Virtual Collaborative Care Versus Specialty Psychiatry Treatment for Depression or Anxiety

Kathryn K. Ridout, MD, PhD; Mubarika Alavi, MS; Catherine Lee, PhD; Lisa Fazzolari, DO; Samuel J. Ridout, MD, PhD; Maria T. Koshy, MD; Brooke Harris, PhD; Sameer Awsare, MD; Constance M. Weisner, DrPH; and Esti Iturralde, PhD

Abstract

Objective: While collaborative care is known to improve depressive and anxiety symptoms in primary care, comparative effectiveness studies of virtual collaborative care versus virtual specialty psychiatry treatment in real-world settings are lacking. This study examined patient depressive and anxiety symptoms over 6 months in collaborative care versus specialty psychiatry.

Methods: This was an observational study with target trial emulation in a large, community-based, integrated health care system. Participants were ≥18 years old with mild-moderate depressive or anxiety symptoms measured by the Patient Health Questionnaire-9 or Generalized Anxiety Disorder-7 Scale. Exclusion criteria included acute suicide risk. Patients were assigned to collaborative care or specialty psychiatry, and symptoms were measured 6 months after treatment initiation using linear mixed-effects regression with inverse probability of treatment weighting.

Results: There were N = 10,380 patients (n = 1,607 in collaborative care; n = 8,773 in specialty psychiatry) with depressive disorders and N = 2,935 (n = 570 in collaborative care; n = 2,365 in specialty psychiatry) with anxiety disorders. Model effects at 6 months showed significant symptom improvement for patients in collaborative care (adjusted mean difference [AMD] = −9.0, 95% CI, −9.7, −8.4 for depression; −5.4, 95% CI, −6.2, −4.7 for anxiety) and in specialty psychiatry (AMD = −5.0, 95% CI, −5.6, −4.5 for depression; −2.8, 95% CI, −3.6, −2.1 for anxiety), with patients in collaborative care showing significantly greater improvement compared to those in specialty psychiatry (AMD = −4.0, 95% CI, −4.7, −3.3, $P < .0001$ for depression; AMD = −2.6, 95% CI, −3.4, −1.8, $P < .0001$ for anxiety).

Conclusions: Virtual collaborative care was at least as effective as specialty psychiatry for depression and anxiety. Collaborative care implementation can support national guidelines regarding depression and anxiety screening and treatment.

J Clin Psychiatry 2024;85(3):24m15332

Author affiliations are listed at the end of this article.

Approximately 1 in 5 adults in the United States experience a lifetime depressive disorder,[1,2] leading to significant disability, disability-related burden,[3] and $326.2 billion in annual costs.[4] Depression impacts outcomes of many prevalent, chronic medical conditions including diabetes and hypertension, along with quality of life, functioning, and overall health status.[5] Depressive disorders impart high risk for suicide,[6,7] a leading cause of death across age groups in the United States.[8] Similarly, anxiety disorders impact 31% of the US population over their lifetimes[9] and are associated with significant functional impairment[9] and poor outcomes.[10] Timely, evidence-based care with psychotherapy and/or medications has been shown to improve outcomes for both disorders.[11–13] Yet, approximately half of patients do not receive adequate depression or anxiety care,[14] suggesting that strategies to improve patient connection with evidence-based care are needed.

One evidence-based care model associated with reduced depressive or anxiety symptoms, improved quality of life, and sustained remission is collaborative care.[15,16] Collaborative care involves a multidisciplinary team focused on population-based treatment using measurement-based care, treatment to target, accurate diagnosis, and patient-centered care.[17] Randomized controlled trials and meta-analyses have demonstrated that collaborative care is superior to noncollaborative care models in primary care for depression and anxiety.[15,18–21] Yet, collaborative care is not widely implemented, and the majority of patients with depression or anxiety are referred to specialty

Clinical Points

- Collaborative care for depression or anxiety is an evidence-based treatment framework to improve depressive or anxiety symptoms, but real-world evidence compared to specialty psychiatry treatment is lacking.
- Collaborative care is an effective treatment paradigm for depressive and anxiety symptom reduction compared to specialty psychiatry referral and treatment.

psychiatry, which is associated with limited referral connection and treatment delays.[22–24] Such delays are associated with poorer patient outcomes,[25] 43%–52% higher ambulatory costs,[26–29] and >$210 billion lost earnings/year.[4]

To date, outcomes for depression or anxiety after treatment in specialty psychiatry compared to collaborative care are unclear. Further, there is a relative lack of data regarding real-world collaborative care implementation outcomes,[30–36] which would facilitate collaborative care implementation, spread, and real-world practice. Finally, previous studies were conducted prior to the COVID-19 pandemic when telehealth was considered an alternative strategy for care delivery.[37] As such, research examining whether collaborative care can be successfully implemented in a virtual care first setting is needed.[38]

Here, we compare depressive or anxiety symptoms between patients treated in a virtual collaborative care program versus virtual specialty psychiatry treatment. We hypothesized that patients enrolling in collaborative care would have improved depressive or anxiety symptom scores at 6 months comparable to patients in specialty psychiatry.

METHODS

Design Overview

This was a retrospective observational study with target trial emulation methods (Supplementary Table 1 outlines the specified and emulated target trial study designs).[39] This study followed the Strengthening the Reporting of Observational Studies in Epidemiology(STROBE) guidelines for observational studies with the target trial framework[40] and was approved by the Kaiser Permanente Northern California (KPNC) Institutional Review Board. Research was conducted in accordance with the principles of the Declaration of Helsinki. All variables were derived from KPNC's electronic health record (EHR) system.

Setting/Participants

KPNC is a large, integrated health care system serving >4.5 million patients (36% of the regional population) through commercial, Medicare, Medicaid, and insurance exchange plans. Patients represent the ethnic and socioeconomic diversity of surrounding/statewide population.[41] Eligible patients had depression or anxiety diagnoses (Supplementary Table 2: *International Classification of Diseases, Tenth Revision, Clinical Modification* [*ICD-10-CM*], codes) between April 1, 2020, and May 31, 2021; were aged ≥18 years; had Patient Health Questionnaire (PHQ)-9 or Generalized Anxiety Disorder (GAD)-7 Questionnaire score of ≥5 and <15; and had ≥1 year of continuous KPNC membership prior to the index date. Exclusion criteria included suicide risk (answer of ≥1 on question 9 of the PHQ-9 or a suicide-related diagnostic code [R45.85, T14.91, T36.xx3(4)-T50.xx2(4), T51.xx2(4)-T65.xx2(4), T71.xx2(4), X71-X83][42]) ≤30 days prior to eligibility screening. Additional exclusion criterion for the specialty psychiatry group was history of collaborative care program care. Multivariate analysis was limited to patients with PHQ-9/GAD-7 ≥10 and primary depression or anxiety diagnoses (not adjustment disorders) prior to baseline.

Interventions and Assignment

Study procedures and protocol were previously published.[43] Consistent with target trial emulation, patients undergoing eligibility screening were eligible for either intervention and came from the same source population (Supplementary Table 1). We identified patients referred by primary care or self-referred to screening eligibility (index visit) where symptoms were assessed, and patients were assigned to treatment based on shared decision making and program access.

Collaborative care. This intervention followed collaborative care principles including validated tool use, accountable care and population management–aligned evidence-based treatments, systematic follow-up, care team and patient communication and coordination, and program oversight.[17,43] Novel program components included integration of the care manager role by therapists into every visit, medication management by program pharmacists, integration of registry clinical outcome tracking into the EHR and visit note, and treatment to target guided by workflows.[43] The entire program was designed to be virtual prior to the COVID-19 pandemic.[43] At the first treatment (baseline) appointment, the therapist remeasured depressive or anxiety symptoms, performed treatment goal setting, and scheduled follow-up appointments. Treatment consisted of problem-solving therapy weekly or every other week. If a patient's condition worsened or did not improve after 2–4 weeks, therapists offer pharmacist medication consultation who could discuss, prescribe, and titrate antidepressants by clinical protocol supplemented with case conference and psychiatrist consultation. Measurement-based symptom tracking was performed at each appointment; outreach was attempted 6 months post-

baseline. All team members and referring providers received ongoing education in care models and workflows.

Specialty psychiatry. At the baseline appointment, the therapist remeasures symptom scores, performs treatment goal setting, and schedules follow-up therapy or medication management appointments at the discretion of the therapist and patient. Medication management was performed by psychiatrists or clinical pharmacists when deemed necessary by a patient or therapist. Measurement-based symptom tracking was performed through PHQ-9 or GAD-7 at baseline and each appointment.

Outcomes

Mean difference in continuous PHQ-9 scores for depression or GAD-7 scores for anxiety was the primary treatment outcome.

Depressive symptoms. Depressive symptoms were measured using the PHQ-9 (9 questions reflecting the *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition [*DSM-5*], criteria as "0" [not at all] to "3"[nearly every day]; scores range from 0 to 27). The PHQ-9 is validated for depressive symptom screening and follow-up with high sensitivity (>88%) and specificity (>88%) for major depression. PHQ-9 scores of 5, 10, 15, and 20 represent mild, moderate, moderately severe, and severe depressive symptoms.[44]

Anxiety symptoms. Anxiety symptoms were measured using the GAD-7 Questionnaire (7 questions reflecting *DSM-5* criteria for GAD with responses ranging from "0" [not at all] to "3" [nearly every day]; scores range from 0 to 21). The GAD-7 is validated for screening and follow-up with a sensitivity of 89% and specificity of 82%.[45]

Symptom response and remission. Symptom response was defined as a ≥50% reduction in symptoms,[46] while remission was defined as a PHQ-9 score of <5 for depression and a GAD-7 score of <3 for anxiety.[44,45]

Covariates

Covariates evaluated at the index date included age, sex, race, ethnicity, and neighborhood deprivation index (NDI, a geocoded measure of socioeconomic status with categories based on the tertiles of the overall cohort; higher scores indicate more deprivation). Body mass index (BMI) was evaluated at the last measurement in the year prior to the index date; the Charlson comorbidity index (CCI) was calculated from data in the year prior to the index date. A positive history of clinic encounters containing psychiatric diagnoses in the year prior to the index date was defined as >3 in-person, telephone, virtual, inpatient, institutional, rehab, or nursing facility clinic encounters containing psychiatric diagnoses using a clinician-curated list of *ICD-10-CM* codes for psychiatry, substance use, and lifestyle. Patient antidepressant use in the year prior to the index date and baseline symptom score were also included. Covariates evaluated during the follow-up period included antidepressant drug use during the follow-up (defined as 1 day to up to 6 months after baseline).

Statistical Analysis

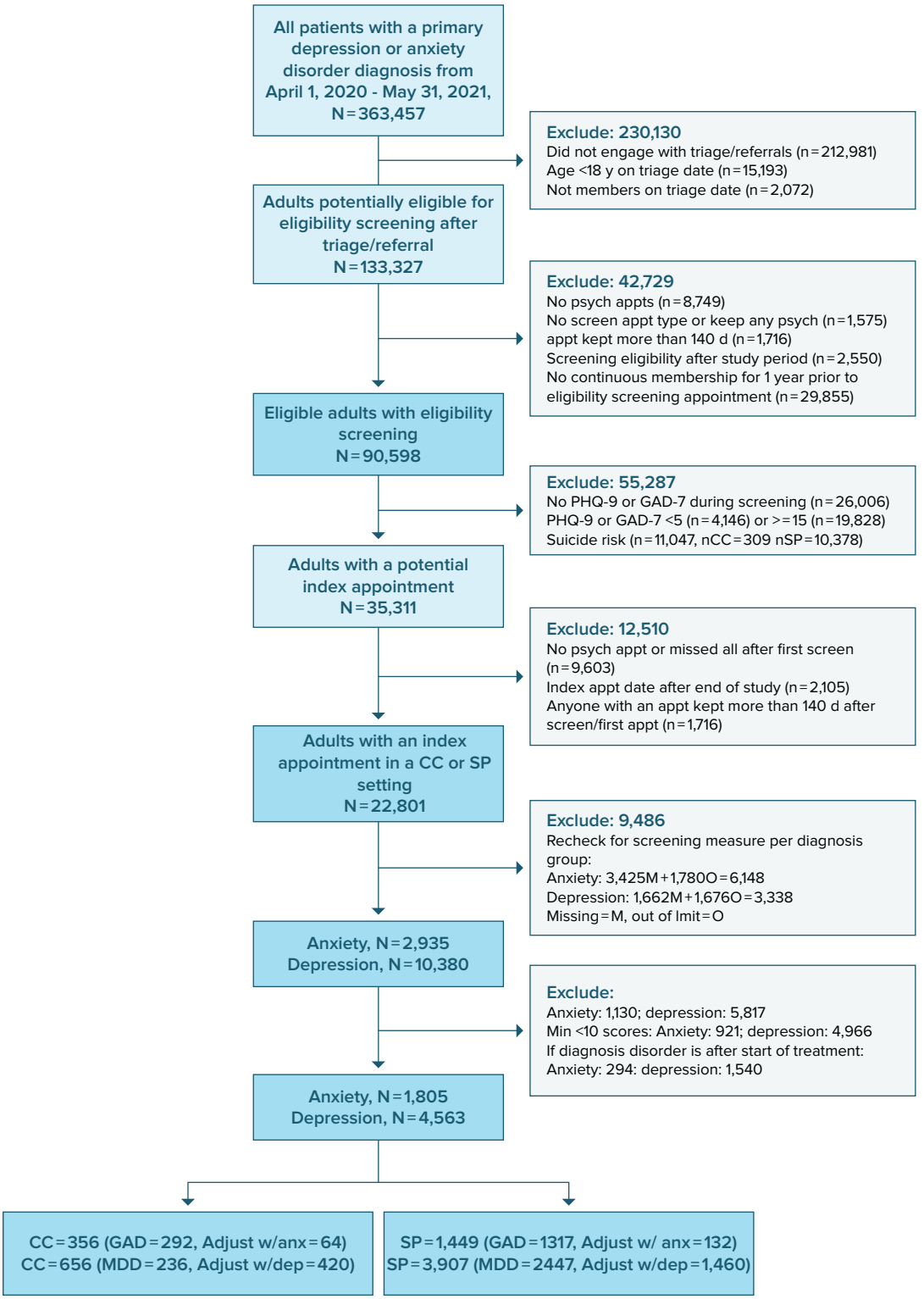
A significance level (type I error rate) of 0.05 was set for all tests. Clinical and demographic characteristics were summarized using means and proportions. Using the full cohort, we used bivariate analysis to examine treatment assignment dependency on patient characteristics. We identified gender, race, age, CCI, NDI, screening symptom score, history of clinic encounters containing psychiatric diagnoses in the year prior to the index date, antidepressant therapy in the year prior to the index date, and time from eligibility screening to baseline symptom assessment as significant for both depression and anxiety and BMI for depression. Using these results, we conducted a propensity score weight analysis using inverse probability of treatment weighting (IPTW, assuming every patient in the population would be offered the treatment) to create a variable weight used in all subsequent analyses to emulate balance achieved via randomization for known covariates. A weighted linear mixed-effects model including patients with a baseline PHQ-9/GAD-7 score of ≥10 and a primary depression or anxiety diagnosis (not adjustment disorders) evaluated the outcome of mean PHQ-9 difference for patients with depressive disorders or mean GAD-7 difference for patients with anxiety disorders, adjusting for baseline scores. For patients without follow-up symptom measures, we imputed baseline symptom value assuming a conservative null effect (average mean difference of zero). Models included treatment group, continuous time, interaction between treatment group and time, and covariates as fixed effects and participants as random effects. Models were fit using the restricted maximum likelihood method assuming a spatial power covariance structure due to unequally spaced measurements, allowing all available responses to be used and handling data missing at random. Fitted models were used to estimate the adjusted mean difference (AMD) in PHQ-9 or GAD-7 scores at time points of interest. Unadjusted bivariate analysis estimated mean scores by day to illustrate trends in follow-up scores to compare interventions. All analyses were performed using SAS 9.4 (Cary, North Carolina).

RESULTS

Patient Characteristics

There were N = 10,380 patients (15% in virtual collaborative care; 85% in virtual specialty psychiatry) with depressive disorders and N = 2,935 (19% in

Figure 1.
Study Flow Diagram



Abbreviations: appts = appointments, CC = collaborative care, GAD-7 = Generalized Anxiety Disorder-7 Questionnaire, MDD = major depressive disorder, PHQ-9 = Patient Health Questionnaire-9, psych = psychiatry, SP = specialty psychiatry.

Table 1.

Unweighted and Weighted Characteristics of Patients With Depression or Anxiety by Virtual Treatment Group

Patient characteristic	Unweighted			Weighted		
	Collaborative care N (%)	Specialty psychiatry N (%)	SMD	Collaborative care (%)	Specialty psychiatry (%)	SMD
Depression, N = 10,380	N = 1,607	N = 8,773		N = 1,607	N = 8,773	
Race						
Asian	252 (15.7%)	1057 (12.0%)	−0.11	12.0	12.6	0.02
Black	107 (6.7%)	664 (7.6%)	0.04	10.0	7.4	−0.10
Latinx	276 (17.2%)	1522 (17.3%)	0.005	14.9	17.3	0.06
Other/unknown	166 (10.3%)	890 (10.1%)	−0.01	10.9	10.2	−0.03
White	806 (50.2%)	4640 (52.9%)	0.05	52.3	52.6	0.01
Gender						
Female	1085 (67.5%)	6280 (71.6%)	0.09	30.1	29.1	0.02
Non-female	522 (32.5%)	2493 (28.4%)		69.9	70.9	
Age, y						
18–39	948 (59.0%)	4836 (55.1%)		55.6	55.4	
40–64	516 (32.1%)	3009 (34.3%)		33.3	34.3	
65+	143 (8.9%)	928 (10.6%)		11.1	10.3	
Mean (SD)	40 (15.6)	41 (16.4)	−0.08	41.1 (41.9)	40.6 (17.7)	0.03
Body mass index, kg/m^2[a]						
Missing	660 (41.1%)	2402 (27.4%)	−0.29	28.4	29.5	0.02
Normal	310 (19.3%)	1865 (21.3%)	0.05	21.8	21	−0.02
Overweight	279 (17.4%)	1873 (21.3%)	0.10	19.6	20.7	0.03
Obese	275 (17.1%)	1851 (21.1%)	0.10	22.0	20.5	−0.04
Severely obese	68 (4.2%)	670 (7.6%)	0.14	7.3	7.1	−0.01
Underweight	15 (0.9%)	112 (1.3%)	0.03	1.0	1.2	0.02
Charlson comorbidity index						
0	1382 (86.0%)	6950 (79.2%)	−0.16	80.4	80.2	−0.05
1	128 (8.0%)	1003 (11.4%)		11.5	11	
2+	97 (6.0%)	820 (9.3%)		8.1	8.8	
Neighborhood deprivation index[b]						
1	454 (28.3%)	2035 (23.2%)	−0.15	23.1	23.8	0.04
2	412 (25.6%)	2223 (25.3%)		23.6	25.6	
3	373 (23.2%)	2174 (24.8%)		25.8	24.8	
4	368 (22.9%)	2338 (26.6%)		27.4	25.8	
>3 encounters with psychiatry diagnosis in the past 1 y						
No	1549 (96.4%)	7260 (82.8%)	0.46	85.4	84.9	0.02
Yes	58 (3.6%)	1513 (17.2%)		14.6	15.1	
Antidepressant medication usage in the past 1 y						
No	1259 (78.3%)	4971 (56.7%)	0.48	59.7	60	−0.01
Yes	348 (21.7%)	3802 (43.3%)		40.3	40	
Screen GAD-7/PHQ-9						
Mean (SD)	9.3 (2.7)	10.2 (2.7)	−0.32	10.2 (7.0)	9.9 (4.5)	0.06
Median (IQR)	9 (4)	10 (5)				
Screen GAD-7/PHQ-9 category						
Mild	856 (53.3%)	3476 (39.6%)		39.5	41.8	
Moderate	751 (46.7%)	5297 (60.4%)		60.5	58.2	
Time of eligibility screening to baseline symptom assessment, d						
Mean (SD)	10 (25.5)	15 (31.9)	−0.17	6.4 (22.6)	20.4 (22.7)	0.16
Diagnosis of any MDD prior to treatment start						
Yes	537 (33%)	5796 (66%)	−0.69	59.8	61	−0.03
No	1070 (67%)	2977 (34%)		40.2	39	
Baseline GAD-7/PHQ-9 score						
Mean (SD)	9.1 (3.5)	10.0 (4.2)				
Median	9 (4)	10.0 (7.0, 13.0)				
Baseline GAD-7/PHQ-9 category						
Mild	813 (50.6%)	3328 (37.9%)				
Moderate	581 (36.2%)	3724 (42.4%)				
Moderately severe	93 (5.8%)	791 (9.0%)				
None	110 (6.8%)	715 (8.2%)				
Severe	10 (0.6%)	215 (2.5%)				

(continued)

Table 1 (continued).

Patient characteristic	Unweighted			Weighted		
	Collaborative care N (%)	Specialty psychiatry N (%)	SMD	Collaborative care (%)	Specialty psychiatry (%)	SMD
At least 1 follow-up measure in 6 mo						
Yes	1466 (91.2%)	6700 (76.4%)				
No	141 (8.8%)	2073 (23.6%)				

Patient characteristic	Unweighted			Weighted		
	Collaborative care N (%)	Specialty psychiatry N (%)	SD	Collaborative care (%)	Specialty psychiatry (%)	SD
Anxiety, N = 2,935	N = 570	N = 2,365		N = 570	N = 2,365	
Race						
Asian	99 (17.4%)	274 (11.6%)	−0.16	13	12.8	−0.01
Black	24 (4.2%)	126 (5.3%)	0.05	5.3	5.1	−0.01
Latinx	100 (17.5%)	361 (15.3%)	−0.06	15.5	15.7	0.01
Other/unknown	68 (11.9%)	227 (9.6%)	−0.08	10.1	10	−0.001
White	279 (48.9%)	1377 (58.2%)	0.19	56.1	56.4	0.01
Gender						
Female	391 (68.6%)	1685 (71.2%)	0.06	72.8	70.8	−0.04
Non-female	179 (31.4%)	680 (28.8%)		27.2	29.2	
Age, y						
18–39	390 (68.4%)	1528 (64.6%)		62.8	65.4	
40–64	162 (28.4%)	683 (28.9%)		32.3	28.4	
65+	18 (3.2%)	154 (6.5%)		4.9	6.2	
Mean (SD)	36 (13)	37 (14.6)	−0.12	37 (31.3)	37 (16.2)	0.04
Body mass index, kg/m^2[a]						
Missing	229 (40.2%)	751 (31.8%)	−0.18	32.7	33.3	0.01
Normal	137 (24.0%)	580 (24.5%)	0.01	22.8	24.4	0.04
Obese	71 (12.5%)	413 (17.5%)	0.14	17.1	16.5	−0.01
Overweight	107 (18.8%)	464 (19.6%)	0.02	19.9	19.4	−0.01
Severely obese	21 (3.7%)	129 (5.5%)	0.08	6.6	5.1	−0.07
Underweight	5 (0.9%)	28 (1.2%)	0.03	0.9	1.1	0.03
Charlson comorbidity index						
0	518 (90.9%)	2023 (85.5%)	−0.20	84.8	86.6	0.06
1	37 (6.5%)	208 (8.8%)		8.6	8.4	
2+	15 (2.6%)	134 (5.7%)		6.6	5.1	
Neighborhood deprivation index[b]						
1	166 (29.1%)	602 (25.5%)	−0.1	25.2	26	0.09
2	168 (29.5%)	649 (27.4%)		29.4	27.6	
3	128 (22.5%)	611 (25.8%)		21.8	25.7	
4	108 (18.9%)	502 (21.2%)		23.6	20.7	
>3 encounters with psychiatry diagnosis in the past 1 y						
No	551 (96.7%)	2095 (88.6%)	0.31	90.7	90.1	0.02
Yes	19 (3.3%)	270 (11.4%)		9.3	9.9	
Antidepressant medication usage in the past 1 y						
No	474 (83.2%)	1624 (68.7%)	0.34	71.3	71.4	0.003
Yes	96 (16.8%)	741 (31.3%)		28.7	28.6	
Screen GAD-7						
Mean (SD)	10.5 (2.4)	11.0 (2.3)	−0.18	10.8 (5.3)	10.9 (2.6)	−0.05
Median (IQR)	11 (3)	11 (4)		11 (5)	11 (4)	
Screen GAD-7 category						
Mild	186 (32.6%)	622 (26.3%)		31.7	27.6	
Moderate	384 (67.4%)	1743 (73.7%)		68.3	72.4	
Time of eligibility screening to baseline symptom assessment, days						
Mean (SD)	9 (22)	13 (26)	−0.15	5.1 (8.7)	17 (20.5)	0.20
Diagnosis of any MDD prior to treatment start						
Yes	464 (81.4%)	2173 (91.9%)	−0.31	90.5	89.9	0.02
No	106 (18.6%)	192 (8.1%)		9.5	10.1	
Baseline GAD-7						
Mean (SD)	10.6 (2.9)	11.2 (3.1)				
Median	11 (5)	11 (4)				

(continued)

Table 1 (continued).

Patient characteristic	Unweighted			Weighted		
	Collaborative care N (%)	Specialty psychiatry N (%)	SD	Collaborative care (%)	Specialty psychiatry (%)	SD
Baseline GAD-7 category						
Mild	206 (36.1%)	709 (30.0%)				
Moderate	307 (53.9%)	1376 (58.2%)				
Moderately severe	53 (9.3%)	258 (10.9%)				
None	4 (0.7%)	2 (0.1%)				
Severe	0 (0%)	20 (0.8%)				
At least 1 follow-up measure in 6 mo						
Yes	349 (61.2%)	1062 (44.9%)				
No	221 (38.8%)	1303 (55.1%)				

[a]Body mass index categories are defined as follows: <18.5, underweight; ≤18.5 to <25, normal; ≤25 to <30, overweight; ≤30 to <40, obese; ≥40, severely obese.
[b]Neighborhood deprivation index is a geocoded measure of socioeconomic status with categories based on the tertiles of the overall cohort, with higher scores indicating more deprivation.
Abbreviations: GAD-7 = Generalized Anxiety Disorder-7 Scale, IQR = interquartile range, kg = kilogram, m^2 = meters squared, MDD = major depressive disorder, PHQ-9 = Patient Health Questionnaire-9, SMD = standardized mean difference.

collaborative care; 81% in specialty psychiatry) with anxiety disorders. For the multivariate analysis including only patients with a baseline PHQ-9/GAD-7 score of ≥10 and a depression or anxiety diagnosis, there were N = 4,563 patients (14% in collaborative care; 86% in specialty psychiatry) with depressive disorders and N = 1,805 (20% in collaborative care; 80% in specialty psychiatry) with anxiety disorders (Figure 1). During the study period, 99.5% of specialty psychiatry appointments were virtual. For both interventions and diagnoses, most patients were <40 years old, female, and non-Latinx white (Table 1). There were significant differences by intervention in these characteristics and baseline BMI, CCI, and NDI. Clinical characteristics differed between interventions, including prior year history of clinic encounters with a psychiatric diagnosis ($P < .0001$ for both diagnoses), time of eligibility screening to baseline symptom assessment ($P = .002$ for both diagnoses), and antidepressant use in the year prior to the eligibility screening ($P < .0001$ for both diagnoses). Baseline PHQ-9 scores were 9.1 ± 3.5 for collaborative care and 10.0 ± 4.2 for specialty psychiatry ($P < .0001$); baseline GAD-7 scores were 10.6 ± 2.9 for collaborative care and 11.2 ± 3.1 for specialty psychiatry ($P < .0001$).

Response to Treatment Over Time for Depressive Disorders

For patients with major depressive disorder, patients in both interventions showed significant improvements in depressive symptoms compared to baseline (Figure 2A and 2B), with patients in collaborative care showing an AMD of −9.0 (95% CI, −9.7 to −8.4; Table 2) and those in specialty psychiatry showing an AMD of −5.0 (95% CI, −5.6 to −4.5) at 6 months; collaborative care showed significantly greater improvement compared to specialty psychiatry ($P < .0001$). Estimates at the mean treatment time (72 days) showed similar significant improvements. In an analysis including patients with only an adjustment disorder diagnosis, depressive symptoms significantly improved in both interventions at 6 months (AMD = −9.1, 95% CI, −9.8 to −8.3 in collaborative care; AMD = −5.6, 95% CI, −6.3 to −4.8 in specialty psychiatry) with collaborative care having significantly higher improvements ($P < .0001$).

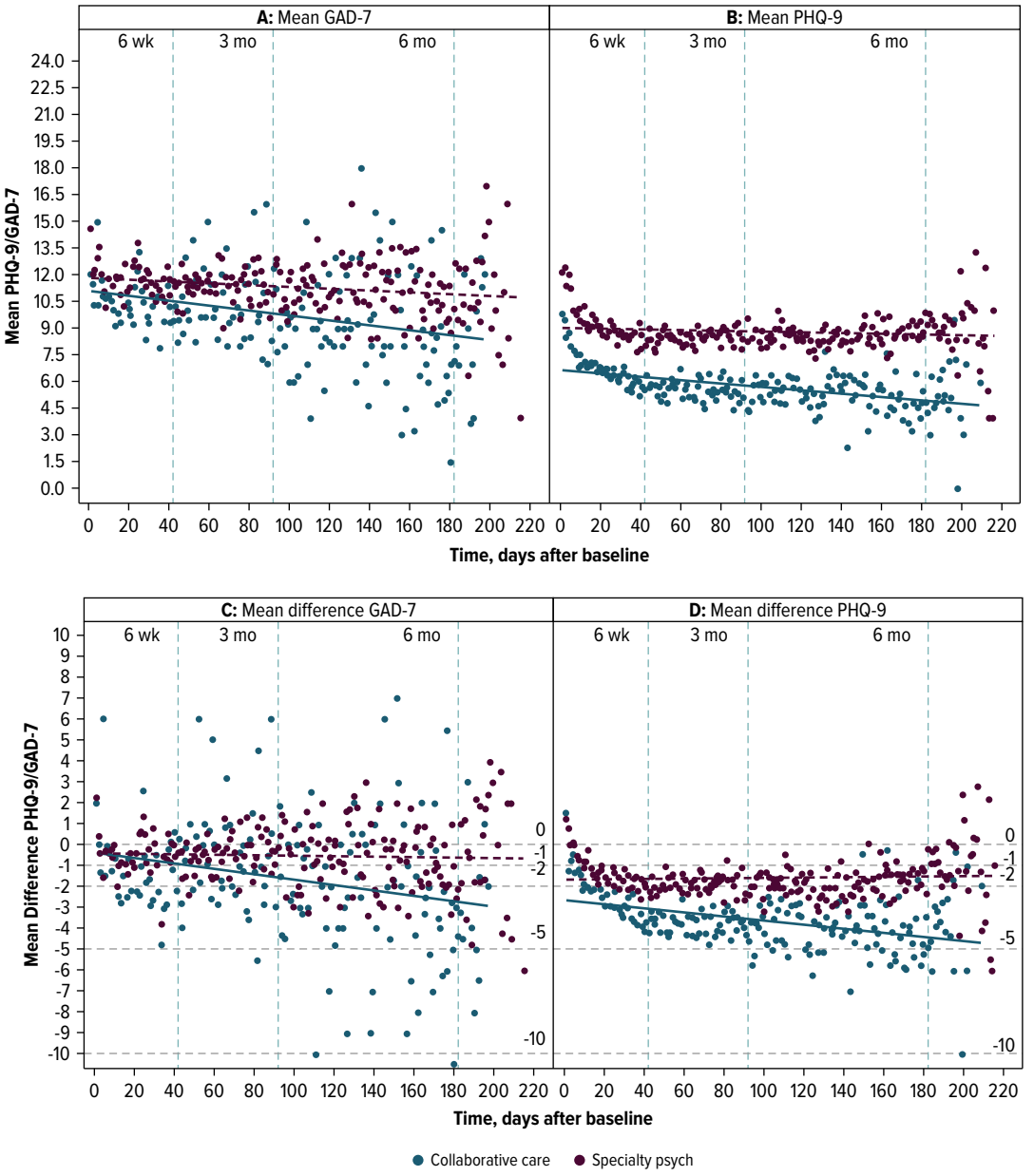
There was a significant time-by-treatment interaction in collaborative care vs specialty psychiatry ($P < .0001$; Table 3). Lower baseline depressive symptoms, time from baseline to treatment start, antidepressant use during treatment, and older age were significantly associated with depressive symptom reduction during follow-up ($P < .0001$ except age 40–64 years; $P = .042$). Antidepressant use in the year prior to screening ($P = .011$) and a history of clinic encounters containing psychiatric diagnoses in the year prior ($P < .0001$) were all associated with worsening depressive symptoms during the follow-up. Post hoc examination of unadjusted rates of depression response and remission using the full cohort (N = 10,380) at the last follow-up measure revealed that 55% of patients had treatment response and 43% had depression remission in virtual collaborative care vs 36% response and 27% remission in virtual specialty psychiatry (Supplementary Table 3).

Response to Treatment Over Time for Anxiety Disorders

For patients with primary anxiety disorders, patients in both interventions showed significant anxiety symptom improvement from baseline (Figure 2C and 2D), with virtual collaborative care showing an AMD of −5.4 (95% CI, −6.2 to −4.7; Table 2) and specialty psychiatry showing an AMD of −2.8 (95% CI, −3.6 to −2.1) at 6 months. Patients in collaborative care had a

Figure 2.

Unadjusted and Mean Difference Outcomes for Depressive and Anxiety Symptoms Over Time



Abbreviations: GAD-7 = Generalized Anxiety Disorder-7 Questionnaire, PHQ-9 = Patient Health Questionnaire.

significantly greater improvement compared to those in specialty psychiatry ($P < .0001$). Estimates at the mean treatment time (49 days) revealed that patients in virtual collaborative care (AMD = −2.6, 95% CI, −3.2 to −2.1) and specialty psychiatry (AMD = −1.3, 95% CI, −1.8 to −0.7) had significant improvement in anxiety symptoms, with collaborative care having significantly greater improvements compared to specialty psychiatry ($P < .0001$). In an analysis including patients with adjustment disorder diagnoses, anxiety symptoms significantly improved in both groups (AMD = −3.4, 95% CI, −6.5 to −0.4 in collaborative care; AMD = −3.8, 95% CI, −6.5 to −0.4 in specialty psychiatry).

There was a significant time-by-treatment interaction in collaborative care vs specialty psychiatry ($P < .0001$; Table 3). Lower baseline anxiety symptoms ($P < .0001$) and time from baseline to treatment ($P < .0001$) were significantly associated with symptom reduction at follow-up, while a high NDI (score of 2 [$P = .043$]) was significantly associated with higher follow-up symptoms

Table 2.

Adjusted Mean Difference in Treatment Outcomes for Patients With Depressive and Anxiety Symptoms

	Collaborative care (95% CI)	Specialty psychiatry (95% CI)	Mean difference (95% CI)	*P* value
At 6 mo post-baseline, MDD and anxiety disorders only[a]				
Mean PHQ-9 change	−9.0 (−9.7 to −8.4)	−5.0 (−5.6 to −4.5)	−4.0 (−4.7 to −3.3)	<.0001
Mean GAD-7 change	−5.4 (−6.2 to −4.7)	−2.8 (−3.6 to −2.1)	−2.6 (−3.4 to −1.8)	<.0001
At mean treatment time post-baseline, MDD and anxiety disorders only (depression = 72 d; anxiety = 49 d)[b]				
Mean PHQ-9 change (95% CI)	−5.4 (−6.0 to −4.9)	−3.1 (−3.5 to −2.7)	−2.4 (−2.8 to −2.0)	<.0001
Mean GAD-7 change (95% CI)	−2.6 (−3.2 to −2.1)	−1.3 (−1.8 to −0.7)	−1.4 (−1.7 to −1.1)	<.0001
At 6 mo post-baseline adjustment with depressed mood and adjustment with anxiety[a]				
Mean PHQ-9 change (95% CI)	−9.1 (−9.8 to −8.4)	−5.6 (−6.3 to −4.8)	−3.5 (−4.3 to −2.8)	<.0001
Mean GAD-7 change (95% CI)	−3.4 (−6.5 to −0.4)	−3.8 (−6.5 to −1.2)	0.40 (−2.6 to 3.4)	.792

[a]N = 4,563 participants with depressive disorders (MDD = 2,683); mean (SD) PHQ-9 at baseline = 13.3 (2.9). Adjustment disorder with depressed mood = 1,880; mean (SD) PHQ-9 at baseline = 12.8 (2.7). N = 1805 participants with anxiety disorders (primary anxiety disorders = 1,608); mean (SD) GAD-7 Questionnaire = 12.8 (2.3). Adjustment with anxiety = 196; mean (SD) GAD-7 Questionnaire = 12.1 (1.8) were used the linear mixed-effects models.
[b]Seventy-two and 49 days represent the mean length of treatment for depression and anxiety, respectively.
Abbreviations: GAD-7 = Generalized Anxiety Disorder-7 Questionnaire, MDD = major depressive disorder, PHQ-9 = Patient Health Questionnaire.

compared to baseline. Post hoc examination of unadjusted response and remission rates using the full cohort (N = 2,935) at last measure revealed that 14% of collaborative care patients had treatment response and 0.3% had anxiety remission vs 10% response and 0.1% remission in specialty psychiatry (Supplementary Table 3).

DISCUSSION

These results show that a virtual collaborative care program for depression with novel programmatic features[43] was associated with significant improvements durable up to 6 months after treatment initiation compared to specialty psychiatry. On average, patients moved from moderate symptoms to not meeting criteria for a depressive disorder (Table 2). Similarly, patients with anxiety showed clinical improvements during collaborative care treatment at least as effective as specialty psychiatry (Table 2). Our results extend previous work comparing collaborative care for depression to enhanced primary care.[47] In addition to demonstrating the effectiveness of a virtual collaborative care program compared to specialty psychiatry in a large population, we demonstrate that novel programmatic elements, including manager role integration into each clinical contact and utilization of pharmacist prescribers,[43] are efficacious.

Collaborative care had a large effect size (Cohen $d = -2.23$; 95% CI, −2.46 to −2.00) for major depressive disorder; previous efficacy trials in smaller populations showed small effect sizes for collaborative care.[47,48] Differences in baseline population or programmatic elements may contribute to these findings. Many collaborative care models focus on treating older adults.[15] The mean age of this study population was 37 ± 15 years for anxiety and 41 ± 16 years for depression, yet it demonstrated comparable, positive outcomes to collaborative care in older populations, suggesting that the care model extends well to younger populations. Patient outcomes in specialty psychiatric care were comparable to previous literature,[49,50] with the average depression severity significantly improving from moderate to mild at 6 months.

Specialty psychiatry in an integrated health care system may share similarities to collaborative care compared to specialty psychiatry in other systems. As such, the finding that patients in collaborative care showed larger reductions in depression or anxiety symptoms compared to specialty psychiatry and a 159% and 153% improvement in remission and response for depression and a 300% and 140% improvement in remission and response for anxiety (Supplementary Table 3) likely reflects programmatic features of collaborative care. The implemented model had routine symptom collection (measurement-based care), scheduled follow-up, structured therapy content, time-limited therapy, algorithms for addressing worsening symptoms (action plan), and symptom-based program graduation.[43] Such model components have been associated with collaborative care program outcomes[15,38] and may have impacted treatment effectiveness compared to specialty psychiatry, where treatment was individually determined by providers and patients.

Clinical variables predicting depressive symptom improvement included baseline PHQ-9, time from

Table 3.

Estimated Change in Mean Outcome (PHQ-9 or GAD-7) From Baseline for Patients With Primary Major Depressive or Anxiety Disorders

	Depression, N = 2,683			Anxiety, N = 1,608		
Patient characteristic	**Mean effect**	**95% CI**	***P* value**	**Mean effect**	**95% CI**	***P* value**
Intercept	6.06	(5.09 to 7.03)	<.0001	5.88	(4.87 to 6.89)	<.0001
Treatment type						
Collaborative care	−1.58	(−2.05 to −1.11)		−1.02	(−1.38 to −0.66)	<.0001
Specialty psychiatry	Reference		<.0001	Reference		
Time baseline to treatment (days)	−0.01	(−0.02 to −0.01)	<.0001	−0.01	(−0.013 to −0.006)	<.0001
Time (days) × treatment type						
Collaborative care	−0.01	(−0.014 to −0.008)		−0.01	(−0.01 to 0)	.0005
Specialty psychiatry	Reference		<.0001	Reference		
PHQ-9/GAD-7 at baseline	−0.59	(−0.64 to −0.53)	<.0001	−0.48	(−0.55 to −0.42)	<.0001
Race/ethnicity						
Asian	−0.07	(−0.6 to 0.45)	.783	0.26	(−0.2 to 0.72)	.273
Black	0.39	(−0.27 to 1.05)	.248	−0.77	(−1.55 to 0)	.05
Latinx	−0.48	(−0.96 to 0)	.05	0.01	(−0.44 to 0.46)	.98
Other/unknown	−0.06	(−0.6 to 0.48)	.836	0.09	(−0.42 to 0.61)	.726
White	Reference			Reference		
Gender						
Female	0.12	(−0.25 to 0.48)	.53	0.02	(−0.32 to 0.36)	.905
Non-female	Reference			Reference		
Age, y						
40–64	−0.39	(−0.77 to −0.01)	.042	−0.4	(−0.75 to −0.04)	.029
65+	−0.63	(−1.27 to 0)	.052	−0.38	(−1.21 to 0.45)	.375
18–39	Reference			Reference		
Body mass index, kg/m^2						
Missing	−0.39	(−0.88 to 0.09)	.112	−0.21	(−0.62 to 0.2)	.322
Overweight	−0.42	(−0.95 to 0.11)	.117	−0.13	(−0.6 to 0.34)	.592
Obese	−0.41	(−0.93 to 0.11)	0.12	0.15	(−0.35 to 0.64)	.564
Severely obese	0.01	(−0.67 to 0.69)	.978	0.11	(−0.7 to 0.91)	.793
Underweight	0.23	(−1.11 to 1.57)	.737	0.68	(−0.71 to 2.07)	.336
Normal	Reference			Reference		
Charlson comorbidity index						
1	−0.19	(−0.75 to 0.37)	.507	−0.2	(−0.78 to 0.37)	.488
2–3	0.26	(−0.38 to 0.89)	.433	−0.16	(−1.02 to 0.69)	.708
0				Reference		
Neighborhood deprivation index						
2	0.27	(−0.2 to 0.73)	.261	0.42	(0.01 to 0.82)	.043
3	0.03	(−0.45 to 0.5)	.907	0.08	(−0.35 to 0.51)	.707
4	0.06	(−0.42 to 0.54)	.812	0.16	(−0.3 to 0.62)	.492
1	Reference			Reference		
>3 encounters with psychiatry diagnosis within the year prior to index visit						
Yes	0.76	(0.31 to 1.2)	.001	−0.01	(−0.55 to 0.53)	.967
No	Reference			Reference		
Antidepressant medication usage within the year prior to index visit						
Yes	0.47	(0.11 to 0.83)	.011	−0.06	(−0.43 to 0.31)	.745
No	Reference			Reference		
Antidepressant medication exposure during treatment						
Yes	−0.98	(−1.22 to −0.74)	<.0001	−0.33	(−0.68 to 0.02)	.064
No	Reference			Reference		

Abbreviations: GAD-7 = Generalized Anxiety Disorder-7 Questionnaire, PHQ-9 = Patient Health Questionnaire-9.

baseline to treatment, age, and antidepressant use during treatment. Variables predicting worsening depressive symptoms included a history of clinic encounters containing psychiatric diagnoses, or antidepressant use in the year prior to screening eligibility. This aligns with previous literature, suggesting that individuals closer to their first depressive episode with lower baseline depressive symptoms, or lacking comorbidities, have a greater likelihood of treatment response,[51] and lower socioeconomic status is associated with poorer depression outcomes.[52]

Older age predicted higher treatment response, which is counterintuitive, given the literature suggesting that treatment resistance incidence increases with age.[53] However, most patients in this cohort had no psychiatric history or comorbidities, suggesting that they may be presenting for their first depressive episode later in life.

For anxiety, lower baseline anxiety symptoms and shorter time between baseline and treatment were significantly associated with anxiety symptom reduction, while a high NDI score was significantly associated with worsening anxiety symptoms. Similar to depression, baseline anxiety scores have been associated with anxiety outcomes,[54] although direct evidence regarding primary delays in anxiety screening to treatment impacting outcomes is limited. Previously, there have been reports of data trends suggesting an association between income and anxiety outcomes[55]; data from this study support this and warrant further investigation.

While this study provides some of the first real-world data regarding virtual collaborative care treatment outcomes for a diverse population in an integrated health setting vs specialty psychiatry treatment, it has limitations. Factors influencing decision making regarding intervention enrollment could impact study results. To address this limitation, we performed IPTW, which only accounts for measured covariates. A randomized controlled trial is needed to control for unmeasured covariates. This study took place in an integrated health system with insured patients. As such, some findings may not generalize to populations without similar insurance or access to care.

These results support the effectiveness of virtual collaborative care to treat mild-to-moderate depressive and anxiety symptoms. Depression is one of the most common mental health conditions in the United States,[1] yet most patients with depression do not achieve treatment response or reach Healthcare Effectiveness Data and Information Set (HEDIS) care quality goals of a 50% symptom reduction.[46,56,57] Collaborative care is a powerful model to help patients obtain timely access to high-quality, evidence-based mental health care, leading to improved outcomes.[15] These results suggest that collaborative care models may have value toward improving specialty psychiatric care and can help define how scarce psychiatric resources should be deployed.

Article Information

Published Online: September 4, 2024. https://doi.org/10.4088/JCP.24m15332

Submitted: March 5, 2024; accepted June 4, 2024.

To Cite: Ridout KK, Alavi M, Lee C, et al. Virtual collaborative care versus specialty psychiatry treatment for depression or anxiety. *J Clin Psychiatry*. 2024;85(3):24m15332.

Author Affiliations: The Permanente Medical Group, Kaiser Permanente Northern California, Oakland, California (K. Ridout, Fazzolari, S. Ridout, Koshy, Awsare); Division of Research, Kaiser Permanente Northern California, Oakland, California (K. Ridout, Alavi, Lee, Weisner, Iturralde); Kaiser Foundation Hospitals, Kaiser Permanente Northern California, Oakland, California (Harris).

Corresponding Author: Kathryn K. Ridout, MD, PhD, Kaiser Permanente Northern California, 401 Bicentennial Way, Santa Rosa, CA 95403 (Kathryn.Erickson-Ridout@KP.org).

Author Contributions: Concept and design: (K. Ridout, S. Ridout, Awsare, Weisner, Iturralde). Acquisition, analysis, or interpretation of data: (K. Ridout, Alavi, S. Ridout, Lee, Iturralde). Drafting of the manuscript: (K. Ridout, Alavi, S. Ridout, Iturralde). Critical revision of the manuscript for important intellectual content: (K. Ridout, Koshy, Awsare, Harris, Weisner, Fazzolari, Iturralde). Statistical analysis: (K. Ridout, S. Ridout, Alavi, Lee). Funding acquisition: (K. Ridout). Administrative, technical, or material support: (K. Ridout, S. Ridout, Awsare, Harris, Fazzolari). Supervision: (Awsare, Koshy, Iturralde).

Relevant Financial Relationships: The authors report no financial or other relationship relevant to the subject of this article.

Funding/Support: This project was supported by competitive, peer-reviewed funding in The Permanente Medical Group (TPMG) Delivery Science and Applied Research program (Oakland, CA). Dr K. Ridout's time was supported by The Permanente Medical Group's Physician Researcher Program.

Role of the Sponsor/Funder: The supporters had no role in the design, analysis, interpretation, or publication of this study.

Author Data Access: Drs K. Ridout and Iturralde and Ms Alavi had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

ORCID: Kathryn Ridout: https://orcid.org/0000-0003-2101-8165; Esti Iturralde: https://orcid.org/0000-0001-6837-4998; Catherine Lee: https://orcid.org/0000-0003-0008-9052; Brooke Harris: https://orcid.org/0000-0001-9166-052X

Supplementary Material: Available at Psychiatrist.com.

References

1. Kessler RC, Berglund P, Demler O, et al. Lifetime prevalence and age-of-onset distributions of *DSM-IV* disorders in the National Comorbidity Survey Replication. *Arch Gen Psychiatry*. 2005;62(6):593–602.
2. Hasin DS, Sarvet AL, Meyers JL, et al. Epidemiology of adult *DSM-5* major depressive disorder and its specifiers in the United States. *JAMA Psychiatry*. 2018;75(4):336–346.
3. Pan American Health Organization. *The Burden of Mental Disorders in the Region of the Americas, 2018*. Pan American Health Organization; 2018.
4. Greenberg PE, Fournier AA, Sisitsky T, et al. The economic burden of adults with major depressive disorder in the United States (2005 and 2010). *J Clin Psychiatry*. 2015;76(2):155–162.
5. Bukh JD, Bock C, Vinberg M, et al. The effect of prolonged duration of untreated depression on antidepressant treatment outcome. *J Affect Disord*. 2013;145(1):42–48.
6. Bachmann S. Epidemiology of suicide and the psychiatric perspective. *Int J Environ Res Public Health*. 2018;15(7):1425.
7. Bradvik L. Suicide risk and mental disorders. *Int J Environ Res Public Health*. 2018;15(9):2028.
8. National Institute of Mental Health. *Suicide*. National Institute of Mental Health. Accessed September 28, 2023. https://www.nimh.nih.gov/health/statistics/suicide
9. Harvard Medical School. *National Comorbidity Survey*; 2017. Accessed June 22, 2023. https://www.hcp.med.harvard.edu/ncs/index.php
10. Kalin NH. The critical relationship between anxiety and depression. *Am J Psychiatry*. 2020;177(5):365–367.
11. Cuijpers P, Sijbrandij M, Koole SL, et al. The efficacy of psychotherapy and pharmacotherapy in treating depressive and anxiety disorders: a meta-analysis of direct comparisons. *World Psychiatry*. 2013;12(2):137–148.
12. Goncalves DC, Byrne GJ. Interventions for generalized anxiety disorder in older adults: systematic review and meta-analysis. *J Anxiety Disord*. 2012;26(1):1–11.
13. Schoenbaum M, Unützer J, McCaffrey D, et al. The effects of primary care depression treatment on patients' clinical status and employment. *Health Serv Res*. 2002;37(5):1145–1158.
14. Puyat JH, Kazanjian A, Goldner EM, et al. How often do individuals with major depression receive minimally adequate treatment? A population-based, data linkage study. *Can J Psychiatry*. 2016;61(7):394–404.
15. Gilbody S, Bower P, Fletcher J, et al. Collaborative care for depression: a cumulative meta-analysis and review of longer-term outcomes. *Arch Intern Med*. 2006;166(21):2314–2321.
16. Grochtdreis T, Brettschneider C, Wegener A, et al. Cost-effectiveness of collaborative care for the treatment of depressive disorders in primary care: a systematic review. *PLoS One*. 2015;10(5):e0123078.

17. AIMs Center. *Patient-Centered Integrated Behavioral Health Care Principles & Tasks Checklist*. University of Washington; 2014. Accessed December 3, 2023. https://aims.uw.edu/sites/default/files/CollaborativeCarePrinciplesAndComponents_2014-12-23.pdf
18. Archer J, Bower P, Gilbody S, et al. Collaborative care for depression and anxiety problems. *Cochrane Database Syst Rev*. 2012;10:CD006525.
19. Fortney JC, Pyne JM, Edlund MJ, et al. A randomized trial of telemedicine-based collaborative care for depression. *J Gen Intern Med*. 2007;22(8):1086–1093.
20. Huffman JC, Niazi SK, Rundell JR, et al. Essential articles on collaborative care models for the treatment of psychiatric disorders in medical settings: a publication by the academy of psychosomatic medicine research and evidence-based practice committee. *Psychosomatics*. 2014;55(2):109–122.
21. Thota AB, Sipe TA, Byard GJ, et al. Collaborative care to improve the management of depressive disorders: a community guide systematic review and meta-analysis. *Am J Prev Med*. 2012;42(5):525–538.
22. Katon W, Unützer J, Wells K, et al. Collaborative depression care: history, evolution and ways to enhance dissemination and sustainability. *Gen Hosp Psychiatry*. 2010;32(5):456–464.
23. Colorafi K, Vanselow J, Nelson T. Treating anxiety and depression in primary care: reducing barriers to access. *Fam Pract Manag*. 2017;24(4):11–16.
24. The National Council. *The Comprehensive Healthcare Integration Framework*; 2024. Accessed August 21, 2024. https://www.thenationalcouncil.org/resources/the-comprehensive-healthcare-integration-framework/
25. Pincus HA, Hough L, Houtsinger JK, et al. Emerging models of depression care: multi-level ('6 P') strategies. *Int J Methods Psychiatr Res*. 2003;12(1):54–63.
26. Katon WJ, Lin E, Russo J, et al. Increased medical costs of a population-based sample of depressed elderly patients. *Arch Gen Psychiatry*. 2003;60(9):897–903.
27. Callahan CM, Hui SL, Nienaber NA, et al. Longitudinal study of depression and health services use among elderly primary care patients. *J Am Geriatr Soc*. 1994;42(8):833–838.
28. Unützer J, Patrick DL, Simon G, et al. Depressive symptoms and the cost of health services in HMO patients aged 65 years and older. A 4-year prospective study. *JAMA*. 1997;277(20):1618–1623.
29. Luber MP, Meyers BS, Williams-Russo PG, et al. Depression and service utilization in elderly primary care patients. *Am J Geriatr Psychiatry*. 2001;9(2):169–176.
30. Solberg LI, Crain AL, Jaeckels N, et al. The DIAMOND initiative: implementing collaborative care for depression in 75 primary care clinics. *Implement Sci*. 2013;8:135.
31. Solberg LI, Crain AL, Maciosek MV, et al. A stepped-wedge evaluation of an initiative to spread the collaborative care model for depression in primary care. *Ann Fam Med*. 2015;13(5):412–420.
32. Coleman KJ, Dreskin M, Hackett DL, et al. A roadmap for institutionalizing collaborative care for depression in a large integrated healthcare system. *J Gen Intern Med*. 2020;35(suppl 2):839–848.
33. Unützer J, Carlo AC, Arao R, et al. Variation in the effectiveness of collaborative care for depression: does it matter where you get your care? *Health Aff (Millwood)*. 2020;39(11):1943–1950.
34. Bauer AM, Azzone V, Goldman HH, et al. Implementation of collaborative depression management at community-based primary care clinics: an evaluation. *Psychiatr Serv*. 2011;62(9):1047–1053.
35. Blackmore MA, Patel UB, Stein D, et al. Collaborative care for low-income patients from racial-ethnic minority groups in primary care: engagement and clinical outcomes. *Psychiatr Serv*. 2022;73(8):842–848.
36. Carlo AD, Jeng PJ, Bao Y, et al. The learning curve after implementation of collaborative care in a state mental health integration program. *Psychiatr Serv*. 2019;70(2):139–142.
37. Fortney JC, Bauer AM, Cerimele JM, et al. Comparison of teleintegrated care and telereferral care for treating complex psychiatric disorders in primary care: a pragmatic randomized comparative effectiveness trial. *JAMA Psychiatry*. 2021;78(11):1189–1199.
38. Sanchez K. Collaborative care in real-world settings: barriers and opportunities for sustainability. *Patient Prefer Adherence*. 2017;11:71–74.
39. Hernan MA, Robins JM. Using big data to emulate a target trial when a randomized trial is not available. *Am J Epidemiol*. 2016;183(8):758–764.
40. Hansford HJ, Cashin AG, Jones MD, et al. Development of the TrAnsparent ReportinG of observational studies emulating a target trial (TARGET) guideline. *BMJ Open*. 2023;13(9):e074626.
41. Gordon N, Lin T. The Kaiser Permanente northern California adult member health survey. *Perm J*. 2016;20(4):15–225.
42. Hedegaard H, Schoenbaum M, Claassen C, et al. Issues in developing a surveillance case definition for nonfatal suicide attempt and intentional self-harm using international classification of diseases, tenth revision, clinical modification (ICD-10-CM) coded data. *Natl Health Stat Rep*. 2018;(108):1–19.
43. Ridout KK, Ridout SJ, Alavi M, et al. Evaluating implementation and outcomes of the achieving depression and anxiety patient-centered treatment collaborative care program in a large, integrated health care system: a mixed methods observational study protocol. *Perm J*. 2022;26(4):39–48.
44. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med*. 2001;16(9):606–613.
45. Spitzer RL, Kroenke K, Williams JBW, et al. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med*. 2006;166(10):1092–1097.
46. AHRQ. Depression screening and follow-up for adolescents and adults. Accessed March 31, 2023. https://www.ahrq.gov/sites/default/files/wysiwyg/pqmp/measures/chronic/chipra-0245-technical-specifications.pdf
47. Coventry PA, Hudson JL, Kontopantelis E, et al. Characteristics of effective collaborative care for treatment of depression: a systematic review and meta-regression of 74 randomised controlled trials. *PLoS One*. 2014;9(9):e108114.
48. Muntingh AD, van der Feltz-Cornelis CM, van Marwijk HW, et al. Collaborative care for anxiety disorders in primary care: a systematic review and meta-analysis. *BMC Fam Pract*. 2016;17:62.
49. Perugi G, Calò P, De Filippis S, et al. Clinical features and outcomes of 124 Italian patients with treatment resistant depression: a real-world, prospective study. *Front Psychiatry*. 2021;12:769693.
50. Weinberger MI, Sirey JA, Bruce ML, et al. Predictors of major depression six months after admission for outpatient treatment. *Psychiatr Serv*. 2008;59(10):1211–1215.
51. Kautzky A, Dold M, Bartova L, et al. Clinical factors predicting treatment resistant depression: affirmative results from the European multicenter study. *Acta Psychiatr Scand*. 2019;139(1):78–88.
52. Buckman JEJ, Saunders R, Stott J, et al. Socioeconomic indicators of treatment prognosis for adults with depression: a systematic review and individual patient data meta-analysis. *JAMA Psychiatry*. 2022;79(5):406–416.
53. Liu X, Mukai Y, Furtek CI, et al. Epidemiology of treatment-resistant depression in the United States. *J Clin Psychiatry*. 2021;83(1):21m13964.
54. Probst G, Vîslă A, Flückiger C. Patients' symptoms and strengths as predictors of long-term outcomes of CBT for generalized anxiety disorder – a three-level, multi-predictor analysis. *J Anxiety Disord*. 2022;92:102635.
55. Murphy JM, Olivier DC, Monson RR, et al. Depression and anxiety in relation to social status. A prospective epidemiologic study. *Arch Gen Psychiatry*. 1991;48(3):223–229.
56. Corey-Lisle PK, Nash R, Stang P, et al. Response, partial response, and nonresponse in primary care treatment of depression. *Arch Intern Med*. 2004;164(11):1197–1204.
57. National Committee for Quality Assurance. HEDIS depression measures specified for electronic clinical data systems. National Committee for Quality Assurance; 2024. Accessed January 13, 2024. https://www.ncqa.org/hedis/the-future-of-hedis/hedis-depression-measures-specified-for-electronic-clinical-data/

The Journal of Clinical Psychiatry

Supplementary Material

Article Title: Virtual Collaborative Care Versus Specialty Psychiatry Treatment for Depression or Anxiety

Authors: Kathryn K. Ridout, MD, PhD; Mubarika Alavi, MS; Catherine Lee, PhD; Lisa Fazzolari, DO; Samuel J. Ridout, MD, PhD; Maria T. Koshy, MD; Brooke Harris, PhD; Sameer Awsare, MD; Constance M. Weisner, DrPH; Esti Iturralde, PhD

DOI Number: 10.4088/JCP.24m15332

LIST OF SUPPLEMENTARY MATERIAL FOR THE ARTICLE

DISCLAIMER

Supplementary Table 1. Target trial protocol. Specification and emulation using observational data

Protocol component	Description	Specification	Emulation using observational cohorts
Eligibility criteria	Who will be included in the study?	Patients with an ICD diagnosis for depression or anxiety between April 1st, 2020, to May 31st, 2021; age ≥18; symptom measure ≥5 to <15; no suicide intent in the last 30 days	Same as for specification. Required data for each person: primary diagnosis, age, screening eligibility, symptom screening, and treatment appointment status, treatment strategy assignment, symptom measure for depression or anxiety at baseline, suicide-related diagnosis or positive answer to question 9 of the PHQ-9 30 days prior to eligibility screening
Treatment strategies	What interventions will eligible persons receive?	1. Collaborative care for depression: Systematic symptom monitoring tied to treatment. Therapy frequency and medication addition determined based on symptoms and follows a recommended protocol. 2. Specialty psychiatry: Patient meets with a psychiatrist and treatment plan determined and scheduled based on clinical judgement	Same as for specification Required data: baseline appointment with one of the two interventions, clinical measurement of depressive or anxiety symptoms
Treatment assignment	How will eligible persons be assigned to the interventions?	Pragmatic trial without blind assignment.	Eligible persons will be assigned to the strategies with which

		Participants will be randomly assigned to either strategy and will be aware of the strategy to which they have been assigned.	their data were compatible at the time of eligibility. Inverse probability score weighing performed from eligibility screening to adjust for confounders to emulate the random assignment of treatment strategies.
Outcome	What outcomes in eligible persons will be compared among intervention groups?	Change in PHQ-9 or GAD-7 score from up to 6 months compared to baseline	Same as for specification. Required data: baseline and follow-up PHQ-9 and GAD-7 scores
Follow-up period	During which period will eligible persons be followed in the study?	Starts at baseline and ends at 6 months plus two weeks after baseline	Same as for specification. Required data: date of loss to follow-up
Causal estimand	Which counterfactual contrasts will be estimated using the above data?	Intention-to-treat effect (effect of being assigned to treatment)	Observational analogue of the intention-to-treat effect
Statistical analysis	How will the counterfactual contrasts be estimated?	Intention-to-treat effect estimated via comparison of 6-month PHQ-9 change in symptoms from baseline among individuals assigned to each treatment strategy. For patients without follow-up symptom measures, impute from the baseline symptom value (assumes a conservative null effect).	Same as intention-to-treat analysis

Supplementary Table 2. International statistical classification of diseases and related health problems, clinical modification (ICD-10-CM) diagnostic codes for depressive or anxiety disorders

ICD-10-CM	Description
Anxiety disorders	
F06.4	Anxiety Disorder Due To Known Physiological Condition
F10.280	Alcohol Dependence With Alcohol-Induced Anxiety Disorder
F12.180	Cannabis Abuse With Cannabis-Induced Anxiety Disorder
F12.280	Cannabis Dependence With Cannabis-Induced Anxiety Disorder
F13.980	Sedative, Hypnotic Or Anxiolytic Use, Unspecified With Sedative, Hypnotic Or Anxiolytic-Induced Anxiety Disorder
F15.280	Other Stimulant Dependence With Stimulant-Induced Anxiety Disorder
F16.980	Hallucinogen Use, Unspecified With Hallucinogen-Induced Anxiety Disorder
F19.280	Other Psychoactive Substance Dependence With Psychoactive Substance-Induced Anxiety Disorder
F40.9	Phobic Anxiety Disorder, Unspecified
F41.1	Generalized Anxiety Disorder
F41.8	Other Specified Anxiety Disorders
F41.9	Anxiety Disorder, Unspecified
F93.0	Separation Anxiety Disorder Of Childhood
Adjustment disorder with anxiety	
F43.22	Adjustment Disorder With Anxiety
Depressive disorders	
F32.0	Major Depressive Disorder, Single Episode, Mild
F32.1	Major Depressive Disorder, Single Episode, Moderate
F32.2	Major Depressive Disorder, Single Episode, Severe Without Psychotic Features
F32.3	Major Depressive Disorder, Single Episode, Severe With Psychotic Features
F32.4	Major Depressive Disorder, Single Episode, In Partial Remission
F32.5	Major Depressive Disorder, Single Episode, In Full Remission
F32.9	Major Depressive Disorder, Single Episode, Unspecified
F33.0	Major Depressive Disorder, Recurrent, Mild
F33.1	Major Depressive Disorder, Recurrent, Moderate

F33.2	Major Depressive Disorder, Recurrent Severe Without Psychotic Features
F33.3	Major Depressive Disorder, Recurrent, Severe With Psychotic Symptoms
F33.41	Major Depressive Disorder, Recurrent, In Partial Remission
F33.42	Major Depressive Disorder, Recurrent, In Full Remission
F33.9	Major Depressive Disorder, Recurrent, Unspecified

Adjustment disorder with depressed mood

F43.21	Adjustment Disorder With Depressed Mood
F43.23	Adjustment Disorder With Mixed Anxiety And Depressed Mood

Supplementary Table 3. Unadjusted patient depressive and anxiety symptom outcomes

	Depression N=8,166		Anxiety N=1,411	
	Collaborative care (n=1,466; 18%)	Specialty psychiatry (n=6,700; 82%)	Collaborative care (n=349; 24.7%)	Specialty psychiatry (n=1,062; 75,3%)
Using last observation for follow-up				
Remission score*	632 (43%)	1,779 (27%)	11 (0.3%)	1 (0.1%)
Score 50% of baseline	806 (55%)	2,394 (36%)	80 (14%)	81 (10%)
Mean follow-up time, days	108		84	
	105	109	78	86
Mean baseline score	9.1	10.0	10.6	11.2
Mean last follow-up score in six months	4.9	7.6	8.8	10.8
Mean difference from baseline	-4.2	-2.6	-2.4	-0.9
Using all repeated observations for follow-up				
Mean time in treatment, days	73		67	
	61	78	56	71
Mean baseline score	9.3	10.3	11.2	11.5
Mean all scores in six months	6.1	8.7	9.9	11.4
Mean difference from baseline	-3.2	-1.7	-1.6	-0.5

* Remission defined as a score of <5 depression (as measured by the patient health questionnaire [PHQ-9]) or <5 anxiety (as measured by the generalized anxiety disorder scale [GAD-7]).
Population represents patients with follow-up measures only.