sessions taught a range of cognitive and behavioural skills to assist with weight control such as goal-setting, strategies for managing cravings (e.g., stimulus control, ‘urge surfing’, and distraction), strategies for managing social situations that trigger overeating (e.g., assertiveness training), strategies for managing emotional triggers of overeating (e.g., pleasant activity scheduling and relaxation training), problem-solving skills, identifying and challenging dysfunctional thoughts that

trigger overeating, graded physical activity, and targeting body dissatisfaction. Specific motivational strategies were the focus of seven sessions, and included a focus on increasing the importance of weight loss by (i) increasing awareness of the costs of eating and weight problems (e.g., health concerns) and decreasing the benefits (e.g., mood regulation) by finding non-food ways of achieving the same benefits; (ii) identifying core values and how eating and weight problems may conflict with these values; and (iii) exploring one's future across various life domains in the event of losing or not losing weight. Motivational-enhancement sessions also focused on enhancing self-efficacy for losing weight (e.g., by identifying personal qualities that can be harnessed for successful weight control). A detailed description of each session's content can be seen in Table 3 of Rieger et al. (2014).

**Intervention for support people.** The support people of patients in the CBT-SP condition participated in 10, 90-minute group sessions comprised of support people alone, with 4-6 participants per group. These sessions commenced eight weeks after the start of the patients' program. The program for support people consisted of six fortnightly sessions followed by a four-month period for support people to practice their support skills. An additional three fortnightly sessions were then held. After a further one-month period for support people to practice these additional support skills, the tenth and final session was held. The rationale for starting the support people intervention eight weeks after the commencement of the patient program was two-fold. Firstly, in accordance with the principles of motivational interviewing, the training of the support people sought to emphasise that the patients have the expertise to manage their weight and that the support person's role is to elicit this expertise. Such an emphasis sought to minimise engagement in controlling behaviours on the part of the support person. Thus in the initial eight weeks of the intervention the focus was on helping patients to develop their expertise in fundamental weight management skills. Secondly, after eight weekly groups, the patient groups were held

fortnightly. In order to partially compensate for this reduction in support from the clinician and group, this was considered to be an ideal time for meetings between the patient and their support person to commence.

The support people program was developed by the authors (ER and JT) on the basis of published manuals on motivational interviewing (Miller & Rollnick, 2013; Rosengren, 2009) and programs for support people in the context of substance misuse (Smith & Meyers, 2004) and eating disorders (Treasure, Smith, & Crane, 2007). The aim of the intervention was to enable support people to become skilled in eliciting self-motivation for weight control from the patients. To help patients increase the importance of weight loss to them, support people were instructed in questions designed to elicit from patients the costs of their eating and weight problems, as well as questions designed to help patients identify the benefits of their eating and weight problems with a view to discussing with their support person alternative (non-food) ways of obtaining these benefits. To help patients increase their self-efficacy for weight loss, support people were instructed in questions designed to elicit from patients statements of confidence in their weight loss abilities. Instruction in communication skills primarily focused on the use of affirmations, asking open-ended questions, avoiding unsolicited advice-giving, and the primacy of good listening skills. Support people were encouraged to have regular support sessions with the patient for reviewing with the patient their weight goals, and identifying the strategies the patient is using to achieve these goals or the obstacles that are impeding goal attainment. Support people were also instructed in problem-solving skills to encourage discussing weight-related problems with the patient in a collaborative manner. Throughout, support people were encouraged to adopt a guiding style and avoid the extremes of being controlling or passive in their support role. A detailed description of each session's content can be seen in Table 5 of Rieger et al. (2014).

**Therapists' training and treatment fidelity.** The interventions for patients and support people were implemented by five therapists with postgraduate degrees in clinical psychology who had extensive experience in CBT and participated in training provided by the second author on motivational interviewing. To ensure that the interventions for patients and support people were delivered in a standardised, quality manner, (i) each intervention was fully manualised, (ii) the therapists participated in weekly supervision sessions with the first author, and (iii) all sessions were recorded and regularly reviewed by the first author.

**Assessment**

Weight (kg) was measured in light clothing using an electronic scale with a 200kg capacity, accurate to 0.1kg, and height (cm) was measured using a wall-mounted stadiometer. Waist circumference was measured at the middle distance between the last rib and the top of the iliac crest (World Health Organization, 2008).

The Weight Efficacy Lifestyle Questionnaire (Rossi, Rossi, Velicer, & Prochaska, 1995) was used to assess confidence in managing one's eating across situations that comprise a high-risk for overeating. Higher total scores indicate greater self-efficacy, with a Cronbach's alpha of 0.90 in the present study. The Impact of Weight on Quality of Life-Lite (Kolotkin, Crosby, Kosloski, & Williams, 2001) was utilised to assess the perceived impact of obesity on various domains of functioning. Higher total scores indicate a greater overall negative impact, with a Cronbach's alpha of 0.75 in the current study. The Weight subscale of the Body Esteem Scale (Mendelson, Mendelson, & White, 2001) was administered to assess satisfaction with one's weight. Higher scores indicate greater weight satisfaction, with a Cronbach's alpha of 0.71 in this study. The Binge Eating Scale (Gormally, Black, Daston, & Rardin, 1982) was used to assess the tendency to engage in disinhibited eating. Higher scores indicate greater disinhibited eating, with a Cronbach's alpha of 0.84 in the present study. In addition, patients in the CBT-SP condition were administered the Quality of

Relationships Inventory (Pierce, Sarason, & Sarason, 1991), which assessed the perceived level of support (Cronbach's alpha = 0.82), conflict (Cronbach's alpha = 0.86), and depth (Cronbach's alpha = 0.66) in the relationship with their support person. Finally, treatment satisfaction was measured using session attendance and a questionnaire developed for the purposes of this study in which participants rated both the usefulness (from 1 'not at all' to 5 'extremely') and the frequency of their use (from 1 'never' to 5 'always') of the key strategies taught in the program.

**Statistical Analysis**

Prior to statistical analysis, data were inspected to assess distribution and detect outliers. Data were screened at the sample and condition level, including visual inspection for normality. Negative skew was observed on the Support and Depth subscales of the Quality of Relationships Inventory (QRI) at baseline and post-treatment. However, although transformations were considered, they were deemed inappropriate as participants were encouraged to select strong support people for participation in the trial. Extreme values were investigated by calculating z-scores. Participants with values exceeding 3.29 were retained in baseline measures given the large sample size (Tabachnick & Fidell, 2013). However, for the smaller samples (i.e., QRI baseline measures and post-treatment and follow-up measures of the anthropometric and psychological variables), analyses were performed with and without outliers. No change was identified in the results, and thus the full sample was retained and reported in the paper.

Data were analysed using mixed models repeated measures (MMRM) ANOVA on an intent-to-treat (ITT) basis (Verbeke & Molenberghs, 2000). This procedure was employed so as to use all available data for participants in the trial, including that from participants who did not complete all assessments (Gadbury, Coffey, & Allison, 2003; West, 2009). Analyses included fixed effects for time (baseline, post-treatment, and follow-up) and intervention

condition (CBT-A vs. CBT-SP), and condition×time interactions. Models were also run with random effects for site (Canberra, Sydney), with no difference from the results reported for the fixed effect models. Twenty participants ($n$ = 10 CBT-A; $n$ = 10 CBT-SP) who were randomised did not attend any treatment sessions but completed baseline measures, and thus were retained. Models used an unstructured covariance structure and restricted maximum likelihood estimation, with the CBT-SP condition (compared to the CBT-A condition) and baseline measurement (compared to post-treatment and follow-up, respectively) acting as the reference categories. In order to assess maintenance effects between post-treatment and follow-up, a post-hoc analysis for each variable was performed with post-treatment as the reference category.

For those in the CBT-SP condition only, analyses were also undertaken regarding patient perceptions of the quality of the relationship with their support person. First, changes in relationship quality from baseline to post-treatment were analysed using repeated measures ANOVA to evaluate the effectiveness of the support people training program. Second, the effect of relationship quality on outcomes was also examined using MMRM including effects for time on the anthropometric outcomes. Specifically, analyses included the effect of baseline relationship quality measures on anthropometric changes from baseline to post-treatment.

Statistical analysis undertaken at a single time point employed chi-square tests with Yates Continuity Correction for categorical variables, and analysis of variance for continuous variables. All analyses employed IBM Statistics SPSS 23 and a significance level of $p < .05$.

## Results

### Sample Characteristics

Table 1 displays descriptive data for the demographic, anthropometric, and psychological variables at baseline. There were no significant differences between the two

treatment conditions in terms of age, gender, education, marital status, weight, BMI, waist circumference, self-efficacy, quality of life, weight-related body esteem, and binge eating. In addition, there were no significant baseline differences between those who completed the one-year follow-up assessment and those who did not on each of these variables, with the exception of age. As shown in Table 1, those participants who discontinued prior to completing the follow-up assessment were significantly younger at baseline ($M$ = 45.36, $SD$ = 11.68) than those who completed this final assessment ($M$ = 48.89, $SD$ = 11.09).

**Anthropometry**

Descriptive data on the outcome measures by condition and time point for the ITT analyses are presented in Table 2. Table 3 displays the analyses for the weight-related outcomes. There were no significant differences between the CBT-A and CBT-SP conditions, or condition-by-time interactions, on any of the anthropometric variables. There was a significant reduction for all participants (combining the CBT-A and CBT-SP conditions) between baseline and post-treatment, and baseline and follow-up respectively, for weight (-6.20kg, -3.96kg), BMI (-2.22kg/$m^2$, -1.55kg/$m^2$), and waist circumference (-6.73cm, -5.03cm). There was a significant weight regain of 2.24kg between post-treatment and follow-up, but weight remained significantly improved from baseline. No significant difference between post-treatment and follow-up for BMI or waist circumference was evident.

**Table 1.** Baseline characteristics of participants at by condition and by completers versus non-completers of the follow-up assessment

| Characteristic | CBT-A ($n$ = 103) ***M (SD)*** | CBT-SP ($n$ = 98) ***M (SD)*** | Condition Comparison | Completers versus Non-completers Comparison |
|---|---|---|---|---|
| Age (years) | 46.93 (12.01) | 47.1 (11.0) | $F$ (1, 199) = .02, $p$ = .902 | $F$ (1, 199) = .4.81, $p$ = .029 |
| Weight (kg) | 105.99 (21.32) | 105.17 (20.05) | $F$ (1, 199) = .08, $p$ = .778 | $F$ (1, 199) = .52, $p$ = .472 |
| BMI (kg/m$^2$) | 37.64 (6.61) | 37.78 (6.02) | $F$ (1, 199) = .022, $p$ = .881 | $F$ (1, 199) = 1.39, $p$ = .241 |
| Waist (cm) | 113.05 (14.86) | 112.05 (13.98) | $F$ (1, 199) = .24, $p$ = .622 | $F$ (1, 199) = .001, $p$ = .973 |
| Self-Efficacy | 98.65 (28.62) | 98.14 (26.86) | $F$ (1, 198) = .017, $p$ = .896 | $F$ (1, 198) = .70, $p$ = .404 |
| Quality of Life | 76.15 (18.14) | 77.01 (18.87) | $F$ (1, 198) = .109, $p$ = .742 | $F$ (1, 198) = 1.06, $p$ = .305 |
| Body Esteem Weight | 6.25 (3.56) | 6.59 (4.30) | $F$ (1, 195) = .375, $p$ = .541 | $F$ (1, 195) = .34, $p$ = .559 |
| Binge Eating | 17.01 (7.67) | 17.06 (7.74) | $F$ (1, 194) = .935, $p$ = .335 | $F$ (1, 194) = .14, $p$ = .710 |
| | ***n* (%)** | ***n* (%)** | | |
| Gender (female) | 72 (69.90) | 76 (77.55) | $\chi^2$ (1, $n$ = 201) = 1.51, *phi* = .09 | $\chi^2$ (1, $n$ = 201) = .000, *phi* = -.001 |
| Education (tertiary) | 63 (61.17) | 65 (66.33) | $\chi^2$ (5, $n$ = 199) = 8.72, *Cramer's V* = .21 | $\chi^2$ (5, $n$ = 199) = 5.04, *Cramer's V* = .16 |
| Married/de facto | 58 (56.31) | 54 (55.10) | $\chi^2$ (3, $n$ = 199) = .59, *Cramer's V* = .06 | $\chi^2$ (3, $n$ = 199) = 6.86, *Cramer's V* = .19 |

Note. Comparisons on continuous measures by condition and completer status at baseline used one-way ANOVA. Comparisons on categorical measures by condition and by completer status at baseline used chi square.

**Table 2.** Descriptive statistics for anthropometry and psychological variables by condition and time point

| Measure | Condition | Baseline | | Post-Treatment | | Follow-Up | |
|---|---|---|---|---|---|---|---|
| | | *n* | *M (SD)* | *n* | *M (SD)* | *n* | *M (SD)* |
| Anthropometry | | | | | | | |
| Weight (kg) | CBT-A | 103 | 105.99 (21.32) | 61 | 100.37 (22.27) | 52 | 102.81 (21.50) |
| | CBT-SP | 98 | 105.17 (20.05) | 57 | 97.25 (17.70) | 43 | 97.76 (18.68) |
| BMI ($kg/m^2$) | CBT-A | 103 | 37.64 (6.61) | 61 | 36.00 (7.64) | 52 | 36.42 (6.38) |
| | CBT-SP | 98 | 37.78 (6.02) | 57 | 35.00 (4.94) | 43 | 34.94 (5.10) |
| Waist (cm) | CBT-A | 103 | 113.05 (14.86) | 60 | 106.96 (16.03) | 47 | 107.71 (14.86) |
| | CBT-SP | 98 | 112.05 (13.98) | 56 | 103.93 (13.04) | 43 | 105.26 (14.11) |
| Psychological | | | | | | | |
| Self-Efficacy | CBT-A | 102 | 98.65 (28.62) | 59 | 121.09 (30.41) | 48 | 115.33 (26.29) |
| | CBT-SP | 98 | 98.14 (26.86) | 55 | 127.73 (27.55) | 41 | 120.86 (28.96) |
| Quality of Life | CBT-A | 102 | 76.15 (18.14) | 59 | 65.85 (20.38) | 49 | 65.2 (18.03) |
| | CBT-SP | 98 | 77.01 (18.87) | 53 | 61.89 (16.95) | 40 | 59.9 (19.06) |
| Body Esteem Weight | CBT-A | 100 | 6.25 (3.56) | 58 | 10.34 (5.79) | 49 | 9.45 (5.22) |
| | CBT-SP | 97 | 6.59 (4.30) | 55 | 9.85 (5.22) | 40 | 9.33 (5.36) |
| Binge Eating Scale | CBT-A | 98 | 18.10 (8.11) | 58 | 11.41 (7.34) | 47 | 12.11 (7.63) |
| | CBT-SP | 98 | 17.01 (7.67) | 54 | 10.37 (6.28) | 41 | 11.71 (7.19) |
| | | | *n* (%) | | *n* (%) | | *n* (%) |
| Binge Eating Severity | | | | | | | |
| None | CBT-A | 98 | 49 (50.0) | 58 | 49 (84.5) | 47 | 38 (80.9) |
| | CBT-SP | 98 | 52 (53.1) | 54 | 45 (83.3) | 41 | 32 (78.0) |
| Moderate | CBT-A | 98 | 35 (35.7) | 58 | 6 (10.3) | 47 | 5 (10.6) |
| | CBT-SP | 98 | 35 (35.7) | 54 | 9 (16.7) | 41 | 7 (17.1) |
| Severe | CBT-A | 98 | 14 (14.3) | 58 | 3 (5.2) | 47 | 4 (8.5) |
| | CBT-SP | 98 | 11 (11.2) | 54 | 0 (0) | 41 | 2 (4.9) |

Note: *M* = Mean, *SD* = Standard Deviation
Post-treatment (12 months); Follow-up (24 months)

**Table 3.** Fixed effects estimates for anthropometry outcomes from mixed models

| | Weight | | | BMI | | | Waist | | |
|---|---|---|---|---|---|---|---|---|---|
| | B (SE) | 95% CI | Sig. | B (SE) | 95% CI | Sig. | B (SE) | 95% CI | Sig. |
| *Primary Analysis* | | | | | | | | | |
| Intercept | 105.17 (2.09) | [101.04, 109.29] | **<0.001** | 37.78 (0.64) | [36.52, 39.04] | **<0.001** | 112.05 (1.46) | [109.17, 114.92] | **<0.001** |
| Between Groups | | | | | | | | | |
| CBT-A vs CBT-SP | 0.83 (2.92) | [-4.94, 6.59] | 0.778 | -0.13 (0.89) | [-1.89, 1.63] | 0.881 | 1.00 (2.04) | [-3.01, 5.02] | 0.622 |
| Repeated Effects | | | | | | | | | |
| Post vs Baseline | -6.20 (0.94) | [-8.07, -4.33] | **<0.001** | -2.22 (0.34) | [-2.89, -1.56] | **<0.001** | -6.73 (1.06) | [-8.82, -4.63] | **<0.001** |
| FU vs Baseline | -3.96 (1.30) | [-6.54, -1.38] | **0.003** | -1.55 (0.47) | [-2.48, -0.61] | **0.001** | -5.03 (1.29) | [-7.58, -2.47] | **<0.001** |
| Interactions | | | | | | | | | |
| Post vs Baseline × CBT-A vs CBT-SP | 1.03 (1.31) | [-1.56, 3.62] | 0.432 | 0.39 (0.46) | [-0.53, 1.31] | 0.409 | 0.66 (1.47) | [-2.24, 3.56] | 0.654 |
| FU vs Baseline × CBT-A vs CBT-SP | 0.93 (1.78) | [-2.59, 4.45] | 0.602 | 0.45 (0.64) | [-0.82, 1.73] | 0.481 | 0.69 (1.78) | [-2.85, 4.23] | 0.699 |
| *Post-Hoc Analysis* | | | | | | | | | |
| Repeated Effects | | | | | | | | | |
| FU vs Post | 2.24 (0.98) | [.29, 4.19] | **.025** | .68 (.37) | [-.05, 1.40] | .068 | 1.70 (.99) | [-.28, 3.67] | .091 |
| Interactions | | | | | | | | | |
| FU vs Post × CBT-A vs CBT-SP | -.10 (1.33) | [-2.75, 2.54] | .938 | .07 (.50) | -.92, 1.05] | .890 | .03 (1.38) | [-2.71, 2.77] | .981 |

Note: Primary Analysis refers to outcomes in which baseline acted as the reference category for time. Post-Hoc Analysis refers to outcomes in which post-treatment acted as the reference category for time, with only effects pertaining to comparisons between post-treatment and follow-up – indicating maintenance effects - included in the table.
Post = Post-treatment (12 months); FU = Follow-Up (24 months)
Bold values denote significant at $p < .05$

Percentage weight change (for the completers only) across the trial is presented in Table 4. Overall, there was a mean loss of 5.43% of baseline weight between baseline and post-treatment ($n$ = 118) and 3.64% from baseline to follow-up ($n$ = 95), and a mean percentage weight regain of 2.46% between post-treatment and follow-up ($n$ = 89). There was no significant difference between conditions in mean percentage weight loss at each time point. Nor was there a significant difference between conditions in those with ≥ 5% loss of baseline weight, which was achieved by 54 (45.8%) and 33 (34.7%) participants at post-treatment and follow-up, respectively.

**Self-Efficacy**

Table 5 displays the analyses for the psychological outcomes. No significant differences in self-efficacy between the two conditions, or condition-by-time interactions, were observed. However, in the overall sample (combining the CBT-A and CBT-SP conditions), there were significant increases in self-efficacy between baseline and post-treatment, and baseline and follow-up. A significant decrease in self-efficacy was observed between post-treatment and follow-up, but this remained a significant improvement compared to baseline.

**Quality of Life**

Results from the quality of life analyses in Table 5 revealed no significant main effect for condition, but a significant reduction in the impact of weight on quality of life was observed between baseline and post-treatment, and baseline and follow-up in both the CBT-A and CBT-SP. In addition, a significant interaction between condition (CBT-A versus CBT-SP) and the change between post-treatment and follow-up, was observed, with estimated marginal means for the interaction suggesting a small increase in the negative impact of weight on quality of life in the CBT-A condition of 1.32 units compared to a continued decrease in the CBT-SP of -3.16 units during this period.

**Table 4.** Weight change across the trial

| | Condition | N | *M (SD) or n (%)* | Comparison |
|---|---|---|---|---|
| | | | *M (SD)* | |
| Post vs Baseline | CBT-A | 61 | -5.13 (6.94) | $F$ (1, 116) = .245, $p$ = .621 |
| | CBT-SP | 57 | -5.76 (6.64) | |
| FU vs Baseline | CBT-A | 52 | -3.03 (6.44) | $F$ (1, 93) = .615, $p$ = .435 |
| | CBT-SP | 43 | -4.37 (10.15) | |
| FU vs Post | CBT-A | 48 | 2.35 (4.74) | $F$ (1, 87) = .029, $p$ = .866 |
| | CBT-SP | 41 | 2.59 (8.46) | |
| | | | *n* (%) | |
| ≥5% Post | CBT-A | 61 | 29 (47.5) | $\chi^2$ (1, n=118) = .05, $p$ = .83, *phi* = .04 |
| | CBT-SP | 57 | 25 (43.9) | |
| ≥5% FU | CBT-A | 52 | 19 (36.5) | $\chi^2$ (1, n=95) = .04, $p$ = .85, *phi* = .04 |
| | CBT-SP | 43 | 14 (32.6) | |

Note: M = Mean, SD = Standard Deviation, Post = Post-treatment (12 months), FU = Follow-Up (24 months)

**Table 5.** Fixed effects estimates for psychological outcomes for mixed models

| | Self-Efficacy | | | Quality of Life | | | Body Esteem Weight | | | Binge Eating | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B (SE) | 95% CI | Sig. | B (SE) | 95% CI | Sig. | B (SE) | 95% CI | Sig. | B (SE) | 95% CI | Sig. |
| *Primary Analysis* | | | | | | | | | | | | |
| Intercept | 98.14 (2.81) | [92.60, 103.67] | **<0.001** | 77.01 (1.87) | [73.32, 80.70] | **<0.001** | 6.59 (0.40) | [5.80, 7.38] | **<0.001** | 17.01 (0.80) | [15.44, 18.58] | **<0.001** |
| Between Groups | | | | | | | | | | | | |
| CBT-A vs CBT-SP | 0.51 (3.93) | [-7.23, 8.26] | 0.896 | -0.86 (2.62) | [-6.02, 4.30] | 0.742 | -0.34 (0.56) | [-1.45, 0.76] | 0.541 | 1.03 (1.12) | [-1.18, 3.25] | 0.358 |
| Repeated Effects | | | | | | | | | | | | |
| Post vs Baseline | 30.07 (3.84) | [22.46, 37.67] | **<0.001** | -10.79(1.68) | [-14.12, -7.47] | **<0.001** | 3.10 (0.66) | [1.78, 4.42] | **<0.001** | -6.29 (0.82) | [-7.91, -4.67] | **<0.001** |
| FU vs Baseline | 22.27 (3.61) | [15.13, 29.42] | **<0.001** | -13.95(2.01) | [-17.93, -9.97] | **<0.001** | 2.57 (0.68) | [1.23, 3.91] | **<0.001** | -4.65 (0.96) | [-6.56, -2.75] | **<0.001** |
| Interaction | | | | | | | | | | | | |
| Post vs Base × CBT-A vs CBT-SP | -6.05 (5.34) | [-16.62, 4.51] | 0.259 | -0.80 (2.32) | [-5.40, 3.79] | 0.729 | 0.87 (0.92) | [-0.97, 2.70] | 0.351 | -0.72 (1.15) | [-2.99, 1.55] | 0.533 |
| FU vs Base × CBT-A vs CBT-SP | -3.99 (4.96) | [-13.81, 5.84] | 0.423 | 3.67 (2.74) | [-1.76, 9.11] | 0.183 | 0.43 (0.92) | [-1.40, 2.25] | 0.654 | -1.70 (1.33) | [-4.35, 0.94] | 0.204 |
| *Post-Hoc Analysis* | | | | | | | | | | | | |
| Repeated Effects FU vs Post | -7.79 (3.23) | [-14.19, -1.39] | **.018** | -3.16 (1.64) | [-6.41, .10] | .057 | -.53 (.62) | [-1.76, .70] | .396 | 1.64 (.73) | [.18, 3.10] | **.028** |
| Interactions | | | | | | | | | | | | |
| FU vs Post × CBT-A vs CBT-SP | 2.07 (4.43) | [-6.72, 10.85] | .642 | 4.48 (2.20) | [.10, 8.86] | **.045** | -.44 (.84) | [-2.11, 1.24] | .605 | -.99 (1.01) | [-2.99, 1.01] | .329 |

Note: Primary Analysis refers to outcomes in which baseline acted as the reference category for time. Post-Hoc Analysis refers to outcomes in which post-treatment acted as the reference category for time, with only effects pertaining to comparisons between post-treatment and follow-up – indicating maintenance effects - included in the table. Base = Baseline; Post = Post-treatment (1 2months); FU = Follow-Up (24 months)
Bold values denote significant at $p < .05$

**Body Esteem: Weight**

Results in Table 5 revealed no significant difference between the two conditions, or condition-by-time interactions, for weight-related body esteem. However, a significant improvement between baseline and post-treatment, and baseline and follow-up, for both the CBT-A and CBT-SP conditions was found. There was no significant change between post-treatment and follow-up, supporting maintenance of improvements in weight-related body esteem during this period.

**Binge Eating**

Results in Table 5 revealed no significant differences between the CBT-A and CBT-SP conditions, or condition-by-time interactions, for binge eating tendencies. However, significant decreases in binge eating tendencies from baseline to post-treatment, and from baseline to follow-up, for both the CBT-A and CBT-SP conditions were found. A significant increase in binge eating tendencies was found between post-treatment and follow-up, but this remained significantly lower than baseline. Further investigation of binge eating categorisation, reported in Table 2, demonstrated a significant decrease in the severity of binge eating categorisation across the trial but no difference between conditions at baseline ($\chi^2$ [2, $n$ = 196] = .45, *Cramer's V* = .05, $p$ = .799), post-treatment ($\chi^2$ [2, $n$ = 112] = 3.63, *Cramer's V* = .18, $p$ = .163), or follow-up ($\chi^2$ [2, $n$ = 88] = 1.11, *Cramer's V* = .11, $p$ = .574).

**Completer Analyses**

Analysis of treatment outcomes was also undertaken using mixed within-between subjects ANOVA for completers, as shown in Table 6. These findings were generally consistent with the ITT analyses, such that significant time effects, but not condition or time-by-condition effects, were observed.

**Table 6.** Completer analysis using mixed between-within subjects analysis of variance

| Measure | Condition | *n* | Baseline *M (SD)* | Post-Treatment *M (SD)* | Follow-Up *M (SD)* | *p*-values Pre-Post | Pre-FU | Post-FU |
|---|---|---|---|---|---|---|---|---|
| Anthropometry | | | | | | | | |
| Weight (kg) | CBT-A | 48 | 105.80 (21.40) | 100.39 (22.27) | 102.50 (21.87) | **<.001** | **<.001** | **.001** |
| | CBT-SP | 41 | 103.12 (18.44) | 95.83 (17.10) | 98.24 (18.98) | | | |
| BMI (kg/m$^2$) | CBT-A | 48 | 37.71 (6.64) | 35.75 (7.03) | 36.49 (6.61) | **<.001** | **<.001** | **.003** |
| | CBT-SP | 41 | 36.84 (5.01) | 34.25 (4.70) | 35.07 (5.19) | | | |
| Waist (cm) | CBT-A | 44 | 112.68 (13.74) | 105.58 (15.42) | 107.40 (15.02) | **<.001** | **<.001** | **.008** |
| | CBT-SP | 41 | 111.39 (12.31) | 103.27 (12.89) | 105.24 (14.42) | | | |
| Psychological | | | | | | | | |
| Self-Efficacy | CBT-A | 46 | 95.09 (31.02) | 120.69 (32.43) | 115.20 (26.13) | **<.001** | **<.001** | **.005** |
| | CBT-SP | 40 | 97.95 (24.82) | 128.67 (29.98) | 120.48 (29.22) | | | |
| Quality of Life | CBT-A | 47 | 75.77 (16.36) | 64.00 (19.21) | 65.49 (18.25) | **<.001** | **<.001** | .539 |
| | CBT-SP | 37 | 70.35 (19.03) | 60.70 (17.52) | 57.81 (18.14) | | | |
| Body Esteem Weight | CBT-A | 46 | 6.73 (3.16) | 10.50 (5.64) | 9.59 (5.21) | **<.001** | **<.001** | .077 |
| | CBT-SP | 39 | 6.67 (4.14) | 10.21 (5.63) | 9.54 (5.26) | | | |
| Binge Eating Scale | CBT-A | 44 | 18.75 (8.42) | 11.30 (7.65) | 12.23 (7.55) | **<.001** | **<.001** | **.014** |
| | CBT-SP | 39 | 15.38 (7.34) | 10.00 (6.48) | 11.59 (7.30) | | | |

Note: *M* = Mean, *SD* = Standard Deviation

Pre = Pre-treatment; Post = Post-treatment (12 months); FU = Follow-up (24 months)

Bold values denote significant at $p < .05$

**Changes in Relationship Quality from Baseline to Post-treatment in the CBT-SP Condition**

Changes in patients' perceptions of the quality of the relationship with their support person (i.e., support, depth, and conflict as assessed via the Quality of Relationships Inventory) from baseline to post-treatment were investigated to provide an index of the effectiveness of the program used to train support people. Results indicated a significant decrease in ratings of relationship support from baseline (*M* = 3.39, *SD* = .51) to post-treatment (*M* = 3.15, *SD* = .71), Wilks' Lambda = .88, F (1, 54) = 7.50, *p* = .008, partial eta squared = .12. There was a trend towards a significant reduction in ratings of relationship depth from baseline (*M* = 3.30, *SD* = .57) to post-treatment (*M* = 3.11, *SD* = .65), Wilks' Lambda = .95, F (1, 54) = 2.94, *p* = .092, partial eta squared = .052. No significant changes in ratings of conflict were identified.

**Relationship Quality as a Predictor of Anthropometric Outcomes in the CBT-SP Condition**

The perceived quality of the patient's relationship with their support person (i.e., support, depth, and conflict as assessed via the Quality of Relationships Inventory) at baseline was investigated as a predictor of treatment change on the anthropometric variables for participants in the CBT-SP condition. There was a significant effect for higher perceived support from the patient's support person at baseline on greater reduction in weight (B (SE) = -4.97kg (2.13), 95%CI: [-9.22, -.72], *p* = .023), BMI (B (SE) = -1.94kg/$m^2$ (.75), 95%CI: [-3.43, -.45], *p* = .012), and waist circumference (B (SE) = -5.43cm (2.04), 95%CI: [-9.52, -1.34], *p* = .01) between baseline and post-treatment.

**Treatment Acceptability**

Treatment acceptability analyses revealed that 44 (21.9%) of patients attended all 26 sessions and 135 (67.4%) attended at least half of the sessions. The mean attendance was

17.9 (68.8%) sessions for those who attended at least one intervention session ($n$ = 181). Eighty-two patients either did not start or complete treatment (41 [41.8%] CBT-A, 41 [39.8%] CBT-SP). No significant differences were identified between the CBT-A and CBT-SP conditions on mean number of sessions attended or withdrawal from treatment.

At post-treatment, there was no significant difference identified between the CBT-A and CBT-SP conditions on the frequency of strategy use ($M$ = 3.06, $SD$ = 0.10 vs $M$ = 3.28, $SD$ = 0.10, respectively) or the usefulness of strategies taught in the program ($M$ = 4.03, $SD$ = 0.12 vs $M$ = 4.10, $SD$ = 0.12, respectively). The mean ratings indicated that patients reported using the strategies 'often' and perceived them to be 'very' useful.

## Discussion

The present study sought to investigate the additive benefits of training support people in motivational interviewing strategies, as well as determining whether the CBT weight loss intervention resulted in improved psychological (in addition to anthropometric) outcomes. There was minimal evidence for the role of the support people intervention in augmenting the outcomes of the CBT intervention, which resulted in significant improvements in each of the anthropometric and psychological variables from baseline to the end of treatment and the one-year follow-up.

Minimal evidence was found for the hypothesised greater improvements in patients with support people trained in motivational interviewing strategies relative to those who received the CBT weight loss program alone. Indeed, the only suggested greater benefit for the addition of support people was continued reduction in the negative impact of weight on quality of life for those in the CBT-SP condition from the end of treatment to the follow-up relative to a slight increase for those in the CBT-A condition.

Several factors may have accounted for this unexpected result. It is possible that support people might demonstrate additive value to interventions that are less comprehensive

than a cognitive-behavioural approach, such as lifestyle interventions relying largely on psychoeducation. Alternatively, it is possible that training support people in motivational interviewing strategies does not have an overall positive impact on the outcomes of adults with obesity, although this interpretation is contrary to research attesting to the beneficial role of social support in weight management (Butryn et al., 2011; Greaves et al., 2011; Shaikh, Yaroch, Nebeling, Yeh, & Resnicow, 2008) and in terms of broad indices of psychological and physical well-being (e.g., Holt-Lunstad, Smith, & Layton, 2010), as well as research supporting the benefits of motivational interviewing for weight loss (Armstrong et al., 2011).

The limited evidence for the greater effectiveness of the support people intervention may have been due to inadequacies in the training program for support people. This interpretation is somewhat speculative as no baseline assessment of each support person's skills was undertaken, which precludes a direct evaluation as to whether or not support people increased their mastery of motivational interviewing skills as a result of the program. However, it is consistent with the finding that, overall, patient perceptions of the level of support in the relationship with their support person declined over the course of the treatment program (with a trend towards a decrease in the perceived depth of this relationship). Fundamental to motivational interviewing is developing a strong, collaborative relationship with the individual based on safety, acceptance, affirmation, and respect for autonomy so that the individual is able to fully explore and resolve their ambivalence regarding change. Thus, if support people improved in their capacity to build a collaborative relationship with the patients as a result of taking part in the training program, there should have been an improvement on the support and depth dimensions of the Quality of Relationships Inventory. It is possible that a 10-session group training program for support people is insufficient to overcome the pervasive use of ineffective forms of weight management support by significant others (Kiernan et al., 2012; Zwickert & Rieger, 2014). The lack of success in the

training program for support people is in accordance with findings from previous research that has sought to teach motivational interviewing skills. While there is evidence that non-professionals can be trained to successfully deliver interventions for complex conditions (Patel et al., 2010), studies also attest to the challenge of training even clinicians in motivational interviewing, such that research is needed to identify the optimum methods for training non-professionals in these skills (Miller & Rose, 2009). For example, future implementations of the current program for training support people might benefit from including personal follow-up coaching as each support person attempts to implement the skills learned during training sessions in real-world settings (Miller & Rose, 2009).

In the present study, patients who experienced greater perceived support from their support person (i.e., the extent to which patients could rely on their support person for assistance) at the commencement of the trial experienced greater improvements in weight, BMI, and waist circumference at the end of treatment. These findings are of a preliminary nature given that it cannot be determined whether support *per se* or a correlate of support predicts anthropometric outcomes. However, they are suggestive of the relevance of social support for successful weight management, such that interventions that can successfully enhance the social support available to obese individuals may yield improved outcomes. Thus further research investigating the predictive role of level of perceived support for the support person is warranted, as is research seeking to identity characteristics (in addition to their perceived supportiveness) of effective support people.

While not enhanced by the inclusion of support people, the CBT weight loss program resulted in significant improvements in both anthropometric and psychological outcomes. Significant reductions from baseline to the end of treatment were evident on each of the weight-related variables (i.e., weight, BMI, and waist circumference), and were comparable to previous weight loss programs (e.g., Christian, Tsai, & Bessesen, 2010;

Diabetes Prevention Program Research Group, 2002), including cognitive-behavioural interventions (e.g., Werrij et al., 2009). Specifically, patients across the two CBT conditions lost a mean 5.4% of initial body weight at the end of treatment and 46% of patients experienced clinically significant weight loss (in terms of ≥ 5% loss of baseline weight) (Williamson, Bray, & Ryan, 2015). Comparable to other lifestyle weight loss trials (Butryn et al., 2011), including cognitive-behavioural trials (Cooper et al., 2010), there was a significant increase in weight from the end of treatment to the follow-up one year later, with patients regaining approximately one-third of lost weight, although the final measure was still significantly lower than at baseline. At the follow-up assessment, patients in the two CBT conditions lost a mean 2.2% of initial weight and 35% of patients had attained a weight loss of at least 5% of their baseline weight. In contrast to weight, patients maintained their post-treatment reductions in BMI and waist circumference at follow-up.

As well as improvements in the anthropometric variables, the CBT program produced significant improvements on each of the psychological measures at the end of treatment. Those psychological variables that demonstrated some deterioration from post-treatment to follow-up (i.e., weight-related self-efficacy and binge eating) were nevertheless still significantly improved relative to baseline. Importantly, some of the improvements in psychological functioning were fully maintained at follow-up (i.e., weight-related quality of life in the CBT-SP condition and weight-related body esteem for both conditions), despite the occurrence of some weight regain at this time. Also utilising a cognitive-behavioural approach, Werrij et al. (2009) similarly found that improvements in psychological functioning were either fully (shape and weight concerns and self-esteem) or partially (depression) maintained 12 months after treatment ended.

While improved psychological well-being in people with obesity is a beneficial outcome in itself, it may also be of importance for future success in weight management. For

instance, the pivotal role of self-efficacy in the context of weight management has been demonstrated (Linde, Rothman, Baldwin, & Jeffery, 2006), with a review of studies addressing 25 predictors of fruit and vegetable consumption among adults finding that self-efficacy was only one of three factors (along with social support and dietary knowledge) for which strong evidence was found (Shaikh, Yaroch, Nebeling, Yeh, & Resnicow, 2008). Since the longer-term impacts of obesity interventions on psychological functioning have been minimally investigated (Lasikiewicz et al., 2014), further research on psychological outcomes is needed to provide a more comprehensive evaluation of these programs, to identify the elements of intervention that are effective in enhancing different aspects of psychological functioning, and to further understand the role of psychological factors in weight management.

In addition to the aforementioned limitations, the study was limited by an attrition rate of 30.3% (of those who started treatment) for treatment completion, 41.3% for completion of the post-treatment assessment at 12 months, and 52.7% for completion of the follow-up assessment at 24 months. Attrition rates vary widely in lifestyle interventions and high attrition rates are common, although little is known regarding the predictors of attrition (Miller & Brennan, 2015; Moroshko, et al., 2011). While the attrition rate in the present study was comparable to some similar studies (e.g., Werrij et al., 2009), it has implications for its power to detect significant differences between conditions and the generalisability of the findings. Regarding the latter, those who completed the follow-up assessment were significantly younger than those who did not complete this final assessment.

To our knowledge, this is the first randomised controlled trial to evaluate the additive benefits of training the support people of individuals with obesity in motivational interviewing skills. While the data yielded little evidence for the benefits of such an approach, findings suggest that this may have been due to limitations in the program for

training support people given that patients reported a reduction in perceptions of support and depth in the relationship with their support people over the course of the program. That greater perceived support in the relationship between the patient and their support person at baseline predicted better post-treatment weight-related outcomes suggests that identifying effective strategies for building supportive relationships between patients and significant others may improve anthropometric outcomes. The inability of health professionals to provide the degree of support necessary for a problem as prevalent and chronic as obesity, together with evidence of limited quality support for weight management (Kiernan et al., 2012; Zwickert & Rieger, 2014) and pervasive obesity stigma in the social networks of individuals with obesity (Brewis, 2014), underscore the importance of pursuing this line of research so that individuals have available, ongoing, quality support for long-term weight management.

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