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Assessment of mental and physical health outcomes over time in an integrated care setting

Dependra Bhatta^{1*}, Monteic A. Sizer¹, Binod Acharya² and Dipendra Banjara³

Abstract

Background Integrated care addresses the fragmentation of patient health services and potentially improves the experience of care, reduces healthcare costs, and improves health outcomes. This study assessed the improvements in mental health and physical health outcomes among patients living with mental health challenges and treated in an integrated care setting.

Methods The longitudinal retrospective cohort study evaluated anxiety (GAD-7), depression (PHQ-9), systolic blood pressure, and glycated hemoglobin levels from baseline to the next three assessments recorded from October 1, 2018, to December 31, 2023.

Results At baseline, 239 participants responded to mental health outcome measures, 344 to systolic blood pressure, and 164 to glycated hemoglobin level. The Generalized Estimating Equations analysis showed an improvement in GAD-7 (-1.28 [95% CI, -1.71 to -0.85]) and PHQ-9 (-1.37 [95% CI, -1.73 to -0.92]) scores in successive assessments. The physical health outcomes (Systolic blood pressure (-0.004 [95% CI, -1.34 to 1.35]) and glycated hemoglobin (0.04 [95% CI, -0.07 to 0.15])) remained stable.

Conclusion This study demonstrates that patients with mental health challenges treated in integrated care experience improvements in depression and anxiety symptoms, with stable physical health outcomes.

Keywords Integrated care, Depression, Anxiety, Diabetes, Hypertension, Comorbidity

Introduction

Physical and mental well-being are intricately linked, influencing one another in multiple ways. Individuals living with mental health challenges are at higher risk of experiencing chronic physical health and cardiometabolic challenges [1–4]. Physical health-related mortality is two to three times higher among people with mental health challenges compared to the general population [5–7], leading to an average life expectancy reduction of 8 to 17.5 years compared to those without psychiatric impairments [8]. While suicide contributes to a portion of the decreased life expectancy of individuals with mental health challenges, physical health conditions account

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for the majority of their premature mortality [9–11]. One way mental health issues can manifest in physical health challenges is through physical health side effects of psychotropic medication. For example, the adverse effects of antipsychotics, olanzapine, or fluoxetine medications are associated with worsened HbA1c, triglycerides, and total cholesterol [12]. The metabolic effects of these medications can induce weight gain, diabetes, and dyslipidemia, often mediated by other preexisting clinical and socioeconomic risk factors. In addition, the factors typically associated with mental health issues, including economic disadvantages and unhealthy lifestyles such as smoking, substance use, limited or no physical activities, and unhealthy dietary habits, can result in poor physical health [13–15].

In many healthcare systems, primary care includes both physical and mental health services and is the first place people go for treatment. These services are provided by general physicians, family physicians, or primary care teams who handle check-ups, ongoing conditions, and initial mental health screening. However, the service lacks targeted interventions, including psychotherapy, psychiatric medication management, and intensive substance use treatment programs. Similarly, behavioral health services, while essential in treating mental health disorders, often lack physical health services, which can lead to fragmented care for patients with complex health needs. The access to and quality of healthcare for patients with chronic conditions such as metabolic syndromes, who are also dealing with mental health challenges, remain worrisome. This population receives fewer physical health screenings and lower-quality primary care compared to the general population [16, 17]. Only a small proportion of mental health patients have established primary care providers [18]. Even among those with access to primary care, engagement levels are often sub-optimal, resulting in delayed regular physical screenings [18, 19]. The fragmented nature of healthcare systems exacerbates inadequate coordination between primary care and mental health care providers, as well as between the health and social care sectors. This fragmentation limits efficient access to comprehensive care, reinforces stigma and fear of judgment, and undermines adherence to treatment, particularly in prioritizing physical health [20, 21]. Consequently, these inefficiencies lead to gaps in care and poor mental and physical health outcomes. To address this gap, integrated care is needed, where both physical and behavioral health services are coordinated to provide comprehensive patient-centered care, ensuring that all aspects of a patient's health are managed together effectively.

From a conceptual standpoint, for individuals with mental health challenges, integrating primary health care

services into behavioral health care clinics¹ can address both their physical and mental health needs, leading to better overall health outcomes [22, 23]. Integrated care improves care coordination by ensuring patients receive timely medical and mental health interventions. It also increases access to medical treatment, which is essential for those with chronic conditions that might otherwise go unmanaged in traditional mental health settings [24, 25]. Additionally, shared decision-making between primary care providers and mental health professionals can improve treatment adherence and long-term health monitoring. Despite these potential benefits, prior studies on integrated care have shown mixed results [26]. Some studies indicate significant health improvements [23, 27], while others find little to no effect [28, 29].

To address this gap, our study evaluated changes in mental health outcomes (depression and anxiety) and physical health outcomes (systolic blood pressure and glycated hemoglobin) over four assessment periods in an integrated care setting. Unlike studies that compared integrated care to non-integrated care, our goal was to assess whether patients improve over time within this model. This study focused on patients with mental health challenges treated at two Behavioral Health Clinics of Northeast Delta Human Services Authority in Louisiana, where primary care services were integrated with existing behavioral health clinics. We hypothesized that patients receiving care in the integrated setting would significantly improve physical and mental health outcomes over time, reflecting the benefits of a well-coordinated and integrated treatment approach. However, we also acknowledge that other factors, such as patient adherence, illness severity, and external stressors, may influence the degree of improvement.

Methods

Study design and population

It is a longitudinal cohort study of patients experiencing mental health challenges and treated in an integrated care setting. The study included patients aged 18 years and above treated at Monroe Behavioral Health Clinic (MBHC) and Bastrop Behavioral Health Clinic (BBHC) of Northeast Delta Human Services Authority (NEDHSA), a Louisiana State Local Government Entity. NEDHSA service region primarily encompasses rural areas of Northeast Louisiana, where the patients face significant marginalization, and access to healthcare is often limited by geographic and socioeconomic barriers [30, 31]. NEDHSA is one of the recipients of the SAMSHA's²

¹ Behavioral health care clinics are outpatient clinics where people receive treatment for mental health and substance use disorders. The clinics offer services like counseling, therapy, psychiatric care, and addiction treatment.

² SAMHSA stands for the Substance Abuse and Mental Health Services Administration, a U.S. government agency that provides funding to improve

Promoting Integration of Primary and Behavioral Health Care (PIPBHC) Grants in Louisiana. The purpose of the grant was to integrate primary care into behavioral health settings by providing resources such as funding for training, the development of care coordination systems, and support for implementing comprehensive care models that included both physical and mental health services. The resources were designed to enhance the mental health and physical health of adults with mental illness who also experience co-occurring physical health conditions or chronic diseases, as well as individuals with substance use disorders. Patients usually served in integrated care included insufficient connections to primary care, high-risk clinical factors like hypertension, and chronic general medical conditions like diabetes.

Data were collected from October 1, 2018, to December 31, 2023, with the same patients followed up across all assessments. Data were collected following the National Outcome Measures (NOMs)³ guidelines for adults developed by SAMHSA [32]. This study included the assessment range from the first assessment (baseline) to the fourth assessment. The time difference between the consecutive assessments ranged from three to six months. Each assessment collected detailed demographic information, as well as mental and physical health outcomes. Mental health outcomes were measured using self-reported Generalized Anxiety Disorder (GAD)-7 and Patient Health Questionnaire (PHQ)-9 scores for anxiety and depression, respectively. Physical health outcomes included systolic blood pressure and glycated hemoglobin. Covariates included gender (male and female), race (African American and non-African American races), age group (18–40, 41–60, and 60+ years), and insurance at the first assessment (Medicare, Medicaid, and Private/Other). This study was exempted by the Institutional Review Board, Louisiana Department of Health. Trained mental health service providers, including APRN and RN conducted all assessments and recorded the data in SPARS, SAMSHA's data collection portal.

Statistical analysis

In this study, the Generalized Estimating Equations (GEE) method was used to analyze the longitudinal data, as it is well suited to take into account the positive correlation arising from repeated measurements from the same individuals over time. We used an unstructured covariance structure; the GEE method is robust to misspecification of the correlation structure if the mean model is correctly specified [33, 34].

Four outcome variables, two from each mental health and primary health category, were modeled. The GAD-7 and PHQ-9 scores at each time point were considered for the mental health outcome measures. Similarly, systolic blood pressure and glycated hemoglobin were considered for physical health outcome measures. We developed six models for mental health outcomes (GAD-7 and PHQ-9) and six models for physical health outcomes (systolic blood pressure and glycated hemoglobin). The models for GAD-7 and PHQ-9 analyzed how different covariates were associated with changes in anxiety and depression scores. The models for systolic blood pressure and glycated hemoglobin examined the relationship between covariates and changes in blood pressure and glycated hemoglobin levels. The primary focus was the assessment time point, as our goal was to evaluate changes in health outcomes over time in patients receiving treatment in an integrated care setting for mental health challenges.

To account for variations in the timing of the four assessments, we treated the assessment time points as a continuous, time-varying variable. It allowed us to examine how changes in time (from baseline to follow-ups) affected the health outcomes, while adjusting for the varying timing of assessments across patients. We built progressive models that added covariates step-by-step to ensure clarity and rigor in our analysis. The first model of each outcome variable (Model 1) included time-variant assessment as a covariate, while the second model (Model 2) incorporated time-invariant socio-demographic variables. The third model (Model 3) added time-variant health parameters as covariates.

Result

A total of 436 patients were treated in an integrated care setting from October 2018 to December 2023. However, not all of them were included in this study due to incomplete data collection primarily caused by the COVID-19 pandemic. The pandemic impacted participation in assessments conducted in 2020 and beyond. Patients who had only a baseline assessment without a follow-up were excluded from the study. Patient characteristics at baseline are reported in Table 1. Of the 436 patients, 239 completed the baseline mental health outcome screening measures and presented with moderate levels of anxiety (mean GAD-7 score: 8.07) and depression (mean PHQ-9 score: 8.29). Of them, 143 (60%) were African American, 139 (58%) were female, 105 (44%) were aged 41 to 60 years, and 155 (64.9%) were insured through Medicaid. Approximately 47% of patients who completed the mental health screening at baseline had Depressive Disorder as their primary diagnosis. Among those with a different primary diagnosis, 96% had Depressive Disorder as a secondary diagnosis. About 80% of the patients were new to the clinics. Of the total 436 individuals, data on

access to mental health and substance use disorder services.

³ NOMs provide a framework for collecting data on various health outcomes, including mental health status, substance use, and overall quality of life, to ensure that treatment programs are meeting the needs of patients and achieving measurable improvements.

Table 1 Baseline characteristics of patients treated in integrated care setting

	Mental Health Measures	Physical Health Measures	
	GAD-7 and PHQ-9 N = 239	Systolic Blood Pressure N = 344	Glycated Hemoglobin N = 164
GAD-7, Mean (SD)	8.07 (6.03)	8.33 (6.31)	8.25 (6.33)
Missing, N (%)	0 (0)	157 (45.64)	50 (30.49)
PHQ-9, Mean (SD)	8.29 (6.55)	8.51 (6.80)	8.13 (6.41)
Missing, N (%)	0 (0)	157 (45.64)	50 (30.49)
Assessment = 1, N	239	344	164
Race, N (%)			
African American	143 (60.00)	212 (62.00)	102 (62.00)
Non- African American	96 (40.00)	132 (38.00)	62 (38.00)
Gender, N (%)			
Female	139 (58.00)	195 (57.00)	92 (56.00)
Male	100 (42.00)	149 (43.00)	72 (44.00)
Age group, N (%)			
18–40	79 (33.00)	115 (33.00)	51 (31.00)
41–60	105 (44.00)	154 (45.00)	63 (38.00)
60+	55 (23.00)	75 (22.00)	50 (31.00)
Insurance, N (%)			
Medicaid	155 (64.90)	223 (64.80)	99 (60.40)
Medicare	54 (22.60)	68 (19.90)	42 (25.60)
Private/Other	29 (12.10)	51 (14.80)	22 (13.40)
Missing, N (%)	1 (0.40)	2 (0.60)	1 (0.60)
Glycated Hemoglobin, Mean (SD) mmol/L	5.61 (1.16)	5.64 (1.33)	5.63 (1.32)
Missing, N (%)	125 (52.30)	188 (54.65)	
Systolic Blood Pressure, Mean (SD) mm Hg	131.8 (17.60)	130.89 (16.86)	131.90 (16.27)
Missing (N)	52 (21.76)	0 (0.00)	8 (4.88)

Mental health outcomes were measured with 3-point scaled GAD-7 and PHQ-9 questionnaires. Those scores were considered continuous variables in this study. GAD-7, PHQ-9, Glycated Hemoglobin, Systolic Blood Pressure, and Assessment were time variant variables. The assessment ranged from the first assessment (baseline) to the fourth assessment and the variable was considered as continuous variable. The time difference between the consecutive assessments ranged from three to six months

physical health outcome measures, systolic blood pressure and glycated hemoglobin at baseline were collected from 344 to 164 individuals, respectively. Among 344 individuals, 212 (62%) were African American, 195 (57%) were female, 154 (45%) were in the 41 to 60 years old age group, and 223 (64.8%) had Medicaid. Similarly, among the 164 patients, 102 (62%) were African American, 92 (56%) were female, 63 (38%) were in the age group 41 to 60 years old, and 99 (60.4%) were insured through Medicaid. Notably, more than 90% in the non-African American category were White.

A substantial proportion of patients exceeded clinically relevant thresholds at baseline on both mental and physical health measures. Specifically, 67.7% ($n=162$) scored 5 or more on the PHQ-9 (mild depression), and 62.76% ($n=150$) scored 5 or more on the GAD-7 (mild anxiety). For physical health, 49.7% ($n=171$) had elevated blood pressure (systolic ≥ 130 mmHg), and 31.7% ($n=52$) had elevated glucose levels (≥ 5.6 mmol/L). These cut-offs for mental health and physical health parameters align with established clinical guidelines [35–38]. The distribution of mental and physical health outcomes at different assessments is reported in Fig. 1. Compared with

the baseline, the mental health outcome in the follow-up assessments prominently improved (Fig. 1. (a) and (b)), revealing two notable patterns: a slight U-shaped trend and a reduction in score variability. However, no major changes were observed in the case of physical health outcomes (Fig. 1. (c) and (d)). In Model 3, the GAD-7 score decreased by 1.44 points, indicating that, on average, patients' anxiety symptoms (as measured by the GAD-7 scale) improved by 1.44 points from one assessment to the next (Table 2). In PHQ-9 Model 2, the score decreased by 1.30 points, suggesting that, on average, patients' depression symptoms (as measured by the PHQ-9 scale) improved by 1.30 points from one assessment to the next. Both reductions were statistically significant, indicating meaningful improvement in both anxiety and depression symptoms over time.

Model 3 for GAD-7 and PHQ-9, which adjust for all the time-variant and invariant variables, showed that the depression and anxiety symptoms are higher among the non-African American category of Race (GAD-7 Model 3 ($b=3.94$; 95% CI, 1.92, 5.96); PHQ-9 Model 3 ($b=3.59$; 95% CI, 1.42, 5.76)) than among African Americans. The anxiety symptoms were significantly lower among

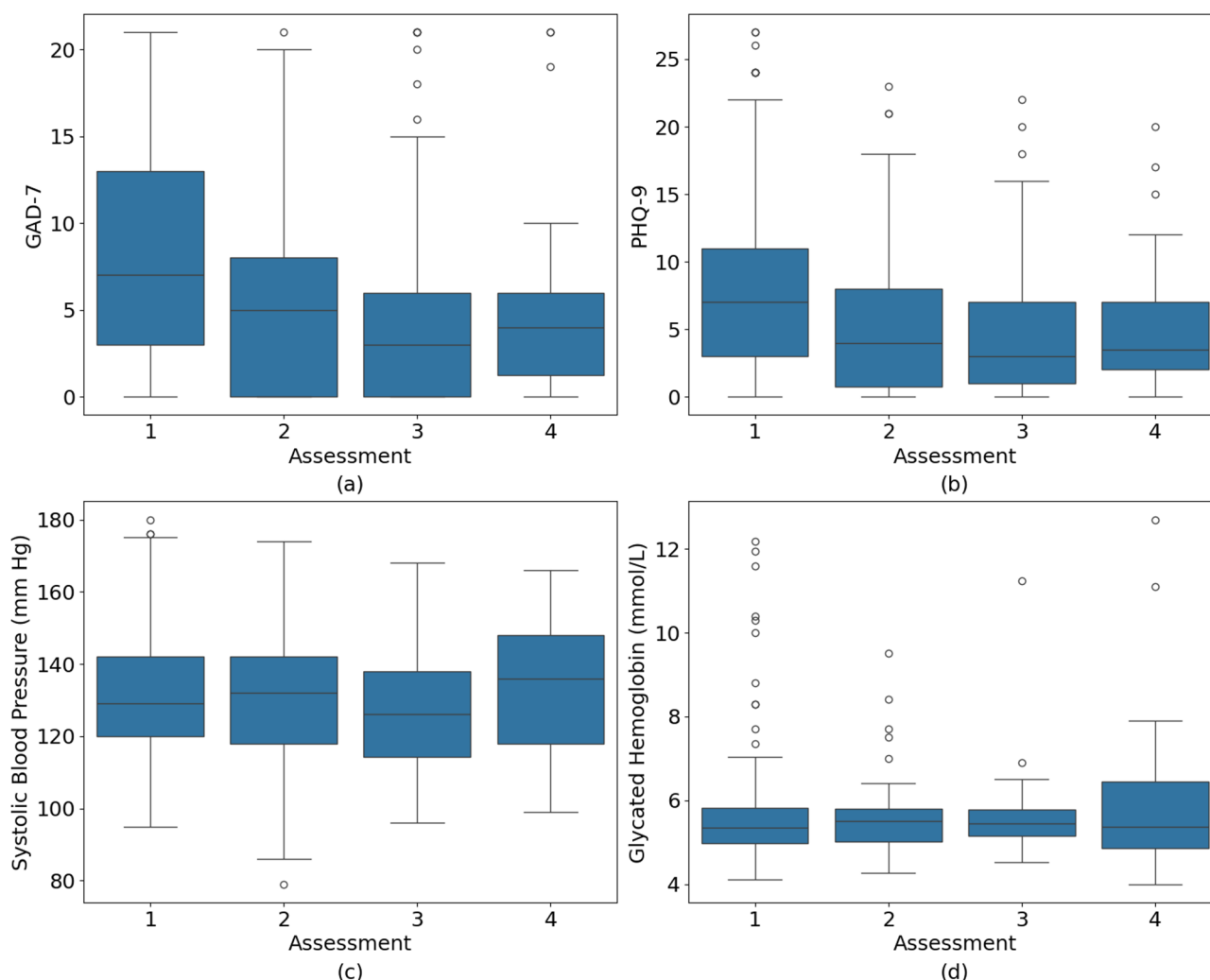


Fig. 1 Trends in mental and physical health parameters across four assessments. Baseline is represented as the 1st assessment. The time between consecutive assessments ranged from three to six months. Each box plot shows the distribution of scores, with the horizontal line inside the box indicating the median, and the circles representing outliers based on the raw data. **(a)** Generalized Anxiety Disorder scores (GAD-7); **(b)** Patient Health Questionnaire scores (PHQ-9); **(c)** Systolic blood pressure (mm Hg); **(d)** Glycated hemoglobin (mmol/L)

the older age group (60+ years ($b = -2.84$; 95% CI, $-5.54, -0.14$). Similarly, the depression symptoms were significantly lower among the patients insured with Medicare ($b = -2.82$; 95% CI, $-5.41, -0.23$). The association between mental health outcomes and physical health outcomes was not statistically significant. Over time, systolic blood pressure and glycated hemoglobin did not significantly improve (Table 3). The analysis of the association of time-variant and invariant covariates on the systolic blood pressure (Systolic Blood Pressure Model 3) showed that the older age group (60+ years) was positively associated ($b = 12.63$; 95% CI, 6.20 to 19.06).

Discussion

In this longitudinal study of patients treated in an integrated care setting in northeast Louisiana, patients achieved significant improvements in depression and

anxiety symptoms. Improvements were most pronounced between the first assessment (baseline) to the follow-up assessments. Figure 1 (a) and (b) indicated a U-shaped trend and decreasing variability in scores. The non-linear pattern suggested that anxiety and depression symptoms improved in the early treatment phase but slightly increased later. This could have been due to factors like treatment fatigue, external stressors, natural symptom fluctuations, or patient adherence and follow-up timing differences. Over time, the decreasing variability in scores suggested that integrated care helped stabilize mental health symptoms, leading to more consistent outcomes across patients. This could have been because patients with severe symptoms showed the most improvement. Additionally, standardized treatment approaches and continuous monitoring in integrated

Table 2 Association between mental health parameters (GAD-7 and PHQ-9) scores and covariates based on GEE models

	GAD-7			PHQ-9		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Assessment	-1.28*** [-1.71, -0.85]	-1.22*** [-1.64, -0.79]	-1.44** [-2.68, -0.20]	-1.37*** [-1.81, -0.92]	-1.30*** [-1.73, -0.86]	-1.07 [-2.30, 0.15]
Race (Ref: African American)						
Non- African American		1.67*** [0.50, 2.84]	3.94*** [1.92, 5.96]		1.98** [0.75, 3.21]	3.59*** [1.42, 5.76]
Gender (Ref: Female)						
Male		-1.01 [-2.16, 0.13]	-0.28 [-2.17, 1.62]		-0.72 [-1.92, 0.49]	0.79 [-1.29, 2.87]
Age Group (Years) (Ref: 18–40)						
41–60		1.41** [0.08, 2.74]	-1.82 [-4.09, 0.46]		1.77** [0.38, 3.17]	-0.48 [-2.97, 2.01]
60+		-0.56 [-2.23, 1.11]	-2.84** [-5.54, -0.14]		-0.70 [-2.46, 1.06]	-1.92 [-4.90, 1.05]
Insurance (Ref: Medicaid)						
Medicare		-1.43 [-2.88, 0.02]	-2.23 [-4.61, 0.15]		-1.43 [-2.96, 0.11]	-2.82** [-5.41, -0.23]
Private/Other		-0.34 [-2.17, 1.48]	-0.26 [-3.27, 2.76]		-0.20 [-2.12, 1.71]	-0.22 [-3.50, 3.05]
Glycated hemoglobin (mmol/L)			0.21 [-0.60, 1.02]			0.44 [-0.41, 1.29]
Systolic Blood Pressure (mm Hg)			0.01 [-0.04, 0.07]			0.01 [-0.05, 0.06]
Constant	9.01*** [8.03, 9.99]	8.60*** [7.14, 10.06]	7.22 [-1.29, 15.72]	9.31*** [8.30, 10.32]	8.51*** [6.98, 10.03]	5.37 [-3.54, 14.27]

GAD-7 and PHQ-9 are the outcome variables. 95% Confidence Interval (Lower limit, Upper Limit) is in parentheses. GEE = Generalized Estimating Equations

** $p < 0.05$, *** $p < 0.01$

care settings may have reduced the variations in patient outcomes.

On average, depression and anxiety scores significantly reduced by 1.28 and 1.37 points, respectively, in each assessment. Sadock, Auerbach [39] and Sadock, Perrin [40] showed that the PHQ-9 and GAD-7 scores decreased significantly in the follow-up visits compared to the first visit among the patients treated in an integrated care setting. In contrast to our clinical settings, which focuses on the integration of primary care into mental health care, their studies primarily emphasize the integration of mental health care into primary care settings. In another setting of integration of behavioral health to physical health, Ray-Sannerud, Dolan [41] found that the clinical improvements on depression and anxiety symptoms were maintained approximately two years after the baseline. There might be some possibility that the symptoms fluctuate over time, or the depression and anxiety screening tools might be subjective to hypothetical bias [42]. Nevertheless, our study showed consistently modest improvement in depression and anxiety over time, suggesting the sustained benefit of behavioral health integration on mental health outcomes.

More severe depression and anxiety symptoms are associated with poor quality of life [43, 44]. There is a

plethora of literature that shows that the prevalence of depression and anxiety has been rising in the context of the COVID-19 pandemic [45–48]. The onset of the pandemic has significantly disrupted social and occupational functioning, impacting mental health status [49]. Social distance and isolation led to increased loneliness and decreased social support. Moreover, financial insecurity and changes in the work environment also created stress and uncertainty. Thus, the disruption in mental health highlights the importance of consistent mental health screenings for appropriate prevention and intervention measures [50]. However, inconsistent utilization of mental health outcome screening measures contributes to further worsening symptoms [51], increasing the burden on social and occupational well-being. The use of mental health screening forms, such as PHQ-9 and GAD-7, is higher in integrated care settings compared to primary care clinics [52, 53], broadening the possibility of early identification and timely intervention of mental health disorders in integrated care. Consequently, depression and anxiety symptoms improve significantly among patients treated in integrated care settings compared to those from the same demographics with similar baseline mental health scores [40]. By addressing these social determinants of health, NEDHSA integrated care may

Table 3 Association between physical health parameters (Systolic blood pressure (mmol/L) and glycated hemoglobin (mm Hg)) and covariates based on GEE models

	Systolic Blood Pressure			Glycated Hemoglobin		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Assessment	0.004 [-1.34, 1.35]	-0.06 [-1.39, 1.27]	-0.31 [-2.39, 1.77]	0.04 [-0.07, 0.15]	0.04 [-0.07, 0.15]	0.10 [-0.06, 0.26]
Race (Ref: African American)						
Non- African American		-1.84 [-5.12, 1.44]	-3.82 [-8.40, 0.76]		0.42** [0.03, 0.82]	0.14 [-0.27, 0.56]
Gender (Ref: Female)						
Male		0.69 [-2.52, 3.91]	0.05 [-4.36, 4.45]		0.17 [-0.22, 0.56]	-0.01 [-0.39, 0.38]
Age Group (Years) (Ref: 18–40)						
41–60		2.91 [-0.73, 6.55]	2.79 [-2.22, 7.79]		0.35 [-0.12, 0.81]	0.28 [-0.19, 0.75]
60+		11.62*** [7.06, 16.19]	12.63*** [6.20, 19.06]		0.57** [0.05, 1.09]	0.52 [-0.02, 1.05]
Insurance (Ref: Medicaid)						
Medicare		-4.35** [-8.57, -0.12]	-4.47 [-10.08, 1.15]		0.17 [-0.31, 0.65]	0.26 [-0.21, 0.74]
Private/Other		-2.06 [-6.68, 2.56]	-3.65 [-10.86, 3.57]		-0.01 [-0.60, 0.57]	0.08 [-0.53, 0.69]
GAD-7			0.20 [-0.35, 0.76]			0.002 [-0.05, 0.05]
PHQ-9			0.07 [-0.45, 0.58]			0.01 [-0.04, 0.06]
Constant	130.69*** [128.06, 133.32]	128.53*** [124.41, 132.64]	128.74*** [122.15, 135.34]	5.59*** [5.33, 5.85]	5.02*** [4.56, 5.48]	4.99*** [4.41, 5.57]

Systolic Blood Pressure and Glycated Hemoglobin are the outcome variable. 95% Confidence Interval (Lower limit, Upper Limit) is in parentheses. GEE=Generalized Estimating Equations

** $p < 0.05$, *** $p < 0.01$

have contributed to the observed improvements in anxiety (GAD-7) and depression (PHQ-9) symptoms, as these factors are known to impact mental health. The consistent decrease in GAD-7 and PHQ-9 scores may reflect not only the direct impact of mental health interventions but also the comprehensive approach that includes addressing patients' broader social needs.

Our study found that African Americans reported significantly lower anxiety and depression scores than non-African Americans, a group that was over 90% White. This seemed to contrast with some existing literature documenting mental health disparities, where African Americans often experience higher rates of depression and anxiety compared to Whites [54, 55]. However, other studies have suggested a lower lifetime prevalence of these disorders in African Americans compared to Whites [56–58]. Several factors could contribute to this apparent discrepancy. Some studies have shown that African Americans exhibit higher levels of positive coping and resilience [59, 60]. Also, cultural factors and stigma associated with mental health in African American communities may impact how individuals report their symptoms. The lower reported scores among

African American participants in our study could be due to differences in help-seeking behavior or willingness to disclose mental health challenges, rather than an actual difference in prevalence. Our research focused on a rural region where social determinants of health, such as socioeconomic status, access to resources, and experiences of discrimination, can influence mental health. It emphasizes the need for future research to explore the intersection of race and these factors to better understand mental health disparities.

The changes in systolic blood pressure and glycated hemoglobin in this study remained statistically insignificant over time. There are a few possible reasons why this study did not observe statistically significant improvements in those physical health parameters. First, the baseline levels for these outcomes were already modest, leaving less room for measurable improvement [61]. Second, the two-year study period may not have been long enough to detect significant changes in these parameters. Wells, Kite [52], in their pre-post comparison of systolic blood pressure of the patients treated in the community mental health center integrated care, showed that the systolic blood pressure for the initially hypertensive

patients decreased by 15 points from baseline to 90 days assessment. Compared with that study, the baseline profile of 344 patients in this study had a somewhat lower systolic blood pressure average. We followed up with patients until the next 18 months from the baseline visit compared to the 90-day observation in their study. Our findings suggested that the systolic blood pressure and glycated hemoglobin among the patients treated in the integrated care settings did not deteriorate up to two years of follow-up, despite the high risk of worsening health in this population. For instance, antipsychotic medications such as olanzapine and fluoxetine are known to negatively impact metabolic health, contributing to increased HbA1c levels [12]. The metabolic effects can lead to weight gain, diabetes, and dyslipidemia, particularly in patients with preexisting clinical and socioeconomic risk factors. People with mental health conditions often face challenges that can negatively impact their physical health. Factors like financial struggles, smoking, substance use, lack of exercise, and unhealthy eating habits can all contribute to worsening health over time [13–15]. Lowering systolic blood pressure and HbA1c levels in a sustained way may usually take longer time than the window of this study.

Mental health disorders and primary health outcomes influence each other [62]. Our study found no significant association between blood pressure and glycated hemoglobin with GAD-7 or PHQ-9. This contrasts with studies reporting both positive and negative associations. Some studies found that depression and anxiety increase the risk of high blood pressure [63, 64], while others suggest hypertension-related brain changes contribute to depression [65]. In contrast, some studies report that high blood pressure reduces depression and anxiety symptoms [66, 67], by dampening emotional responses [68–70]. Additionally, patient-initiated behaviors such as less exercise, poor diet, and lower adherence to oral hypoglycemic contributed to depression symptoms among patients with diabetes [71].

Strengths and Limitations

In northeast Louisiana, the ratio of individuals to primary care physicians is 1547:1, compared to 1418:1 for the rest of Louisiana [72]. Integration of primary care into behavioral health clinics could provide greater access to primary care services for patients facing mental health challenges. The strength of this study lies in its emphasis on the importance of accessible and comprehensive care in areas where healthcare resources are often limited. However, this study also has several limitations. First, this study utilized GAD-7 and PHQ-9 measures to the patient population to measure their mental health outcomes, which are not clinical diagnoses of anxiety and depression but nevertheless are validated instruments

long used in health research [36, 73]. Second, this study lacks a comparison group that did not receive integrated care, which could have provided the measure of relative improvements in health improvements in patients within the integrated care compared to those without. Third, lower sample size on glycated hemoglobin at baseline. Several factors contributed to this, including patient reluctance to attend in person for blood collection and external disruptions such as the COVID-19 pandemic in later years. To address this limitation, we implemented strategies to enhance follow-up retention and data completeness in subsequent assessments, including participant engagement efforts and reminder systems. Fourth, we lacked data on patients who were already in the treatment plan before the implementation of PIPBHC Integrated Care, preventing us from adjusting the statistical model for prior treatment history. However, the number of these patients was very low.

Conclusion

This study highlights the health outcome improvements of the patients facing mental health challenges and treated in integrated care settings. Follow-up assessments demonstrated improvements in depression and anxiety symptoms compared to baseline, along with stable physical health outcomes in systolic blood pressure and glycated hemoglobin levels. The observed improvements in depression and anxiety may be attributed to several key factors, including enhanced care coordination, greater accessibility to primary care services, and the seamless integration of routine physical care into behavioral health interventions. By addressing both mental and physical health needs in a holistic manner, integrated care provides a more comprehensive approach to patient well-being. Notably, while physical health outcomes remained stable throughout the study, this stability may reflect the protective role of integrated care in preventing deterioration rather than driving immediate physiological improvements. Given that many chronic conditions, such as hypertension and diabetes, typically progress over time, maintaining stable health indicators within the study's timeframe suggests that integrated care may help mitigate worsening physical health through consistent monitoring, timely interventions, and improved patient engagement.

We acknowledge the strong association between mental and physical health. While our study did not specifically investigate these cause-and-effect relationships, future research should explore whether reducing psychological distress leads to better physical health over time or if maintaining stable physical health helps improve mental well-being. Long-term studies examining these connections could offer valuable insights into the lasting benefits of integrated care.

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Author contributions

D.Bhatta and M.S. were involved in conceptualization of the study. D.Bhatta was involved in data collection and statistical analysis. D.Bhatta, M.S., B.A., and D.B. were involved in interpretation of the results. D.Bhatta wrote the first draft of the manuscript. D.Bhatta, M.S., B.A., and D.B. reviewed and provided input in the manuscript. All authors read and approved the final manuscript.

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Data availability

The datasets generated and analysed during the current study are not publicly available due to the potential for identifying participants.

Declarations

Ethics approval and consent to participate

Authors obtained IRB determination from the Louisiana Department of Health Institutional Review Board. The Board finds that the research protocol meets the criteria under 45 CFR 46.104(d) [4](ii) as EXEMPT. As a result, the need for ethics approval and consent to participate was waived. This study was performed in accordance with relevant guidelines and regulations in the Declaration of Helsinki. Clinical trial number- not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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