Randomized Controlled Trial to Assess Reduction of Cardiovascular Disease Risk in Patients With Bipolar Disorder: The Self-Management Addressing Heart Risk Trial (SMAHRT)

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ABSTRACT

Objectives: Persons with bipolar disorder experience a disproportionate burden of medical conditions, notably cardiovascular disease (CVD), leading to impaired functioning and premature mortality. We hypothesized that the Life Goals Collaborative Care (LGCC) intervention, compared to enhanced usual care, would reduce CVD risk factors and improve physical and mental health outcomes in US Department of Veterans Affairs patients with bipolar disorder.

Method: Patients with an *ICD-9* diagnosis of bipolar disorder and ≥ 1 CVD risk factor (N = 118) enrolled in the Self-Management Addressing Heart Risk Trial, conducted April 2008–May 2010, were randomized to LGCC (n = 58) or enhanced usual care (n = 60). Life Goals Collaborative Care included 4 weekly self-management sessions followed by tailored contacts combining health behavior change strategies, medical care management, registry tracking, and provider guideline support. Enhanced usual care included quarterly wellness newsletters sent during a 12-month period in addition to standard treatment. Primary outcome measures included systolic and diastolic blood pressure, nonfasting total cholesterol, and physical health–related quality of life.

Results: Of the 180 eligible patients identified for study participation, 134 were enrolled (74%) and 118 completed outcomes assessments (mean age = 53 years, 17% female, 5% African American). Mixed effects analyses comparing changes in 24-month outcomes among patients in LGCC (n = 57) versus enhanced usual care (n = 59) groups revealed that patients receiving LGCC had reduced systolic (β = −3.1, *P* = .04) and diastolic blood pressure (β = −2.1, *P* = .04) as well as reduced manic symptoms (β = −23.9, *P* = .01). Life Goals Collaborative Care had no significant impact on other primary outcomes (total cholesterol and physical health–related quality of life).

Conclusions: Life Goals Collaborative Care, compared to enhanced usual care, may lead to reduced CVD risk factors, notably through decreased blood pressure, as well as reduced manic symptoms, in patients with bipolar disorder.

Trial Registration: ClinicalTrials.gov identifier: NCT00499096

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Bipolar disorder is a chronic mental illness that is associated with substantial functional impairment, morbidity, economic burden, and mortality.[1,2] Individuals with bipolar disorders (bipolar disorder I, bipolar disorder II, and bipolar disorder not otherwise specified) also die younger than the general US population,[1,3] and a key driver of morbidity and subsequent premature mortality is cardiovascular disease (CVD).[1,4,5] Some of the most common medical conditions (eg, hypertension, obesity) that disproportionately burden patients with bipolar disorder[5] are also the leading risk factors for CVD.

Bipolar disorder presents a unique challenge apart from other mental illnesses and may require a customized intervention strategy to reduce CVD risk.[6–8] The cyclical nature of this condition (alternating mood episodes) may exacerbate CVD risk factors, which are further compounded by unhealthy behaviors,[9,10] multiple medications,[11] and fragmentation of health care.[6] Yet few treatment models have been developed to address these multifaceted CVD risk factors in bipolar disorder, especially self-management of risk factors.[12]

Current treatment interventions that focus on reducing CVD risk in persons with bipolar or other mental disorders chiefly rely on care management strategies (eg, depression in primary care settings,[13] psychotherapy,[12] or intensive lifestyle interventions in mental health specialty settings[14,15]). Life Goals Collaborative Care (LGCC) is based on the Chronic Care Model[16,17] but places an emphasis on self-management through targeted health behavior change strategies to address the psychosocial origins of CVD risk factors.[18] Life Goals Collaborative Care has been shown to improve overall mental health outcomes[19–21] and, given its focus on multiple risk factors, has the potential to reduce CVD risk factors as well.[22]

The purpose of the randomized controlled effectiveness Self-Management Addressing Heart Risk Trial (SMAHRT) is to determine whether LGCC, compared to enhanced usual care, reduces CVD risk factors and improves overall outcomes among patients with bipolar disorder. We hypothesized that, compared to those receiving enhanced usual care, patients with bipolar disorder receiving LGCC would have reduced CVD risk factors, including reductions in blood pressure, cholesterol, and improved physical health–related quality of life.

Clinical Points

- Bipolar disorder is a complex chronic condition that requires integrated medical and psychiatric care to produce optimal outcomes.
- Collaborative chronic care models represent an evidence-based strategy that has the potential to efficiently improve the delivery of integrated services.
- Behavioral interventions that support patient self-management, brief care management, and registry monitoring can reduce bipolar symptoms and cardiovascular risks.

METHOD

The design and rationale for SMAHRT have been described elsewhere in a protocol article.[22] In brief, SMAHRT is a randomized controlled effectiveness trial comparing US Department of Veterans Affairs (VA) patients with bipolar disorder and at least 1 CVD risk factor receiving care in outpatient mental health or primary care clinics who were randomly assigned to receive LGCC or enhanced usual care. The trial is registered at ClinicalTrials.gov (identifier: NCT00499096).

Setting and Participants

Patients were recruited from a mental health outpatient clinic in southeastern Michigan and a primary care outpatient clinic in northern Ohio. Patients diagnosed with bipolar disorder and a CVD risk factor who received care between fiscal year (FY) 2008 and FY 2009 were first identified based on a medical record review of patients with an *International Classification of Diseases*, *Ninth Revision* (*ICD-9*) diagnosis (codes 296.0–296.1 and 296.4–296.8). Patient inclusion criteria were (1) adult patients who had a current diagnosis of bipolar disorder in the past 12 months (bipolar I disorder, bipolar II disorder, bipolar disorder not otherwise specified, or schizoaffective disorder-bipolar subtype) based on clinician documentation of diagnosis or treatment plan and (2) diagnosis of or receiving treatment for at least 1 of the following medical conditions associated with increased CVD risk within the past 12 months: hyperlipidemia or dyslipidemia (documented diagnosis, low-density lipoprotein ≥ 160 mg/dL, or receiving statin or other treatment), hypertension (documented diagnosis or blood pressure ≥ 140/90 mm Hg on 2 occasions), diabetes mellitus (documented diagnosis or $HbA_{1c} \geq 7\%$, or receiving treatment), obesity (documented diagnosis or body mass index [BMI] ≥ 30), or current diagnosis of arteriosclerotic cardiovascular disease.

Patient exclusion criteria were minimal and designed to maximize the generalizability of LGCC and included (1) substance intoxication or withdrawal symptoms at the time of recruitment encounter, (2) current enrollment in an intensive case management or assertive community treatment program based on medical record review, or (3) unwillingness or inability to provide informed consent or comply with study requirements at the time of the recruitment encounter (eg, due to terminal medical illness or dementia).

Recruitment and Consent Procedures

A study clinical assessor with a background in nursing oversaw recruitment and clinical assessments. Using the list of potentially eligible patients based on medical record data, the clinical assessor approached patients at the time of their appointment. After confirming eligibility, patients provided informed consent and received a clinical examination and filled out a self-completed survey. Participants received remuneration of $10 for each assessment. Study recruitment, enrollment, and patient participation in the 12-month intervention phase occurred between April 2008 and May 2010. The last assessment of 24-month outcomes was completed in May 2012. The study was reviewed and approved by the VA Medical Center Institutional Review Board.

Of the 180 eligible patients identified for study participation, 134 were initially enrolled after verification of diagnosis and suitability with providers. Eight dropped out prerandomization after signing consent but did not complete any assessments, and hence, no data are available on these patients. An additional 8 dropped out immediately after randomization (n = 7) or due to sudden death (n = 1), leaving a total of 118 with complete baseline and follow-up data for analysis (Figure 1).

Treatment Assignment and Intervention

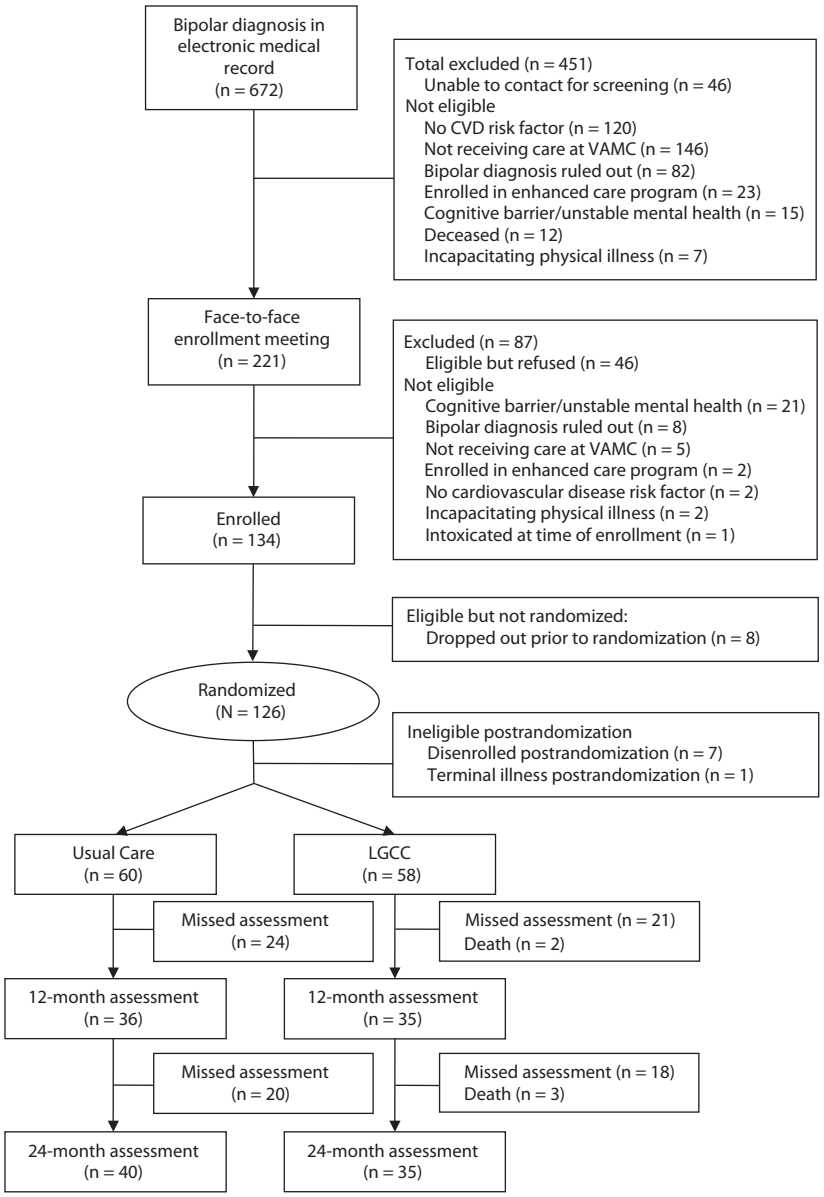
Participants were randomized to the LGCC intervention or enhanced usual care (Table 1) in blocks of 15 to 20 people that were stratified by age, race, and diabetes diagnosis in order to ensure balance of these characteristics.

LGCC intervention. The SMAHRT trial protocol for the LGCC intervention arm (Table 1) has been described in detail elsewhere[22]; was implemented by a master's level, trained health specialist; and included 4 of the 6 components of the original Chronic Care Model[23] but enhanced using Social Cognitive Theory to focus on health behavior change.[22]

Following randomization, the health specialist initiated a presession assessment to promote treatment engagement and participation. During this time, the health specialist assessed patient preferences for communication, motivation for health changes, availability for group participation, and principal provider contact information for emergency situations. Participants were then scheduled to attend the group self-management sessions, described below.

Self-management support. The bulk of the LGCC intervention time was devoted to self-management, in part because many of the CVD risk factors were potentially mutable to health behavior change. The health specialist led four 2-hour group self-management sessions held weekly based on the Life Goals psychotherapy program[24] enhanced to include discussion on the management of CVD risk factors within the context of bipolar disorder.[18,21,22] The first session provided an overview of bipolar disorder and CVD risk, stigma issues, and a discussion of personal goals, values, and strategies to help in achieving positive health behavior change. The next 2 sessions focused on health behavior change strategies that also helped with bipolar symptom coping strategies, notably diet (eg, avoiding overeating when depressed) and exercise

Figure 1. CONSORT Diagram for the Self-Management Addressing Heart Risk Trial (SMAHRT) Comparing Life Goals Collaborative Care to Enhanced Usual Care



Abbreviations: CONSORT = Consolidated Standards of Reporting Trials, CVD = cardiovascular disease, LGCC = Life Goals Collaborative Care, VAMC = Veterans Affairs Medical Center.

(eg, walking to reduce stress), and the final session focused on enhancing communication with providers, the role of collaborative care management, and setting specific objectives in health behavior goals.

Care management/registry tracking. The health specialist followed up with patients after the end of the self-management sessions on a monthly basis for up to 12 months to track symptoms and medical need as well as progress toward health behavior change and personal goals. As part of ongoing care management, the health specialist used an electronic registry created with Microsoft Access to track patient health behaviors and care needs over the course of the intervention.[25] If patients were having elevated symptoms or needed medical care, the health specialist contacted their mental health and general medical providers to schedule a follow-up appointment. The health specialist also provided information to the patient's general medical and mental health providers regarding the patient's current CVD risk factor indicators (eg, weight, blood pressure, laboratory values) via consultation notes available in the electronic medical record or secure e-mail.

Guideline support. The health specialist disseminated treatment guidelines to mental health and primary care providers at participating sites. Guidelines included 1-page tips for management of bipolar disorder (www.healthquality.va.gov) as well as summaries of the American Diabetes Association/American Psychiatric Association practice guidelines for CVD risk assessment.[26]

Table 1. Life Goals Collaborative Care (LGCC) and Enhanced Usual Care Components

Life Goals Collaborative Care	Enhanced Usual Care
Self-management sessions by health specialist Four group sessions (90–120 minutes, about 8–10 individuals per group cohort) covering • Bipolar disorder facts • Understanding personal and behavioral risk factors for cardiovascular disease • Setting personal goals • Active discussions of coping with manic and depressive symptoms and strategies to manage psychiatric/medical risk factors • Provider engagement and communication tips	**No self-management sessions or follow-up contacts by health specialist** Wellness mailings, including summaries of topics unrelated to LGCC self-management content, including sleep, smoking cessation, and fatigue
Care management by health specialist • Conducts ongoing patient contacts to reinforce lessons from self-management and facilitate provider communication (at least 1/mo) • Contacts (cues) providers regarding symptoms or health concerns relayed by patients (but does not make treatment decisions) • Ongoing wellness monitoring • Registry tracking • Links to community resources	**No ongoing contacts or care management by health specialist or registry tracking provided**
Ongoing clinical management by assigned primary care and mental health provider team that includes case management, psychotherapy, and group sessions	**Ongoing clinical management by assigned primary care and mental health provider team that includes case management, psychotherapy, and group sessions**
Clinical registry tracking • Health specialist monitors patient progress in health behavior change for up to 12 months from enrollment • Health specialist monitors psychiatric and medical symptoms, documented safety/rescue plan	**No registry tracking**
Guideline support • Health specialist provides summary information to primary care and mental health providers on bipolar disorder treatment and health issues (eg, cardiovascular disease risk monitoring)	**Guideline support** • Health specialist provides summary information to primary care and mental health providers on bipolar disorder treatment and health issues (eg, cardiovascular disease risk monitoring)

LGCC fidelity. The health specialist underwent a 2-day training program developed by the investigators and followed a standardized set of protocols and intervention manual. Fidelity was measured using a combination of reviews of health specialist logs and direct observation of a random sample of Life Goals group sessions in which a content checklist was used to evaluate session delivery.[24] Key fidelity indicators included number of group sessions completed by the patient and number of care management contacts.

Enhanced usual care. Enhanced usual care patients received regular mailings regarding wellness topics in addition to standard mental health and medical treatment (Table 1). They did not receive the other principal LGCC components (health specialist contact, self-management, or care management). Enhanced usual care patients' general medical and mental health providers did receive the same practice guideline information at the beginning of the study as the providers for the LGCC patients, but the health specialist did not communicate with providers about their specific patients. Standard treatment at both sites included outpatient case management and group psychotherapy sessions specifically focused on mental health treatment that were provided by a mental health provider team, as well as access to a primary care provider.

Data Collection and Measures

Patients underwent a clinical examination (blood pressure, nonfasting blood draws, BMI, and waist circumference) at baseline, 6, 12, and 24 months. The nurse clinical assessor measured the patient's blood pressure based on 2 readings while he or she was sitting, measured height and weight, and conducted blood draws that were analyzed at on-site VA laboratories. Nonfasting total cholesterol was ascertained from blood draws because of the difficulty in obtaining fasting values (ie, barriers for patients to come in the early morning for blood draws) and evidence suggesting that nonfasting total cholesterol is comparable to fasting values.[27]

Patients also completed a survey at the time of the clinical assessment to ascertain outcomes including health-related quality of life, functioning, symptoms, and other patient factors.[19,28–31] The clinical assessor was blinded to randomization of patient assignment.

Primary and Secondary Outcomes

Primary outcomes were identified a priori to address the hypothesis that LGCC, compared to enhanced usual care, would reduce CVD risk factors within 12 months. Primary outcomes for which this study was powered (with Bonferroni correction for multiple comparisons) included systolic and diastolic blood pressure, nonfasting total cholesterol, and physical health–related quality of life. Blood pressure and total cholesterol are considered key intermediate physiological measures of CVD-related morbidity and mortality.[32] They also represent the 2 most common CVD risk factors observed among individuals diagnosed with bipolar disorder.[5] Taking control of these risk factors can decrease CVD risk substantially.[32] The 12-item Short Form Health Survey

Table 2. Baseline Demographic and Clinical Characteristics of Study Enrollees

	Total (N = 118)		LGCC (n = 58)		Usual Care (n = 60)			
	N	%	n	%	n	%	*t* or χ^2	*P* Value
Demographic characteristic								
Age, mean ± SD, y[a]	52.8 ± 9.9		53.1 ± 10.6		52.4 ± 9.2		−0.40	.69
Age breakdown							0.48	.79
< 50 years	40	33.9	22	38.0	22	36.7		
50–59 years	44	37.3	18	31.0	22	36.7		
≥ 60 years	34	28.8	18	31.0	16	26.6		
Female	20	17.0	10	17.2	10	16.7	0.01	.93
Nonwhite	6	5.1	3	5.2	3	5.0	0.00	1.00
Some college education	80	68.4	42	73.7	38	63.3	1.45	.23
Lives alone	35	31.8	18	32.1	17	31.5	0.01	.94
Current smoker	47	40.9	23	40.4	24	41.4	0.01	.91
Hazardous drinking[b]	15	15.3	7	15.6	8	15.1	0.00	.95
Current illicit drug use	31	26.5	15	25.9	16	27.1	0.02	.88
Clinical characteristic								
Current diagnosis							3.68	.30
Bipolar I disorder	44	37.3	20	34.5	24	40.0		
Bipolar II disorder	26	22.0	14	24.1	12	20.0		
Bipolar disorder NOS	45	38.2	21	36.2	24	40.0		
Schizoaffective disorder, bipolar subtype	3	2.5	3	5.2	0	0.0		
Psychotropic medication								
Prescription for any atypical antipsychotic	59	50.0	30	51.7	29	48.3	0.14	.71
Prescription for any mood stabilizer	91	77.1	47	81.0	44	73.3	0.99	.32
Lithium	20	17.0	11	19.0	9	15.0	0.33	.57
Lamotrigine	28	23.7	14	24.1	14	23.3	0.01	.92
Valproate	39	33.1	20	34.5	19	31.7	0.11	.74
Carbamazepine	10	8.5	5	8.6	5	8.3	0.00	1.00
Cardiovascular disease diagnosis								
Hypertension	81	69.8	43	74.1	38	65.5	1.02	.31
Hyperlipidemia	98	83.8	45	77.6	53	89.8	3.22	.07
Diabetes mellitus	30	25.4	13	22.4	17	28.3	0.55	.46
Obesity (BMI ≥ 25)	107	90.7	48	82.8	59	98.3	8.46	< .01
Heart disease	22	19.0	11	19.0	11	19.0	0.00	1.0
Framingham Risk Score[c]							1.11	.57
< 10%	48	40.7	26	44.8	22	36.7		
10%–20%	48	40.7	23	39.7	25	41.7		
≥ 20%	22	18.6	9	15.5	13	21.6		

[a]Range, 31–80 years.
[b]Current hazardous drinking was defined based on the Alcohol Use Disorders Identification Teat question on whether the patient consumed 6 or more drinks during a single occasion.
[c]Framingham Risk Scores is divided into 3 risk categories to help estimate the 10-year risk for coronary heart disease: high risk (10-year risk ≥ 20%), moderately high risk (10-year risk = 10%–20%), or lower to moderate risk (10-year risk < 10%).
Abbreviations: BMI = body mass index, LGCC = Life Goals Collaborative Care, NOS = not otherwise specified, SD = standard deviation.

(SF-12) was used to assess physical health–related quality of life.[33] Two composite scores for physical (PCS) and mental health (MHS) were generated based on the SF-12.

Secondary physical health outcomes included nonfasting high-density lipoprotein (HDL) levels, and direct low-density lipoprotein (LDL) levels, weight, including BMI, and waist circumference. We also calculated the Framingham Risk Score, which is an estimate of 10-year CVD risk based on age, sex, current cholesterol, blood pressure, diabetes diagnosis, and current smoking status.[34]

Additional secondary outcomes based on the patient survey included mental health–related quality of life based on the SF-12, functioning, and psychiatric symptoms. The World Health Organization's Disability Assessment Scale is a 12-item survey assessing the degree of functional impairment experienced over the past month regarding self-care, mobility, cognition, social functioning, and role functioning.[35] Psychiatric symptoms were ascertained using the Internal State Scale, a 16-item assessment of depressive and manic symptoms that was strongly correlated with clinician ratings of manic or depressive episodes.[36]

Analysis

Descriptive and bivariate analyses were conducted comparing treatment arms. Mixed effects analyses were also used to determine the effect of LGCC versus enhanced usual care on primary outcomes (blood pressure, total cholesterol, and physical health–related quality of life), which, based on previous research,[21] were hypothesized to be most responsive to the intervention. Effect size estimates from our previous pilot work[21] suggested a Cohen *d* for primary outcomes (blood pressure) to range from 0.40 to 0.42; thereby a sample size

Table 3. Repeated Measures Analysis: 24-Month Outcomes Comparing Life Goals Collaborative Care (LGCC) Versus Enhanced Usual Care

	LGCC				Enhanced Usual Care				Repeated Measures[a]			
Measure, mean ± SD	Baseline	6 Months	12 Months	24 Months	Baseline	6 Months	12 Months	24 Months	β	95% CI	*t*	*P*
Blood pressure, mm Hg												
Systolic	131.8 ± 16.4	128.3 ± 14.0	127.7 ± 17.7	127.2 ± 15.4	133.8 ± 17.4	135.9 ± 18.2	134.2 ± 18.9	130.4 ± 13.6	−2.94	−6.00 to 0.12	−1.90	.05
Diastolic	80.7 ± 11.4	76.3 ± 11.7	75.3 ± 10.6	75.9 ± 10.4	83.8 ± 14.0	82.2 ± 11.3	80.5 ± 10.3	78.5 ± 10.3	−2.18	−4.23 to −0.12	−2.10	.03
Total cholesterol, mg/dL	176.9 ± 37.2	173.6 ± 32.6	173.6 ± 42.4	178.9 ± 45.5	195.6 ± 44.2	191.5 ± 48.4	181.8 ± 44.7	175.9 ± 42.4	3.63	−2.88 to 10.15	1.10	.27
HDL, mg/dL	37.6 ± 10.6	36.7 ± 13.0	37.3 ± 8.0	39.0 ± 12.1	35.9 ± 13.9	36.0 ± 11.4	38.3 ± 11.3	37.1 ± 7.9	0.04	−1.73 to 1.80	0.04	.96
LDL, mg/dL	103.8 ± 30.4	105.3 ± 28.2	103.1 ± 32.1	105.6 ± 39.5	117.1 ± 38.3	116.2 ± 40.1	107.3 ± 36.0	105.7 ± 34.2	2.34	−3.15 to 7.83	0.85	.39
BMI	32.0 ± 6.2	33.3 ± 6.9	32.3 ± 5.9	31.3 ± 5.8	34.5 ± 9.1	33.1 ± 5.1	34.0 ± 5.7	33.4 ± 6.1	0.11	−1.01 to 1.23	0.19	.84
Waist circumference, in	43.1 ± 6.1	43.9 ± 6.4	43.4 ± 5.5	43.2 ± 5.3	44.8 ± 5.6	43.8 ± 5.8	44.7 ± 6.2	44.9 ± 6.2	0.17	−0.43 to 0.77	0.56	.57
Framingham Score	12.4 ± 8.9	10.4 ± 6.3	11.5 ± 8.4	11.5 ± 6.4	15.4 ± 10.8	15.2 ± 10.3	11.8 ± 7.0	9.9 ± 6.8	−0.34	−1.48 to 0.79	−0.60	.55
SF-12 Quality of Life[b]												
MCS	32.7 ± 7.7	34.4 ± 6.8	32.6 ± 8.3	34.9 ± 7.5	33.6 ± 7.7	32.9 ± 8.4	33.4 ± 7.1	34.6 ± 7.1	0.89	−0.51 to 2.29	1.26	.21
PCS	35.9 ± 7.2	35.8 ± 7.8	37.5 ± 7.8	36.8 ± 6.6	33.6 ± 7.2	34.5 ± 7.3	36.3 ± 6.6	35.3 ± 7.0	0.11	−1.09 to 1.32	0.18	.85
Functioning (WHO-DAS)[c]	16.6 ± 9.4	15.9 ± 8.0	15.4 ± 8.9	15.0 ± 10.9	17.9 ± 9.9	19.1 ± 10.4	17.0 ± 9.5	16.5 ± 10.7	−0.44	−1.64 to 0.76	−0.73	.46
Mood symptoms[d]												
Depressive symptoms	64.1 ± 53.2	52.3 ± 43.4	67.7 ± 55.8	50.6 ± 46.4	84.3 ± 53.5	75.5 ± 53.9	70.0 ± 62.8	60.3 ± 55.9	−3.91	−14.18 to 6.36	−0.75	.45
Manic symptoms	190.5 ± 122.0	175.8 ± 139.4	153.0 ± 92.0	148.9 ± 120.9	183.5 ± 120.8	192.5 ± 130.1	193.9 ± 125.9	173.4 ± 105.8	−23.9	−42.9 to −4.78	−2.48	.01

[a]Repeated measures analyses models included the baseline value of the outcome measure (to account for differences in outcomes at baseline), baseline obesity (defined as BMI ≥ 30), effect of LGCC, time (6, 12, 24 months), and the interaction of time and study group.

[b]The 12-item Short-Form Health Survey (SF-12) includes a mental health component score (MCS) and physical health component score (PCS). Possible scores range from 0 to 100, with higher scores indicating better health. For both summary scores, the population mean ± SD is 50 ± 10.

[c]World Health Organization Disability Assessment Scale (WHO-DAS); Possible scores range from 0 to 48; higher scores indicating worse functioning.

[d]Symptom scores (0–10 points for each item) are based on the Internal State Scale. For depressive symptoms, possible scores range from 0 to 200, with higher scores indicating more severe depressive symptoms. For manic symptoms, possible scores range from 0 to 500, with a higher score indicating more severe manic symptoms.

Abbreviation: CI = confidence interval.

of 108 was sufficient to detect significant effects in our primary outcomes. We used repeated measures mixed effects models, which allow unequal observations per subject, ie, missing observations on some measures for some subjects, to examine the LGCC effect. The main outcomes models included the baseline value of the outcome measure (to account for differences in outcomes at baseline), baseline obesity (defined as BMI ≥ 30), the effect of LGCC, time (6, 12, and 24 months), and the interaction of time and study group.

RESULTS

Of the 118 patients enrolled in the study, 58 were randomized to the LGCC group, and 60 were randomized to enhanced usual care. Of the 118, there were 2 nonstudy-related deaths (Figure 1). Mean (SD) participant age was 52.8 (9.9) years, 17% were women, 5% were nonwhite, and the majority (62%) were diagnosed with bipolar I or bipolar II disorder. Based on the high prevalence of multiple CVD risk factors, the majority (59%) had a *moderately high* to *high* 10-year risk for a serious CVD event based on a Framingham Risk Score of ≥ 20% (Table 2). Post hoc analyses of medication use showed that 97% of enrolled patients were prescribed an antihypertensive at baseline, and 3% had started an antihypertensive medication during the follow-up period.

Baseline health-related quality of life scores were lower than US population norms of 50 (Table 3). There were no significant differences in demographic or clinical characteristics between the 2 randomized arms except for baseline BMI.

Mixed effects analyses assessing changes in 24-month outcomes revealed that, compared to enhanced usual care, LGCC reduced systolic blood pressure at borderline significance ($\beta = -2.9$, $P = .05$, Cohen $d = -0.20$) and reduced diastolic blood pressure significantly ($\beta = -2.2$, $P = .03$, Cohen $d = -0.24$). There were no significant differences in the other primary outcomes (Table 3). After post hoc Bonferoni adjustment for multiple comparisons, these findings were not statistically significant ($P > .0125$).

For secondary outcomes, participants randomized to LGCC compared to those randomized to enhanced usual care experienced reduced manic symptoms over the 24-month period ($\beta = -23.9$, $P = .01$). There were no significant differences in the other secondary outcomes, including HDL, LDL, BMI, depressive symptoms, or functioning.

Fidelity assessment to LGCC indicated that the majority (68%) completed at least 3 of the 4 self-management sessions and an adequate number of follow-up contacts over the 12-month intervention phase (mean = 4.6, SD = 3.6). Interventionist registry data indicated that the health specialist had a mean number of 1.2 (SD = 1.0) and 0.3 (SD = 0.6) contacts per patient with their mental health and primary care providers, respectively. To further determine the role of care management in patient outcomes, we conducted a post hoc multivariate analysis

to determine whether variation in health specialist-provider care management contacts might have explained changes in outcomes over time. We added to the main outcomes models for systolic and diastolic blood pressure the total number of mental health or primary care management contacts made by the health specialist with the patient's providers among the LGCC intervention group. Number of care management contacts was not associated with changes in systolic or diastolic blood pressure; respectively, (β for number of care management contacts: systolic blood pressure $\beta = -0.61$, $P = .44$; diastolic blood pressure $\beta = -0.10$, $P = .85$).

DISCUSSION

Compared to usual care, LGCC reduced cardiovascular disease risk, notably through lower systolic and diastolic blood pressure. Our observed changes in blood pressure (ie, a 4-point drop) can be associated with reduced stroke mortality by 14%, reduced CVD mortality by 9%, and reduced total mortality by 7%.[37] Moreover, LGCC significantly improved blood pressure control despite 97% of the study cohort receiving prescriptions for antihypertensive medications at baseline. LGCC compared to enhanced usual care was also associated with reduced manic symptoms over time, a finding that is consistent with previous trials of the Chronic Care Model for bipolar disorder.[19,20] Life Goals Collaborative Care was not associated with reductions in other CVD risk factors, including cholesterol or BMI, or changes in physical health–related quality of life. Still, health-related quality of life scores in our sample were almost 20 points below national norms, which was consistent with similar studies of VA patients with bipolar disorder.[21,38] Fidelity to LGCC was comparable to that in similar studies.[19–21]

To our knowledge, this is the first study to demonstrate reductions in CVD risk factors for persons with bipolar disorder seen in primary or mental health specialty care settings. There is a paucity of treatment models specifically designed to address the unique characteristics of bipolar disorder. Bipolar disorder is one of the most costly mental disorders; evidence suggests that up to 70% of the costs of bipolar disorder are attributed to general medical care,[39] and CVD is the most common cause of mortality.[5] Hence, interventions that address gaps in physical as well as mental health outcomes are paramount for this group.

This is also one of the few Chronic Care Model–based studies to demonstrate clinically significant changes in physical outcomes for patients with mental disorders.[23] Recent research has found that the Chronic Care Model may reduce CVD risk factors for patients with unipolar depression in primary care,[40] and it primarily involved nurse care management. In contrast, our study is the first to demonstrate clinically significant effects on CVD risk factors based on a version of the Chronic Care Model that chiefly relied on patient-self-management. Notably, post hoc analyses revealed that less than 3% (n = 3) of enrolled patients started antihypertensive medications after study enrollment. Moreover, the number of provider care manager contacts was considerably less than self-management contacts by the health specialist; thus, the effects of LGCC may not have been due to increased care management. Self-management is an important component of the Chronic Care Model, and LGCC takes advantage of similar approaches involving health behavior change and symptom coping strategies that are similar to existing treatment modalities such as group psychotherapy or wellness management,[22] thus making it potentially more scalable to implement by existing providers in routine practice than care management.

Limitations of this study included the relatively small sample size, which precluded adequate power to determine the effects of LGCC on secondary outcomes, and study involvement was limited to a couple of sites. We were also unable to obtain fasting laboratory values for lipids, in part because scheduling a time for blood draws prior to eating (eg, in the early morning) was difficult for patients, as many of them were unable to visit the clinic at that time. Study protocols also did not assess changes in either adherence or dose of medications used to treat cardiometabolic conditions. Even though most of the LGCC intervention involved health specialist–patient contact, there was a possibility that health specialist contact with VA providers who cared for both LGCC and enhanced usual care patients may have affected care for both groups of patients. As the study was designed to mimic as closely as possible real-world clinical care settings, we did not use a formal diagnostic assessment for bipolar disorder but rather relied on diagnostic codes and verification from provider notes. Finally, the VA has a number of unique system characteristics (eg, almost all patients have a primary care provider) and patient characteristics (eg, preponderance of males) that may have affected generalizability.

Nonetheless, as a relatively brief intervention, LGCC may improve physical and mental health outcomes in patients with bipolar disorder, notably by reducing blood pressure and manic symptoms. In light of funding limitations and the implementation of new models of care (eg, medical home models in the VA and elsewhere), LGCC is a potentially scalable model that can facilitate improved outcomes for persons with bipolar or other mental disorders. Additional research on whether existing providers available in community-based settings can implement LGCC in a similar fashion is warranted, especially given the potential scarcity of clinicians in smaller practices.

Drug names: carbamazepine (Carbatrol, Equetro, and others), lamotrigine (Lamictal and others), lithium (Lithobid and others).

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Potential conflicts of interest: **Drs Kilbourne** and **Bauer** are authors of the workbook *Overcoming Bipolar Disorder: A Comprehensive Workbook for Managing Your Symptoms & Achieving Your Life Goals* (New Harbinger Publications, 2008), which was the basis for many of the current study intervention materials, and receive publication royalties.
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