Mental Health in Family Medicine 2013;10:15–21

Article

Patient's weight 6 months after depression treatment is not affected by either clinical remission or enrolment in collaborative care management

Kurt B Angstman MS MD
Department of Family Medicine, Mayo Clinic, Rochester, MN, USA

Todd W Wade MD
Department of Family Medicine, Mayo Clinic, Rochester, MN, USA

Ramona S DeJesus MD
Division of Primary Care Internal Medicine, Mayo Clinic, Rochester, MN, USA

Kathy L MacLaughlin MD
Department of Family Medicine, Mayo Clinic, Rochester, MN, USA

Gregory L Angstman MD
Department of Family Medicine, Mayo Clinic Health System- Austin, Austin, MN, USA

ABSTRACT

Objective The primary aim of this study was to determine whether enrolment in collaborative care management (CCM) for treatment of major depression would have a significant impact on 6-month changes in weight compared with patients treated by their primary care provider with usual care. The secondary aim was to determine whether clinical remission would also affect 6-month weight changes.

Design A retrospective chart review study included 1550 patients who had been diagnosed with major depression or dysthymia and who had a Patient Health Questionnaire (PHQ-9) score of $\geq$ 10 with follow-up data (PHQ-9 score and weight) at 6 months.

Subjects The study sample consisted of adult patients (aged $\geq$ 18 years) from primary care practices, representing all body mass index (BMI) categories. The exclusion criteria were a diagnosis of bipolar disorder, recent obstetric delivery or recent gastric bypass procedure.

Measurements Weight was measured at index and 6 months, with BMI calculated from electronic medical record data. Patient assessment data (including PHQ-9 score and clinical diagnosis) and demographic variables (age, gender, marital status and clinical location) were also collected.

Results With regression modelling, neither enrolment in CCM ($P = 0.306$) nor clinical remission ($P = 0.828$) was associated with a significant weight gain.

Conclusion After 6 months, enrolment in CCM had no significant impact on weight gain or weight loss among patients treated for depression, nor was improvement to clinical remission a factor in the patient's weight after 6 months. Incorporating a weight loss management intervention within the model may be warranted if concomitant weight reduction is desired.

Keywords: collaborative care management, depression, obesity, primary care

Introduction

The association between obesity and depression has been repeatedly reported; the incidence of depression in obese women is as high as 25%, and obese individuals with depression do poorly in weight loss programmes.[1–3] A meta-analysis of 15 studies (n = 58 745) demonstrated a bidirectional relationship between these two conditions. That is, obesity increased the risk of depression (unadjusted odds ratio (OR) = 1.55); this was most pronounced among Americans. Likewise, baseline depression increased the likelihood of developing obesity (OR = 1.58), and was an independent predictor.[4]

Depression scores had been reported to predict adherence during weight loss interventions. Thus overweight individuals with higher baseline depression scores were more likely to drop out of such interventions or to maintain static body weight.[5] Recent innovative approaches to the management of patients with depression and obesity have shown promise in smaller studies. A structured weight loss treatment programme alone or in conjunction with depression management has demonstrated both weight loss and improved mood.[6,7] Behavioural weight loss intervention alone or when combined with cognitive behavioural therapy (CBT) resulted in weight loss and improved mood.[8]

Symptoms of depression such as hopelessness, diminished interest, poor concentration and poor sleep may impair the ability of the patient to make important and informed health-related decisions. One study demonstrated that by concentrating on motivation and the patient's psychological state, they were able to improve decision making related to weight loss intervention, bariatric surgery and psychotherapy.[9] Another study incorporated behavioural activation with nutrition counselling. Emphasis was placed on redirecting depressive behaviours such as overeating to weight-loss-promoting behaviours such as exercise. The end result was decreased caloric intake, and weight loss.[10] A recent meta-analysis determined that nearly all non-pharmacological weight loss strategies resulted in decreased depressive symptoms. It appeared that neither the duration nor the intensity of the treatment affected the degree of symptom change.[11]

The collaborative care management (CCM) model has been shown to improve depression outcome and maintain remission.[12,13] In previous studies of patients under CCM, we have demonstrated a negative impact on clinical outcomes for depression with worsening depression severity, clinical diagnosis of recurrent versus first episode of depression and the patient self-assessment scores for increased anxiety symptoms and an abnormal screening for bipolar disorder.[14–17] A recent study (n = 1111) demonstrated no impact on depression outcomes at 6 months based on the patient's body mass index (BMI) at enrolment.[18] This would be contrary to the hypothesis that obesity has a significant predictive value in depression remission. Interestingly, similar findings were reported in a smaller, 1-year randomised trial (n = 194) that compared a weight loss drug vs. lifestyle modification vs. combined weight loss drug and lifestyle modification vs. weight loss drug plus brief therapy for depressed and obese patients. The combined therapy yielded the greatest weight loss and the drug therapy alone yielded the least weight loss. There was no relationship between baseline depression scores and BMI, nor was there a relationship between depression scores and percentage of initial weight loss at subsequent assessment intervals. Furthermore, there did not appear to be any significant difference in weight loss for patients with different levels of depression severity.[19]

In this study, we sought to evaluate whether there was a 6-month weight difference among depressed patients who were enrolled in CCM compared with those patients who remained under usual care with their primary care provider. Based on our previous finding that baseline BMI did not affect clinical outcome, our hypothesis was that enrolment in CCM would not have a significant impact on 6-month changes in weight. The secondary hypothesis was that clinical remission would also not affect 6-month weight changes. Since the method of depression treatment (pharmacotherapy, psychotherapy, combined, etc.) may vary based on the individual patient's clinic needs over a 6-month time period, specific modalities were not a component of this study design.

Methods

CCM was initially implemented at one of four primary care sites in our institution in March 2008, and its adoption at all four sites was completed in March 2010. Approximately 100 000 adult patients are cared for by these primary care practices. Details of the CCM model and process have been described elsewhere.[17,20] Briefly, CCM at our institution is patterned after the IMPACT study[12] and involved an RN care manager with psychiatry oversight. After the initial intake visit, patients were generally contacted by phone based on clinical need. Recommendations for therapeutic changes were made to the primary care physicians by the RN care managers or psychiatrist.

This retrospective chart review study included patients diagnosed with major depression or dysthymia between 1 March 2008 and 30 June 2011, allowing for 6 months of follow-up data to 30 December 2011. The exclusion criteria were clinical diagnosis of bipolar disorder, obstetric delivery (6 months prior to or 1 year after enrolment in CCM; n = 101 patients), bariatric surgery (±1 year of enrolment in CCM; n = 4 patients) and those patients who declined to give authorisation for clinical research.

The dependent variable was weight change 6 months after a clinical diagnosis of major depression and a score on the Patient Health Questionnaire-9 (PHQ-9)[21] of $\geq$ 10. The independent variables were baseline BMI, age, gender, race, marital status, clinical diagnosis, initial and 6-month PHQ-9 score, and CCM enrolment (versus usual care). BMI was calculated from the electronic medical record by utilising a weight within ±30 days and a height within 2 years prior to or 6 months after the index date. All other data were obtained from the CCM database.

Statistical analysis was performed using MedCalc software (version 12.2.1.0, www.medcalc.org). One-way analysis of variance was utilised to determine significance ($P < 0.05$) for means across multiple groups. Chi-squared analysis was used for testing of categorical variables and, due to the non-normal distributions, Mann–Whitney testing was utilised for continuous variables. Linear regression modelling was performed using all of the listed variables. This study was reviewed and approved by the Institutional Review Board.

Results

Of the 1550 patients enrolled in the depression database and with complete data sets for this study, 867 (55.9%) were treated by their primary care provider under usual care (UC), while 683 (44.1%) were enrolled in CCM. The UC patients were older (45.9 vs. 43.2 years, P = 0.003), less likely to have recurrent depression (33.0% vs. 44.1%, $P < 0.001$) and had slightly lower initial PHQ-9 scores (15.4 vs. 15.9, P = 0.003). Six-month PHQ-9 follow-up compliance was much lower in the UC group (31.1% vs. 86.1%, $P < 0.001$), as were clinical remission rates with a PHQ-9 score of < 5, as determined with an intent-to-treat model (7.8% vs. 39.5%, $P < 0.001$) (see Table 1).

The majority of the patients (67.8%, n = 1050) experienced weight loss or no significant change in their weight from baseline (±2.5%). In total, 32% (n = 500) had a weight gain of at least 2.5% compared with baseline. The patients who gained more than 2.5% of their baseline weight (GW group) after 6 months were more likely to be younger (mean age 42.8 years) than those with weight loss of more than 2.5% (WL group) (mean age 45.9 years) and the weight neutral group (WN group) (mean age 45.5 years). A higher proportion of patients in the WN group were married (55.8%) compared with the other two groups (P = 0.014) (approximately 48%). Gender, race, baseline BMI, clinical diagnosis, initial PHQ-9 score and enrolment in CCM were not statistically significantly different between the groups (see Table 2). Six-month clinical remission (PHQ-9 score < 5), when measured on an intention-to-treat model, ranged from 20.1% to 23.2% and was not significantly different between the groups (P = 0.439).

Regression modelling for the outcome of weight gain of > 2.5% from baseline at 6 months demonstrated that other than age (OR = 0.991, P = 0.011), no other variables were an independent factor in determining this outcome. Specifically, neither enrolment in CCM (P = 0.306) nor clinical remission (P = 0.828) was associated with a significant weight gain (see Table 3).

There are two important subgroups in this study. The first subgroup of patients consisted of those who were obese at the time of diagnosis of depression. In these 633 patients, neither enrolment in CCM (P = 0.884) nor clinical remission (P = 0.908) affected the odds of weight gain after 6 months, or weight loss (P = 0.342 and P = 0447, respectively), while controlling for all other variables by regression modelling (see Table 3). The other subgroup consisted of the 500 patients who did show weight gain of more than 2.5%. The majority of these patients (79.5%, 364/458) stayed in the same BMI category over the 6-month time frame (not counting those who already had a BMI of $\geq$ 40 kg/m^2). In total, 149 of the patients who gained weight were still in the normal BMI category at the end of the 6-month time frame. Thus 77.4% (1199/1550) of the original cohort had no significant weight gain or still had a normal BMI over the course of the study (see Table 4).

Discussion

Although obesity has been shown to have a bidirectional association with clinical depression, this study failed to show a significant impact of an effective depression treatment programme on weight loss or weight gain. At 6 months, 22.8% of the 1550 patients who were either enrolled in the CCM model

Table 1 Patients diagnosed with depression and PHQ-9 $\geq$ 10, treated with collaborative care management or usual care, by variable

	Usual care	Collaborative care management	*P*-value
n = 1550	867 (55.9%)	683 (44.1%)	
Age (years)	45.9 (18.1–95.7)	43.2 (18.0–92.3)	0.003
Gender (female)	72.5% (629)	75.5% (516)	0.202
Marital status (married)	51.3% (445)	52.0% (355)	0.839
Race (white)	91.5% (793)	93.9% (641)	0.094
BMI (kg/m^2)			
< 25 (normal)	34.5% (299)	32.9% (225)	0.467
25 to < 30 (overweight)	26.2% (227)	24.3% (166)	
$\geq$ 30 to < 40 (obese)	29.6% (257)	33.4% (228)	
$\geq$ 40 (morbidly obese)	9.7% (84)	9.4% (64)	
Initial diagnosis	50.2% (435)	49.9% (341)	< 0.001
First episode	33.0% (286)	44.1% (301)	
Recurrent	16.8% (146)	6.0% (41)	
Dysthymia			
Initial PHQ-9 score	15.4 (10–27)	15.9 (10–27)	0.003
Six-month PHQ-9 follow-up compliance	31.1% (270)	86.1% (588)	< 0.001
Clinical remission rate at 6 months (PHQ-9 score < 5): intention-to-treat model	7.8% (68)	39.5% (270)	< 0.001

PHQ-9, Patient Health Questionnaire; CCM, collaborative care management; BMI, body mass index.

or receiving usual care were able to achieve weight loss of at least 2.5%. The remainder remained weight neutral or gained weight. Focusing on the CCM subset of 683 patients, there was no significant difference between the percentage with weight loss, maintenance or gain for those who achieved remission. Treating depression alone without accompanying weight reduction measures did not lead to weight loss, particularly among obese individuals with depression, whereas weight loss strategy alone appeared to improve both weight and mood. A large study targeting both obesity and depression using the collaborative care model that incorporates a behavioural weight loss programme would help to shed light on what treatment approach would best achieve a sustained response. It has been suggested that such an integrative approach should include the selection of an antidepressant that is less likely to promote weight gain, in addition to ensuring good sleep hygiene and adequate sleep, prescribing a diet and exercise plan, and instructing the patients in self-monitoring and documentation.[22]

In our study we observed that clinical remission at 6 months from the baseline measurement did not affect weight change. In obese patients (n = 203) in behavioural treatment programmes (with either a weight focus or a weight and depression focus), Simon *et al*[23] noted an association between a decrease in depression symptoms and weight loss of 5 kg or more over the first 6 months (OR = 2.20). However, the association did not last beyond 6 months. This supports the conclusion that if a patient is both obese and depressed, a treatment programme that affects both comorbidities could potentially improve both outcomes.

With regression analysis, only age appeared to significantly affect weight change at 6 months. Initial diagnosis of first vs. recurrent depression, dysthymia and initial PHQ-9 score did not affect weight. The mean PHQ-9 score among patients in

Table 2 Weight outcomes, grouped by ±2.5% changes, 6 months after diagnosis with depression and PHQ-9 score ≥ 10, by variable

	Weight loss after 6 months of at least 2.5%	Weight ± < 2.5%	Weight gain after 6 months of at least 2.5 %	*P*-value
n = 1550	353 (22.8%)	697 (45.0%)	500 (32.3%)	
Age (years)	45.9	45.5	42.8	< 0.05
Gender (female)	75.4% (266)	73.7% (514)	73.0% (365)	0.739
Marital status (married)	48.4% (171)	55.8% (389)	48.0% (241)	0.014
Race (white)	94.3% (333)	91.2% (636)	93.0% (466)	0.176
Initial BMI (kg/m²)				
< 25.0 (normal)	32.0% (113)	31.7% (221)	38.0% (190)	
25 to < 30 (overweight)	27.2% (96)	25.7% (179)	23.6% (118)	
≥ 30 to < 40 (obese)	30.3% (107)	32.7% (228)	30.0% (150)	
≥ 40 (morbidly obese)	10.5% (37)	9.9% (69)	8.4% (42)	0.332
Initial diagnosis				
First episode	48.4% (171)	50.6% (353)	50.4% (252)	
Recurrent	39.9% (141)	36.4% (254)	38.4% (192)	
Dysthymia	11.6% (41)	12.9% (90)	11.2% (56)	0.765
Initial PHQ-9 score	15.5	15.6	15.9	NS
Enrolled in CCM	44.2% (156)	44.5% (310)	43.4% (217)	0.932
Clinical remission rate at 6 months (PHQ-9 score < 5): intention-to-treat model	20.1% (71)	23.2% (162)	21.0% (105)	0.439

PHQ-9, Patient Health Questionnaire; CCM, collaborative care management; BMI, body mass index.

this study was 15, indicating at least moderate depression which might have influenced the weight outcome. Allocating patients on the basis of age and depression scores to appropriate treatment pathways may be helpful for achieving intervention goals.

Our study was conducted among community dwellers, mostly middle-aged women, who were seen in an academic institution in the midwestern USA, and the results may not be generalised to other population groups. However, we are not aware of any other studies that have examined the impact of CCM on weight change among patients with depression. This study also highlights the need to customise and integrate appropriate treatment strategies within the model when treating depression with associated comorbidity.

Conclusion

After 6 months, enrolment in the collaborative care model had no significant impact on weight gain or loss among patients treated for depression. Furthermore, improvement to clinical remission did not influence the patient's weight after 6 months. Incorporation of a weight loss management intervention into the model may be warranted if a concomitant weight reduction goal is desired.

ACKNOWLEDGEMENTS

Departmental resources were used for this project.

Table 3 Odds ratio (OR) for the outcome of weight gain of at least 2.5% 6 months after diagnosis with depression, by variable

$n = 1550$	OR	CI	*P*-value
Age	0.991	0.985–0.998	0.011
Gender (female)	0.872	0.680–1.119	0.282
Marital status (married)	0.847	0.677–1.058	0.143
Race (white)	1.096	0.720–1.670	0.669
BMI (kg/m^2)			
Normal	Referent	Referent	Referent
Overweight	0.768	0.579–1.019	0.067
Obese	0.798	0.591–1.054	0.109
Morbidly obese	0.661	0.436–1.003	0.051
Initial diagnosis			
First episode	Referent	Referent	Referent
Recurrent depression	1.020	0.806–1.300	0.867
Dysthymia	0.897	0.626–1.285	0.553
Initial PHQ-9 score	1.015	0.989–1.041	0.263
Enrolment in CCM	0.877	0.685–1.128	0.306
Clinical remission at 6 months (PHQ-9 score < 5)	0.969	0.727–1.291	0.828

The above model controls for clinical location to adjust for site-to-site variability in outcomes. PHQ-9, Patient Health Questionnaire; CCM, collaborative care management; BMI, body mass index.

Table 4 Follow-up BMI of patients who gained weight 6 months after diagnosis with depression and score of $\geq$ 10 on the PHQ-9, by baseline BMI

$P < 0.001$	Baseline BMI (kg/m^2)			
Six-month BMI (kg/m^2)	Normal ($n = 190$)	Overweight ($n = 118$)	Obese ($n = 150$)	Morbidly obese ($n = 42$)
Normal	149	0	0	0
Overweight	49	79	0	0
Obese	1	39	136	0
Morbidly obese	0	0	14	42

BMI, body mass index.

REFERENCES

1 Simon GE, Katon WJ, VonKorff M *et al*. Cost-effectiveness of a collaborative care program for primary care patients with persistent depression. *American Journal of Psychiatry* 2001;158:1638–44.

2 Clark MM, Niaura R, King TK *et al*. Depression, smoking, activity level, and health status: pretreatment predictors of attrition in obesity treatment. *Addictive Behaviors* 1996;21:509–13.

3 Carpenter KM, Hasin DS, Allison DB *et al*. Relationships between obesity and DSM-IV major depressive

disorder, suicide ideation, and suicide attempts: results from a general population study. *American Journal of Public Health* 2000;90:251–7.
4 Luppino FS, de Wit LM, Bouvy PF *et al*. Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies. *Archives of General Psychiatry* 2010;67:220–29.
5 Somerset SM, Graham L and Markwell K. Depression scores predict adherence in a dietary weight loss intervention trial. *Clinical Nutrition* 2011;30: 593–8.
6 Kerr J, Patrick K, Norman G *et al*. Randomized control trial of a behavioral intervention for overweight women: impact on depressive symptoms. *Depression and Anxiety* 2008;25:555–8.
7 Linde JA, Simon GE, Ludman EJ *et al*. A randomized controlled trial of behavioral weight loss treatment versus combined weight loss/depression treatment among women with comorbid obesity and depression. *Annals of Behavioral Medicine* 2011;41:119–30.
8 Faulconbridge LF, Wadden TA, Berkowitz RI *et al*. Treatment of comorbid obesity and major depressive disorder: a prospective pilot study for their combined treatment. *Journal of Obesity* 2011;2011: 870385.
9 Wild B, Herzog W, Wesche D *et al*. Development of a group therapy to enhance treatment motivation and decision making in severely obese patients with a comorbid mental disorder. *Obesity Surgery* 2011;21:588–94.
10 Pagoto S, Bodenlos JS, Schneider KL *et al*. Initial investigation of behavioral activation therapy for co-morbid major depressive disorder and obesity. *Psychotherapy (Chicago, Ill.)* 2008;45:410–15.
11 Fabricatore AN, Wadden TA, Higginbotham AJ *et al*. Intentional weight loss and changes in symptoms of depression: a systematic review and meta-analysis. *International Journal of Obesity* 2011;35:1363–76.
12 Unutzer J, Katon W, Callahan CM *et al*. Collaborative care management of late-life depression in the primary care setting: a randomized controlled trial. *Journal of the American Medical Association* 2002;288:2836–45.
13 Gilbody S, Bower P, Fletcher J *et al*. Collaborative care for depression: a cumulative meta-analysis and review of longer-term outcomes. *Archives of Internal Medicine* 2006;166:2314–21.
14 Angstman KB, Dejesus RS and Rohrer JE. Correlation between mental health co-morbidity screening scores and clinical response in collaborative care treatment for depression. *Mental Health in Family Medicine* 2010;7:129–33.
15 Angstman KB, Maclaughlin KL, Rasmussen NH *et al*. Age of depressed patient does not affect clinical outcome in collaborative care management. *Postgraduate Medicine* 2011;123:123–45.
16 Angstman KB, MacLaughlin KL, Williams MD *et al*. Increased anxiety and length of treatment associated with depressed patients who are readmitted to collaborative care. *Journal of Primary Care and Community Health* 2011;2:82–6.
17 Angstman KB, Pietruszewski P, Rasmussen NH *et al*. Depression remission after six months of collaborative care management: role of initial severity of depression in outcome. *Mental Health in Family Medicine* 2012;9:99–106.
18 Angstman KB, Wade TW, DeJesus RS *et al*. Patient body mass index does not predict six-month clinical outcome of depression managed under collaborative care. *Journal of Primary Care & Community Health* 2013;4:119–23.
19 Faulconbridge LF, Wadden TA, Berkowitz RI *et al*. Changes in symptoms of depression with weight loss: results of a randomized trial. *Obesity (Silver Spring, Md.)* 2009;17:1009–16.
20 Williams M, Angstman K, Johnson I *et al*. Implementation of a care management model for depression at two primary care clinics. *Journal of Ambulatory Care Management* 2011;34:163–73.
21 Spitzer RL, Kroenke K and Williams JB. Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary Care Evaluation of Mental Disorders. Patient Health Questionnaire. *Journal of the American Medical Association* 1999; 282:1737–44.
22 Crayton JW. How to manage depression in overweight or obese patients. *Current Psychiatry* 2012; 11:33–9.
23 Simon GE, Rohde P, Ludman EJ *et al*. Association between change in depression and change in weight among women enrolled in weight loss treatment. *General Hospital Psychiatry* 2010;32:583–9.

CONFLICTS OF INTEREST

Dr KB Angstman has a consulting agreement with Tamber Inc. Tamber Inc. was not involved in the study design, data analysis, or manuscript preparation.

ADDRESS FOR CORRESPONDENCE

Dr Kurt B Angstman, Department of Family Medicine, Mayo Clinic, 200 First Street, SW Rochester, MN 55905, USA. Tel: 507 538 8588; fax: 507 538 8543; email: angstman.kurt@mayo.edu

Submitted 15 December 2012
Accepted 19 May 2013