Promoting mental health in Latina immigrant women: Results from the Amigas Latinas Motivando el Alma intervention trial

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ABSTRACT

Introduction: Latina immigrants are at increased risk of depression and anxiety and limited access to mental health care. This study evaluated the effectiveness of Amigas Latinas Motivando el Alma (ALMA), a community-based intervention to reduce stress and promote mental health among Latina immigrants.
Methods: ALMA was evaluated using a delayed intervention comparison group study design. Latina immigrants (*N* = 226) were recruited from community organizations in King County, Washington from 2018 to 2021. Although originally developed to be delivered in-person, due to the COVID-19 pandemic the intervention was adapted mid-study to be delivered online. Participants completed surveys to assess changes in depression and anxiety post-intervention and at a two-month follow-up. We estimated generalized estimating equation models to assess differences in outcomes across groups, including stratified models for those receiving the intervention in-person or online.
Results: In adjusted models, participants in the intervention group had lower levels of depressive symptoms than the comparison group post-intervention (β = −1.82, *p* = 0.01) and at two-month follow-up (β = −1.52, p = 0.01). Anxiety scores decreased for both groups, and there were no significant differences post-intervention or at follow-up. In stratified models, participants in the online intervention group had lower levels of depressive (β = −2.50, *p* = 0.007) and anxiety (β = −1.86, *p* = 0.02) symptoms than those in the comparison group, but there were no significant differences among those that received the intervention in-person.
Conclusions: Community-based interventions can be effective in preventing and reducing depressive symptoms among Latina immigrant women, even when delivered online. Further research should evaluate the ALMA intervention among larger more diverse Latina immigrant populations.

1. Introduction

Latina women are at increased risk for depression and anxiety, with rates twice those of Latino men living in the United States (Brody et al., 2018; Lara-Cinisomo et al., 2021). Latina women face unique determinants of poor mental health, including biological differences, gender socialization, exposure to violence, as well as significant caregiving and work demands. For Latinas who are immigrants, rates of depression and anxiety only increase with time in the United States

(Calzada and Sales, 2019; Cruz et al., 2021; Fitzpatrick et al., 2020). This is in part due to immigration related stressors, including economic strain, family separation, social isolation, and experiences of discrimination once in the United States (Cardoso and Thompson, 2010; Hatzenbuehler et al., 2017; Keller et al., 2017; Lara-Cinisomo et al., 2019; Rios Casas et al., 2020b; Ryan et al., 2021). Latina immigrants also face significant barriers accessing mental health care due to limited access to health insurance and Spanish-speaking providers (Hansen and Aranda, 2012; Paulsen).

Latina immigrants' mental health worsened during to the COVID-19 pandemic due to additional economic stressors, loss of family members, and increased caregiving demands (Fitzpatrick et al., 2020; Lara-Cinisomo et al., 2021; Ornelas et al., 2021; Paulsen; Rossen et al., 2020; Thomeer et al., 2022). Existing stressors were exacerbated by financial strain from loss of work, sadness due to the loss of family members, and increased caregiving demands (Ornelas et al., 2021; Vahratian et al., 2021). Theory and empirical evidence suggest that social support and the use of coping strategies can buffer the impact of stress and promote mental health (Cardoso and Thompson, 2010). Protective factors can include social support from family and community and individual behaviors, such as coping strategies and drawing strength from one's culture. Several studies have shown the protective effects of social support on mental health among Latina immigrants (Perreira et al., 2015; Rios Casas et al., 2020b; Ryan et al., 2021; Viruell-Fuentes et al., 2013; Williams, 2018). However, among immigrants, social ties are often disrupted by migration and Latinas may struggle to build new social connections due to fears associated with their immigration status (J. A. Fox and Kim-Godwin, 2011; Hurtado-de-Mendoza et al., 2014), and family and work obligations (Grzywacz and Smith, 2016; J. M. Torres et al., 2016).

Coping strategies can also buffer the impact of immigration-related stressors on mental health (Driscoll and Torres, 2013; L. Torres, 2010). Previous research has shown that Latina immigrants rely on coping strategies such as spending time in nature, faith-based and cultural practices, and self-care (Rios Casas et al., 2020b). Mindfulness-based coping strategies such as body awareness and self-compassion can also be effective in reducing stress, depression, and anxiety amongst marginalized populations by regulating emotion, especially when these strategies build on existing cultural strengths (Hölzel et al., 2011; Li et al., 2019; Serpa et al., 2014; Smith et al., 2015). Yet, few studies have assessed the stress-reducing effects of mindfulness-based coping strategies in Latina immigrant populations specifically (Boyd et al., 2018; Fjorback et al., 2011; Khoury et al., 2015; Sharma and Rush, 2014) and even fewer interventions have been developed and evaluated using clinical trials (Lopez-Maya et al., 2019; Ortiz et al., 2019). Previous evaluations of mindfulness interventions for Latinas have largely focused on linguistic adaptations (e.g. offering a program in Spanish) without addressing social and cultural factors, and few have included immigrant participants. Recent reviews highlight the methodological limitations of previous research in this area, including very small sample sizes and less rigorous study designs (Castellanos et al., 2020; Cotter, 2020; Hinton et al., 2011).

With the COVID-19 pandemic, there has been new interest in delivering mindfulness-based interventions online, and these interventions have been effective in reducing depression, stress, and anxiety (Farris et al., 2021; Sanilevici et al., 2021). Participants in these studies have been mostly white and middle to upper income populations; few studies have included or been designed for Latino populations. While some research suggests that online mindfulness interventions are less effective on mental health outcomes than those delivered in-person (Spijkerman et al., 2016), other studies have found the effects of online and in-person mental health-focused interventions to be similar (Barak et al., 2008).

The current study aimed to test the efficacy of *Amigas Latinas Motivando el Alma (ALMA)* or Latina Friends Motivating the Soul, an intervention developed to prevent and reduce depression and anxiety symptoms among Latina immigrant women (Ornelas et al., 2022). We conducted the study in partnership with two community-based organizations serving Latino immigrants using a delayed intervention comparison group design. We hypothesized that women in the intervention group would have fewer depression and anxiety symptoms post-intervention and at follow-up than women in the comparison group. Due to COVID, we adapted the intervention mid-study so it could be delivered online. Given the increased relevance of online interventions since the beginning of the pandemic, we also compared the

efficacy of the in-person vs. online delivery. We estimated that a sample size of at least 200 (100 per arm) would detect moderate (2 point) differences in depression and anxiety post-intervention, based on 80% power given anticipated attrition of 15%.

2. Methods

2.1. Study design and participant recruitment

The efficacy trial used a delayed comparison group design. Participants were enrolled in four waves. Within each wave, one intervention site served as the intervention group, and the other site served as the delayed intervention comparison group. The delayed intervention comparison group received the intervention about six months after the comparison group, to allow for data collection and two post-intervention time points. These selections alternated so that each site served as the intervention or comparison group site an equal number of times. Fig. 1 displays the study design and participant enrollment and retention.

Participants were recruited from two community-based organizations serving Latino immigrants over four waves from September 2018 to February 2021. The main mission of the organizations was to provide education, employment, and legal assistance; neither provided physical or mental health services. Bilingual study team members and community organization staff recruited participants through flyers, presentations, social media announcements, and word of mouth. Participants were screened for eligibility criteria, which included identifying as a Latina immigrant, being a Spanish speaker, being 18 years of age or older, and having a low to moderate depression score (under 20) on a clinical screener used to identify depressive symptoms (Patient Health Questionnaire-9 [PHQ-9]). Potential participants with scores of 20 or above on the PHQ-9 were referred to the licensed mental health counselor on the study team. In general, those with scores 20 or higher were considered ineligible, because the focus of the program is on prevention of depression symptoms, not treatment. However, two participants with scores above the cutoff were included because they were already receiving mental health care and their symptoms were under control. Eligible participants were asked to provide consent to participate in the study. The University of Washington Human Subjects Division approved all study procedures.

2.2. Intervention and delayed intervention control groups

ALMA is a community-based intervention to reduce anxiety and depression among Latina immigrant women. For this trial, ALMA was designed as an in-person group intervention that consisted of eight sessions delivered once a week at one of two community-based organizations. Sessions lasted 2 h and were led in Spanish by trained facilitators who were experienced in working with Latino populations and had expertise in mental health, clinical social work, mindfulness, and yoga instruction. The curriculum aimed to promote mental health and well-being by targeting individual (stress and coping strategies) and interpersonal (social support and social ties) determinants believed to mediate depressive and anxiety symptoms (Ornelas et al., 2022). During the sessions, we used several behavior change techniques to encourage participants to use existing and new coping strategies related to mindful movement, body awareness, and other stress reduction techniques (see Appendix Table A for examples) (Michie et al., 2013). Sessions were interactive and included group discussions and activities that integrated elements of Latino culture and their unique experiences as Latina women. A detailed description of the intervention has been previously published and the intervention protocol is available with the clinical trial registration (CTR #NCT0349278) (Clinicaltrials.gov, 2022; Ornelas et al., 2022).

The first two waves (50%) of intervention delivery were delivered in-person at community organizations. At these sessions, participants were
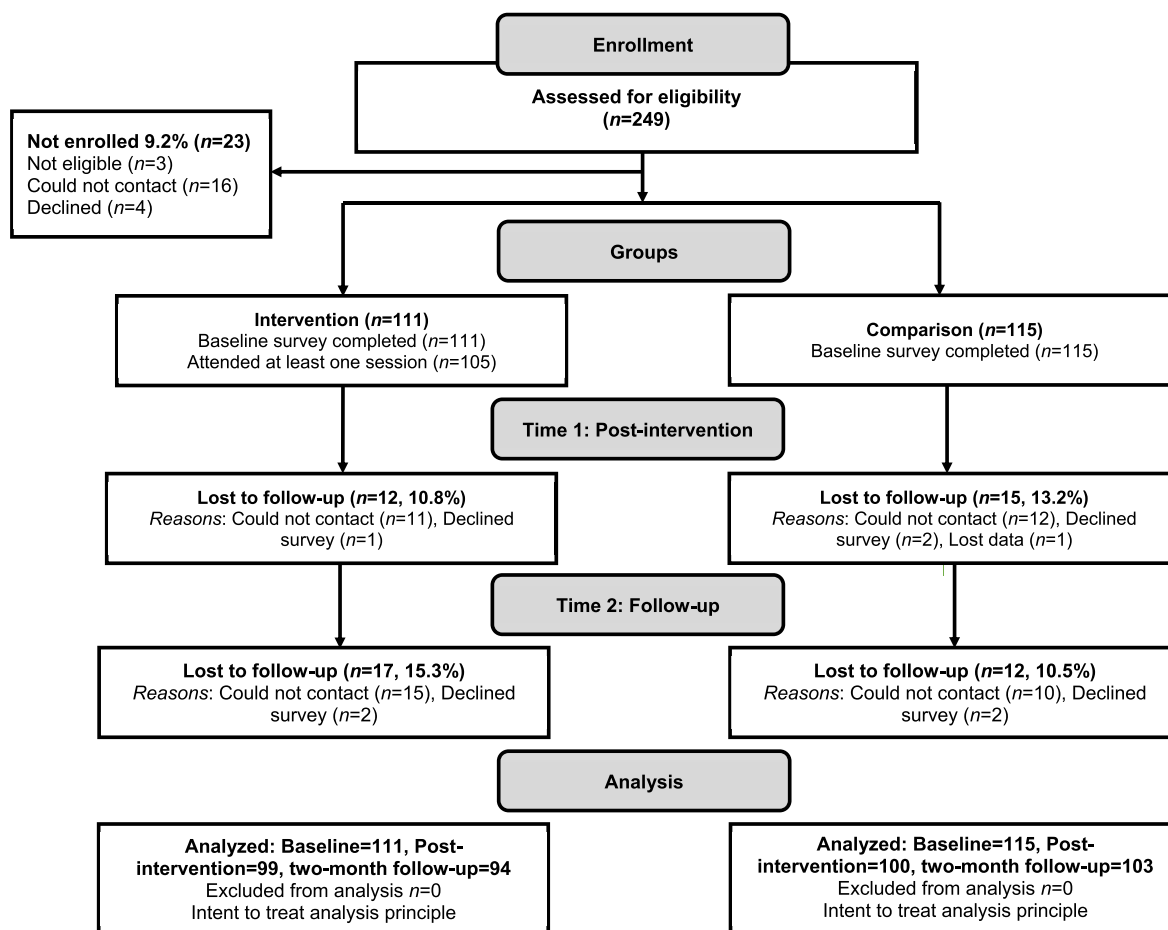
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                          ┌─────────────────────────┐
                          │       Enrollment         │
                          ├─────────────────────────┤
                          │  Assessed for eligibility │
                          │        (n=249)           │
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Enrollment

Assessed for eligibility (n=249)

Not enrolled 9.2% (n=23)
Not eligible (n=3)
Could not contact (n=16)
Declined (n=4)

Groups

Intervention (n=111)
Baseline survey completed (n=111)
Attended at least one session (n=105)

Comparison (n=115)
Baseline survey completed (n=115)

Time 1: Post-intervention

Lost to follow-up (n=12, 10.8%)
Reasons: Could not contact (n=11), Declined survey (n=1)

Lost to follow-up (n=15, 13.2%)
Reasons: Could not contact (n=12), Declined survey (n=2), Lost data (n=1)

Time 2: Follow-up

Lost to follow-up (n=17, 15.3%)
Reasons: Could not contact (n=15), Declined survey (n=2)

Lost to follow-up (n=12, 10.5%)
Reasons: Could not contact (n=10), Declined survey (n=2)

Analysis

Analyzed: Baseline=111, Post-intervention=99, two-month follow-up=94
Excluded from analysis n=0
Intent to treat analysis principle

Analyzed: Baseline=115, Post-intervention=100, two-month follow-up=103
Excluded from analysis n=0
Intent to treat analysis principle

Fig. 1. Flow diagram of ALMA study participant enrollment, participation, and retention.

provided dinner, on-site childcare, and a bus pass to facilitate transportation to and from the sessions. During the first two years of the study, the program was offered approximately every four months (alternating between intervention and control sites). During the last two years of the study, the program was offered more frequently, generally every 3 months. After the study was suspended due to COVID-19, we adapted the intervention for online delivery. This adaptation included condensing the content to fit into six (vs. eight) sessions and adding an orientation session to provide an overview of the program, and guidance/technological support for how to participate in the program through Zoom. All core elements of the curriculum were retained in the online version. Online participants received comparable stipends for food, childcare, and transportation to support their attendance. The delayed intervention control group were only contacted by the research team in order to schedule or administer surveys. They did not receive any type of behavior change intervention during the study period. After the T2 survey, those in the delayed intervention control group were offered the intervention following the same protocol as the intervention group (see Appendix Table A).

2.3. Intervention fidelity

During the ALMA program sessions, participant attendance, and intervention fidelity were tracked weekly by the intervention facilitators. A brief survey was used to assess intervention delivery; facilitators indicated whether they were able to complete all planned activities and provide related materials. This survey also included a space to report any issues that impacted participation, significant current events happening at the time, and participants' level of engagement in session activities.

2.4. Survey procedures and measures

Once enrolled, all participants completed a baseline survey. In the month following the baseline survey, the intervention group received the intervention. This group completed the post-intervention survey (T1) within a month of the final session of the intervention and follow-up surveys two months after the post-intervention survey (T2) and at four months after their baseline survey. After the T2 survey, the delayed intervention comparison group received the intervention, and all participants completed a final survey (T3). Data from the final survey (T3) was intended to provide post-intervention survey data for the comparison group and was not intended to be included in this analysis. Surveys were conducted by trained bilingual interviewers who were not involved in intervention delivery. Participants who received the in-person intervention (Waves 1 and 2) completed the surveys in-person in private locations on site at the community-based organizations from which they were recruited. Participants who received the online intervention (Waves 3 and 4) completed the surveys over the phone. Participants received $30 for each survey they completed. Retention efforts included mailing participants study newsletters and cards in between data collection points.

2.5. Depression

Depression symptoms were assessed using the Patient Health Questionnaire 9 (PHQ-9). The PHQ-9 measures the frequency of nine common depressive symptoms in the past two weeks on a scale of 0 (never)

to 3 (almost every day) and is considered appropriate for repeated testing to assess changes in symptom severity over time (Kroenke et al., 2001; Lowe et al., 2004). Total scores range from 0 to 27 with a score of 20 or more indicating severe symptoms (Kroenke et al., 2001). The PHQ-9 has been previously validated among Spanish speakers and demonstrated good internal consistency in our sample at baseline (α = 0.80) (Huang et al., 2006; Kroenke et al., 2001).

2.6. Anxiety

Anxiety symptoms were assessed using the Generalized Anxiety Disorder-7 (Spitzer et al.). The GAD-7 measures frequency of seven anxiety symptoms in the past two weeks with responses ranging from 0 (not at all) to 3 and is considered appropriate for repeated testing to assess changes in symptom severity over time (Spitzer et al., 2006). Scores range from 0 to 21 with a score of 10 or greater indicating moderate to severe anxiety. The GAD-7 has been validated among Spanish speakers and demonstrated good internal consistency in our sample at baseline (α = 0.85) (Mills et al., 2014; Spitzer et al., 2006).

2.7. Demographic and intervention characteristics

All participants completed a demographic survey that included age, marital or partner status, education, income, employment status, number of children, country of origin, years lived in the US, legal status, and languages spoken (Spanish only, Mostly Spanish, English/Spanish equally, Mostly English). For the question related to legal status, participants were reminded of their option not to respond. Demographic characteristics were chosen based on findings from previous studies that showed they were associated with our primary outcomes, including our own formative research (Rios Casas et al., 2020a; Ryan et al., 2021). We also created a variable for intervention delivery style (in-person or online) to indicate which participants received the intervention in-person versus online.

2.8. Data analysis

2.8.1. Descriptive analyses
We used data from the baseline, post-intervention (T1), and two-month follow-up (T2) surveys for this analysis. To assess possible bias, we conducted descriptive analyses on demographic and primary outcome variables at baseline by group assignment and delivery style. We used t-tests for continuous variables, including depression and anxiety. We used chi-squared tests to detect associations between binary, ordinal, and nominal variables, as well as group assignment and intervention delivery style. We used a p-value of < 0.05 to determine significance. All mean scores presented in Table 1 are crude means.

2.8.2. Intervention analyses
To test the efficacy of the ALMA intervention to reduce anxiety and depressive symptoms among Latina immigrant women, we used a generalized estimating equation (Gee and Ford, 2011) model with proposed estimation and an unstructured working correlation matrix. GEE is a population-averaged model which produces efficient estimates of the coefficients by accounting for within-subject correlation due to repeated measures using a working correlation without the need to specify the full data distribution (Harrison and Hulin, 1989). We specified a marginal mean model, which allows for non-normally distributed data, provides robust standard errors, and imposes no pattern on the correlation matrix because we had few timepoints (Allison, 2018). Time-varying variables were specified as baseline, post-intervention, and follow-up. We report adjusted models because outcomes were very similar to unadjusted models. We adjusted for intervention delivery style, age, education level, and language spoken. To test the efficacy of in-person vs. online delivery of ALMA, we stratified the sample by delivery style and estimated adjusted GEE models for depression and

Table 1
Study participant characteristics across intervention and comparison groups (N = 226).

Characteristics	Full sample (n = 226)		Intervention (n = 111)		Comparison (n = 115)		
	N/ mean	%/SD	N/ mean	%/SD	N/ mean	%/SD	p value
Age	40	0.7	41	1.0	39	0.9	0.10
Under 40	121	53.5	55	49.5	66	57.4	0.24
Years in the US							0.70
Less than 10	48	21.3	21	18.9	27	23.5	
10–20	117	52.0	60	54.1	57	49.6	
More than 20	60	26.7	30	27.0	30	26.1	
Country of origin							0.13
Mexico	168	74.3	90	81.1	78	67.8	
El Salvador	6	2.7	3	2.7	3	2.6	
Colombia	3	1.3	1	0.9	2	1.7	
Other[a]	49	21.7	17	15.3	32	27.8	
Language Spoken							0.50
Monolingual Spanish	133	58.9	62	55.9	71	61.7	
More Spanish than English	58	25.7	33	29.7	25	21.7	
Bilingual Spanish/ English	28	12.4	12	10.8	16	13.9	
Mostly English	7	3.1	4	3.6	3	2.6	
Education							.06
High school degree or higher	150	66.4	67	60.3	83	72.2	
Less than high school	76	33.6	44	39.6	32	27.8	
Partner living in home							0.40
Currently living with partner	142	62.8	73	65.8	69	60.0	
Not living with partner	84	37.2	38	34.2	46	40.0	
Number of children	2	0.1	3	0.1	2	0.1	0.33
Immigration status							0.08
Citizen/current visa/ permission	61	27.0	24	21.6	37	32.2	
Entry and/or stay without permission	132	58.4	73	65.8	59	51.3	
Preferred not to or did not answer	33	14.6	14	12.6	19	16.5	
Monthly income							0.65
Under $2200	105	47.5	53	49.1	52	45.2	
$2200 or more	116	52.5	55	50.9	61	53.0	
Depressive symptoms							0.64
None (0–4)	89	39.4	42	37.8	47	40.9	
Mild (5–9)	80	35.4	41	36.9	39	33.9	
Moderate (10–14)	35	15.5	15	13.5	20	17.4	
Moderate to Severe (15–27)	22	9.7	13	11.7	9	7.8	
Anxiety symptoms							0.81
None (0–4)	76	33.6	39	35.1	37	31.2	
Mild (5–9)	92	40.7	46	41.4	46	40.0	
Moderate (10–14)	40	17.7	19	17.1	21	18.3	
Severe (15–21)	18	8.0	7	6.3	11	9.6	
Depression score	6.86	0.3	7.06	0.5	6.66	0.4	0.66
Anxiety score	6.87	0.3	6.67	0.4	7.06	0.4	0.47

Table 1 (*continued*)

Characteristics	Full sample (n = 226)		Intervention (n = 111)		Comparison (n = 115)		
	N/ mean	*%/SD*	*N/ mean*	*%/SD*	*N/ mean*	*%/SD*	*p value*
Intervention delivery style							0.88
In-person	107	47.4	52	49.1	55	47.8	
Online	119	52.7	59	49.6	60	52.2	

[a] Argentina, Guatemala, Venezuela, Chile, Bolivia, Honduras.

anxiety using the same options as the general sample. Adjusted models for stratified analyses included age, education level, and language spoken as covariates. We present model-based means and 95% confidence intervals in all tables and figures, except Table 1. Data were analyzed using STATA SE version 16.1 (StataCorp, 2019).

Our final sample size was 226 with 27 (11.9%) participants missing post-intervention (T1) data and 29 (12.8%) missing two-month follow-up (T2) data (Fig. 1). Within our final sample, there were a limited number of missing cases for years in the US ($n = 1$), number of children ($n = 4$), and monthly income ($n = 5$). We conducted additional analyses to account for missingness in a variety of ways. We used GEE with weights that were the reciprocal of the estimated non-missing probability at each time point. We used GEE to estimate models with information only from participants who completed all three time points. Finally, we fit a random effects model with random intercept and slopes and full information maximum likelihood using all available time points.

Participants attended an average of 4.6 sessions among the in-person group (range 0–8, 58%) and 3.6 sessions among the online group (range 0–6, 60%). Half of participants (50%) attended 75% or more of the sessions. Based on levels of engagement, we conducted sensitivity analyses to assess whether there were differences in the effect of the intervention among those that participated in at least half of the sessions and those that attended 75% or more.

3. Results

3.1. Descriptive analyses

In Table 1, we report demographic characteristics for the total sample, as well as the intervention and comparison groups. Participants in the intervention group were slightly older than participants in the comparison group, had lower levels of education, and were less likely to be citizens or have permission to be in the United States. Both groups reported low levels of depression and anxiety symptoms at baseline, with 74.3% of participants in the intervention group and 76.5% of participants in the comparison group reporting no depressive symptoms or mild symptoms.

3.2. Depression outcomes

In Table 2, we present model coefficients and means for depression by time, intervention group, and the intervention group by time interaction. In adjusted models, depression scores were almost two points lower post-intervention in the intervention group than the comparison group ($\beta = -1.82$, $p = 0.01$). This difference remained significant at the two-month follow-up (T2) ($\beta = -1.52$, $p = 0.01$). Fig. 2 displays the model-based means and 95% confidence intervals from Table 2, showing that in the intervention group depression scores decreased from 7.01 to 4.96 post-intervention and stayed close to this level at follow-up (5.19), while they remained consistent over time in the comparison group (6.61, 6.39, 6.31) .

Table 2
Adjusted model estimates of contrasts and means for intervention and time effects on depression and anxiety[a], (N = 226).

Model coefficients: contrasts of average scores	Depression			Anxiety		
	β	SE	p value	β	SE	p value
Intervention main effect	0.40	0.64	*p = 0.54*	−0.31	0.63	*p = 0.63*
Time main effect (T1 post-intervention)	−0.23	0.49	*p = 0.65*	**−1.45**	**0.48**	**p = 0.003**
Time main effect (T2 follow- up)	−0.30	0.43	*p = 0.48*	**−1.66**	**0.41**	**p=<0.0001**
Intervention by Time interaction (T1)	**−1.82**	**0.65**	**p = 0.01**	−1.17	0.65	*p = 0.07*
Intervention by Time interaction (T2)	**−1.52**	**0.62**	**p = 0.01**	−0.74	0.61	*p = 0.22*

Model-based estimates of average scores	**Depression**		**Anxiety**	
	Intervention	*Comparison*	*Intervention*	*Comparison*
Baseline				
Mean	7.01	6.61	6.71	7.02
95% CI	6.10, 7.92	5.76, 7.47	5.83, 7.60	6.17, 7.86
Post Intervention (T1)				
Mean	4.96	6.39	4.09	5.56
95% CI	4.06, 5.87	5.32, 7.45	3.34, 4.84	4.67, 6.46
Follow-up (T2)				
Mean	5.19	6.31	4.30	5.35
95% CI	4.20, 6.18	5.27, 7.36	3.48, 5.12	4.43, 6.27

[a] Adjusted for age, education, language spoken, and delivery style.

3.3. Anxiety outcomes

Table 2 also includes model coefficients and means for anxiety. In adjusted models, anxiety symptoms decreased at post-intervention in both the intervention and comparison groups ($\beta = -1.17$, $p = 0.07$). Although the difference was not significant, there was a greater reduction in anxiety scores in the intervention group than the comparison group post-intervention and this reduction was sustained at follow-up (see Fig. 3).

3.4. Differences in depression and anxiety by level of engagement and delivery style

We conducted sensitivity analyses to assess whether there we findings were similar based on level of engagement with the program. For depression, estimates were similar but slightly higher for those that attended at least half of the sessions (N = 203) and 75% or more of the sessions (N = 183). For anxiety, estimates were very similar to the intent-to-treat analysis. Moreover, the different approaches to handle missing data resulted in minor differences in estimates and the same qualitative conclusions (Appendix, Tables B and C). Table 3 displays the differences in intervention outcomes across intervention delivery styles. Among online intervention group participants depression scores decreased from baseline to post-intervention (7.30–5.60), while scores in the comparison group increased slightly during the same period (6.01–6.82). These differences were statistically significant at both post-intervention ($\beta = -2.50$, $p = 0.007$) and follow-up ($\beta = -2.09$, $p = 0.006$). However, among the in-person participants depression scores decreased in both the intervention (6.67–4.25) and comparison groups (7.22–5.82) (Fig. 4). Therefore, there were no significant differences between intervention and comparison groups among participants receiving the intervention in person.

The results for anxiety scores followed a similar pattern. Among participants receiving the intervention online, the intervention group had significantly lower levels of anxiety symptoms post-intervention
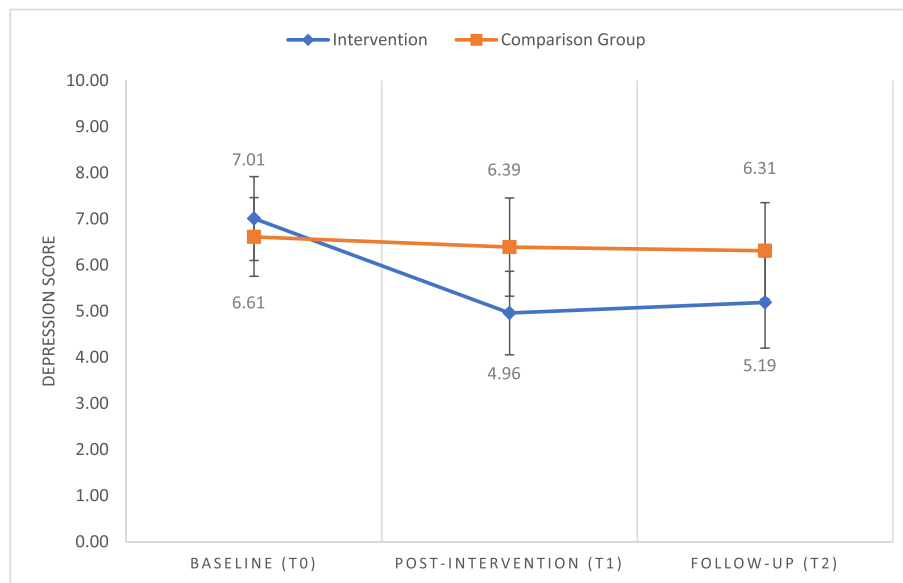
Fig. 2. Mean participant depression scores for intervention and comparison groups at baseline, post-intervention, and follow-up, $N = 226$.
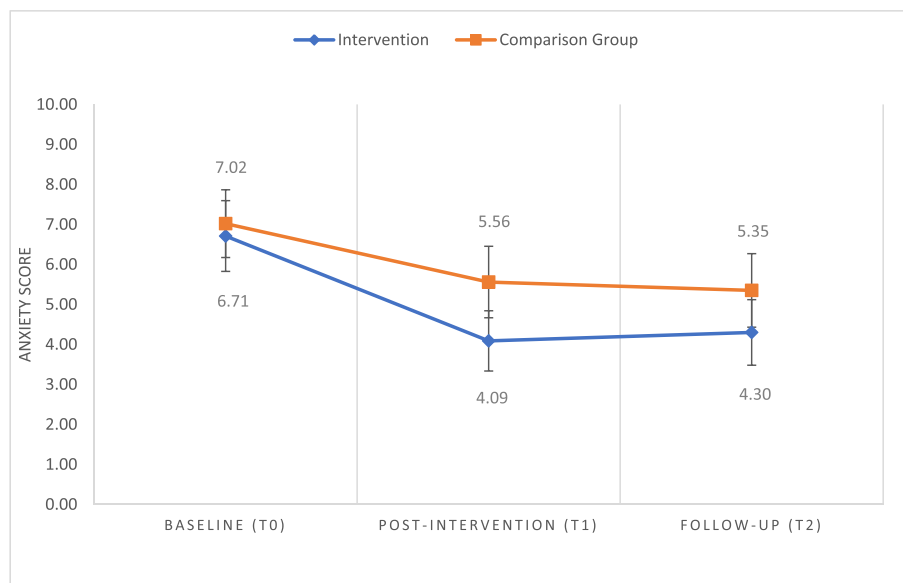

Fig. 3. Mean participant anxiety scores for intervention and comparison groups at baseline, post-intervention, and follow-up, $N = 226$.

Table 3
Adjusted Model Estimates of Contrasts for Intervention and Time Effects for Depression and Anxiety for in-person ($n = 107$) and online ($n = 119$) delivery.[a]

	Depression (in-person)			Depression (online)			Anxiety (in-person)			Anxiety (online)		
	β	SE	*p value*	β	SE	*p value*	β	SE	*p value*	β	SE	*p value*
Intervention main effect	−0.55	0.86	*p = 0.52*	1.29	0.92	*p = 0.16*	−0.84	0.92	*p = 0.36*	0.39	0.87	*p = 0.66*
Time main effect (T1, post-intervention)	**−1.40**	**0.64**	***p = 0.03***	0.80	0.70	*p = 0.25*	**−2.45**	**0.75**	***p = 0.001***	−0.61	0.58	*p = 0.30*
Time main effect	−0.86	0.69	*p = 0.21*	0.25	0.51	*p = 0.63*	**−1.66**	**0.67**	***p = 0.01***	**−1.51**	**0.51**	***p = 0.003***
Intervention by Time interaction (T1)	−1.01	0.85	*p = 0.24*	**−2.50**	**0.92**	***p = 0.007***	−0.26	0.94	*p = 0.79*	**−1.90**	**0.83**	***p = 0.02***
Intervention by Time interaction (T2)	−0.87	0.99	*p = 0.38*	**−2.09**	**0.75**	***p = 0.006***	−1.13	0.94	*p = 0.23*	−0.46	0.81	*p = 0.57*

[a] Adjusted for age, education, and language spoken.

than the comparison group ($\beta = -1.86$, p = 0.02). Yet, this association was not significant at the two-month follow-up ($\beta = -0.24$, p = 0.77). There were no significant differences in anxiety scores between the intervention and comparison groups for participants receiving the intervention in person (Table 3). Among participants receiving it online,

anxiety scores had a larger decrease post-intervention in the intervention group (6.73–4.31) than the comparison group (6.57–6.01) (Fig. 5). Still, at the two-month follow-up there were no significant differences.

In-person (*n*=107)
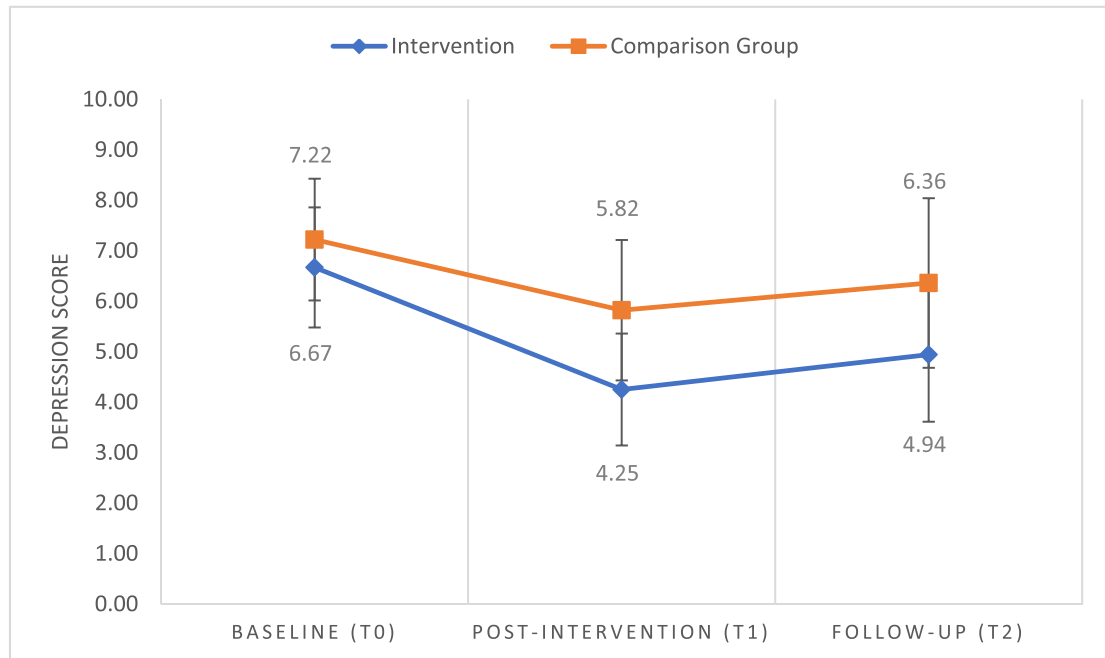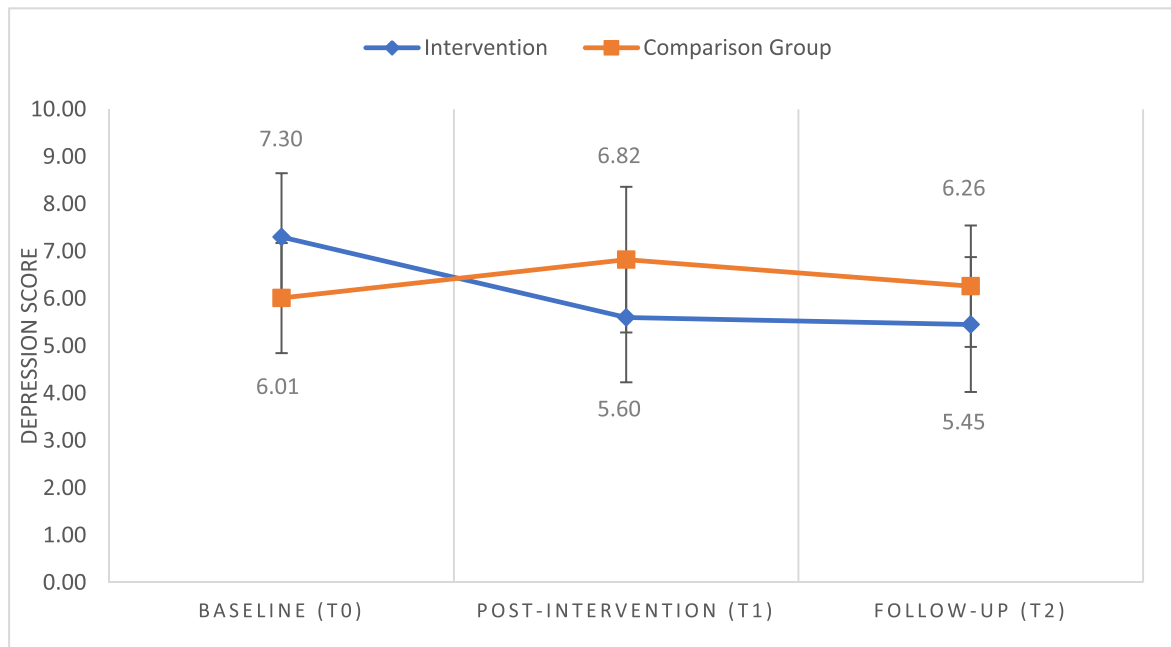

Online (*n*=119)

Fig. 4. Mean participant depression scores for in-person and online intervention and comparison groups at baseline, post-intervention, and follow-up. In-person (*n* = 107).

3.5. Fidelity measures

Intervention facilitators reported that core elements were covered in all of the sessions (*n* = 53). In addition, all equipment and materials needed were in place at 96.2% of the sessions, and the space was set up correctly at 87.5% of the in-person sessions. Fidelity reports also show

facilitator observations of current affairs impacting participants' lives. Examples include changes in political leadership and policies affecting immigration, events of violence or discrimination toward immigrants, and news relating to the COVID-19 pandemic, such as limitations on public services, freedom of movement, and vaccination availability.
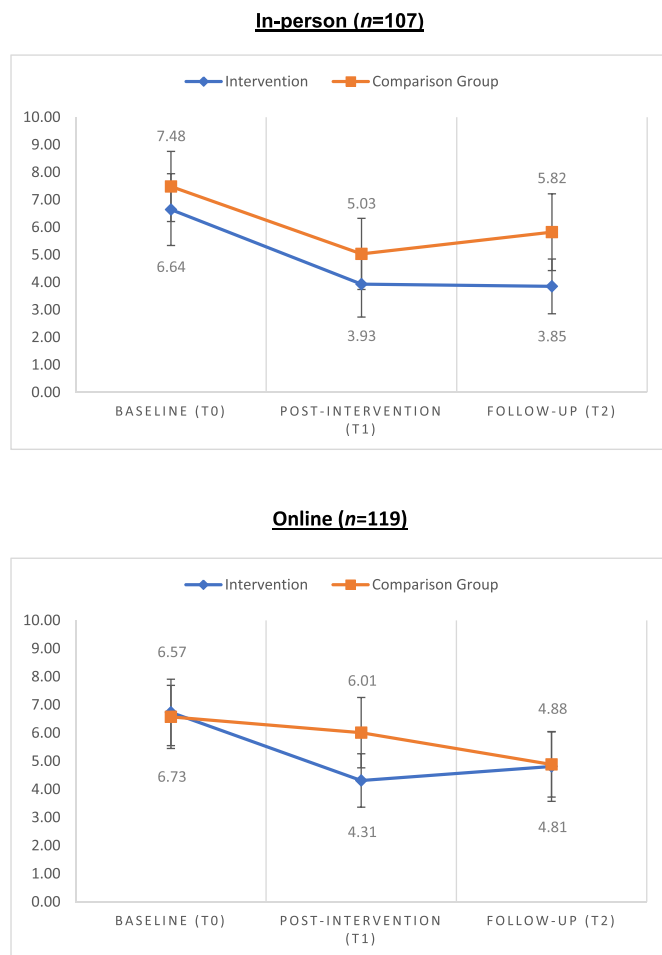
In-person (*n*=107)

Online (*n*=119)

Fig. 5. Mean participant anxiety scores for in-person and online intervention and comparison groups at baseline, post-intervention, and follow-up. In-person (*n* = 107).

4. Discussion

Our study was one of the first to assess the efficacy of a culturally grounded mindfulness-based intervention in a community-based sample of Latina immigrant women using a rigorous study design. We achieved high fidelity in delivering the intervention both in-person and online and maintained high retention rates even during a time of significant disruption due to the pandemic. Most study participants reported no or mild levels of depression and anxiety symptoms at baseline. Participants receiving the intervention had lower levels of depression symptoms than participants in the comparison group, but differences in anxiety symptoms were not significant. Reductions in depression symptoms remained at follow-up, indicating there was no need for clinical intervention or treatment. Participants that received the intervention online had greater reductions in depression and anxiety symptoms than participants that received it in-person. Our findings align with previous studies demonstrating the efficacy of mindfulness-based interventions to reduce depression symptoms in Spanish-speaking Latino samples (Lopez-Maya et al., 2019; Ortiz et al., 2019). Our findings also provide a significant contribution to the literature on mental health interventions for Latina immigrant women and differences across in-person and online intervention delivery style.

Few studies evaluating the efficacy of mindfulness-based interventions have included Latina immigrant women (Lopez-Maya et al., 2019; Ortiz et al., 2019; Roth and Robbins, 2004; Wagner et al., 2016). An evaluation of an 8-week stress-reduction intervention culturally adapted for Latinos with diabetes showed a moderate effect on

depressive symptoms and a small to moderate effect on anxiety symptoms among participants in the intervention group, compared to participants in the control group, who received diabetes education only (Wagner et al., 2016). This study assessed depressive symptoms with the PHQ-9 without the final suicidality item and differences were similar to those in our study, with scores dropping from 6.7 to 4.7 in the intervention group. Other studies evaluating mindfulness-based interventions with Latina immigrant women have similarly found small but significant intervention effects on depression and anxiety (Lopez-Maya et al., 2019; Ortiz et al., 2019). However, these interventions reflected MBSR programs were either offered in Spanish or with only slight modifications made to increase participant acceptability. Furthermore, these studies had very small samples or lacked comparison groups (Ortiz et al., 2019; Roth and Robbins, 2004). Our findings provide evidence that mindfulness interventions offered in a culturally relevant setting and context may be more effective than linguistic adaptations alone.

In our stratified analyses, we observed a decrease in depressive and anxiety symptoms among participants who received the intervention online but not among participants who received the intervention in-person. Notably, and perhaps an explanation for this difference in findings between intervention delivery style, is that participants who received the intervention online did so after the onset of the COVID-19 pandemic. This differential impact between in-person and online delivery may have been due to increased stress and heightened need for mental health services associated with the pandemic. An evaluation of an 8-week online mindfulness-based stress reduction intervention delivered during the early stages of the pandemic found similar results, showing lower stress and anxiety at follow-up for experiential vs. control (Sanilevici et al., 2021). Together, results from these studies suggest that mindfulness-based interventions delivered online may be particularly effective at promoting mental health during a pandemic that requires isolation and social distancing. Future research should assess whether Latina immigrants with concerns about COVID exposure, going out in public due to their legal status, or other barriers to participation may be more comfortable participating in an online intervention (Weaver et al., 2019).

Another difference between participants receiving the intervention in-person and online was that those receiving it in-person were participating from 2018 to 2020, while those receiving it online participated in 2021. The earlier time period was marked by anti-immigrant political rhetoric and immigration enforcement, which resulted in increased fear of deportation, discrimination, and social isolation in Latino communities (Benavides et al., 2021; M. Fox, 2022). Participants enrolled in the study during 2018–2020 had reductions in their depression and anxiety symptoms over time regardless of whether they received the intervention. These reductions may have been due to changes in the social and political environment, resulting in there being smaller differences between the intervention and control group. These political events may have also resulted in differences among those who participated after 2020, in that depression scores remained relatively stable in the comparison group over time, but anxiety levels decreased over time perhaps as a result of changes in the political environment.

4.1. Limitations

There were some limitations to our study. Our study was powered to detect moderate differences in outcomes. While the changes in anxiety were in the expected direction, they were less than the expected magnitude of 2-points and insignificant. Future studies with larger samples may be able to detect small but important changes in depression and anxiety. There was some attrition in our sample, although less than expected based on previous studies, this could result in the intervention appearing more effective if those with higher depression, and anxiety scores were more likely to be lost to follow up. Our sample was also limited to a small geographic area with a specific social and political context, including being connected to community-based organizations,

largely from Mexico and Spanish speaking. Furthermore, depression and anxiety scores were relatively low at the beginning of the study. A more diverse sample with a broader range of scores at baseline would increase generalizability of the findings.

5. Conclusions

Our findings suggest that community-based mental health interventions using evidence-based approaches such as mindfulness and enhancing social support can be efficacious in preventing and reducing depression and anxiety among Latina immigrant women. Given the limited availability of mental health services for this population, community-based interventions can have an important impact. Further research is needed in more diverse Latina immigrant populations to assess the effectiveness of the ALMA intervention in other contexts and settings, as well as whether personal characteristics moderate the impact of the intervention. Future studies should also aim to identify the components of the intervention that had the most impact, as well as whether differences observed by delivery style persist outside of the pandemic.

Author contributions

India J. Ornelas: Conceptualization, Methodology, Resources, Writing – Original Draft, Project administration, Supervision, Funding acquisition. Deepa Rao: Conceptualization, Methodology, Writing – Review and Editing, Supervision, Funding acquisition. Cynthia Price: Conceptualization, Methodology, Writing – Review and Editing. Gary Chan: Methodology, Formal analysis, Software, Writing – Review and Editing. Anh Tran: Conceptualization, Methodology, Writing – Review and Editing. Gino Aisenberg: Conceptualization, Funding acquisition. Georgina Perez: Investigation, Project administration, Writing – Review and Editing. Serena Maurer: Investigation, Project administration, Writing – Review and Editing. Adrianne Katrina Nelson: Data curation, Formal analysis, Software, Writing – Original Draft.

Data availability

The data that has been used is confidential.

Appendix A

Table A
Examples of the ALMA Intervention Behavior Change Techniques (BCT) Based on BCT Taxonomy

1. Goals and planning 1.1. Goal setting (behavior) 1.2. Problem solving 1.3. Action planning 1.4. Review behavior goal(s)	Participants were encouraged to set goals for practicing new coping skills, including planning for times when they might use the skills.
2. Feedback and monitoring 2.3. Self-monitoring of behavior	Participants were encouraged to reflect on their goals and behaviors each week.
3. Social support 3.1. Social support (unspecified)	Participants were encouraged to identify and draw on sources of social support, including connections with other participants.
4. Shaping knowledge 4.1. Instruction on how to perform the behavior 4.4. Behavioral experiments	Facilitators guided participants in a mindful movement practice, and then asked them to reflect on how it made them feel.
5. Natural consequences 5.1. Information about health consequences 5.6. Information about emotional consequences	Facilitators provided information on the mental and physical health consequences of chronic stress.
6. Comparison of behavior 6.1. Demonstration of the behavior	Facilitators demonstrated breathing exercises for participants
7. Associations 7.1. Prompts/cues	Materials were sent home with participants to remind them to practice new coping skills
8. Repetition and substitution 8.1. Behavioral practice/rehearsal 8.3. Habit formation	Participants were given opportunities to practice new behaviors and encouraged to use them regularly.
9. Comparison of outcomes 9.3. Comparative imagining of future outcomes	Participants were invited to reflect on potential changes to their health if they practiced new coping strategies.
11. Regulation 11.3. Conserving mental resources	Facilitators helped participants understand how coping practices can help them reserve energy for other facets of their lives.
12. Antecedents 12.2. Restructuring the social environment 12.6. Body changes	Participants were given opportunities to practice new behaviors in a social setting that included women with similar lived experiences. They were asked to notice changes in their bodies as a way of identifying stress and relief associated with new coping practices.
13. Identity 13.4. Valued self-identify 13.5. Identity associated with changed behavior	Participants were encouraged to associate new behaviors with parts of their identities (e.g. as mothers, spouses, Latinas, caregivers).
15. Self-belief 15.4. Self-talk	Participants were encouraged to practice self-compassion in their self-talk about handling challenging emotions.
16. Covert learning 16.2. Imaginary reward 16.3. Vicarious consequences	Participants were invited to incorporate new practices into their daily lives and notice their impact.

Table B

Adjusted Model Estimates of Contrasts and Means for Intervention and Time Effects on Depression and Anxiety Among participants Completing at Least Half of the Sessions*, N = 203.

Repeated measures model effects	Depression		Anxiety	
	Coefficient	*p value*	*Coefficient*	*p value*
Intervention main effect	0.36	$p = 0.59$	−0.64	$p = 0.32$
Time main effect (T1 post-intervention)	−0.23	$p = 0.64$	−1.44	$\mathbf{p = 0.003}$
Time main effect (T2 follow- up)	−0.30	$p = 0.47$	−1.69	$\mathbf{p = <0.0001}$
Intervention by Time interaction (T1)	−2.15	$\mathbf{p = 0.001}$	−1.07	$p = 0.10$
Intervention by Time interaction (T2)	−1.81	$\mathbf{p = 0.01}$	−0.72	$p = 0.28$

* Adjusted for age, education, language spoken, and delivery style.

Table C

Adjusted Model Estimates of Contrasts and Means for Intervention and Time Effects on Depression and Anxiety Among Participants Completing Most Sessions (75% in-person, 83% online)*, N = 183.

Repeated measures model effects	Depression		Anxiety	
	Coefficient	*p value*	*Coefficient*	*p value*
Intervention main effect	−0.01	$p = 0.99$	−0.82	$p = 0.23$
Time main effect (T1 post-intervention)	−0.25	$p = 0.61$	−1.45	$\mathbf{p = 0.003}$
Time main effect (T2 follow- up)	−0.28	$p = 0.52$	−1.66	$\mathbf{p = <0.0001}$
Intervention by Time interaction (T1)	−2.10	$\mathbf{p = 0.002}$	−1.09	$p = 0.10$
Intervention by Time interaction (T2)	−1.85	$\mathbf{p = 0.01}$	−0.84	$p = 0.21$

* Adjusted for age, education, language spoken, and delivery style.

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