



Do Your Homework: Cognitive Therapy Homework Compliance Predicts Next-Session Depression Severity Improvement

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Abstract

Background Homework is an important component of cognitive therapy (CT), and has been associated with improved treatment outcome. However, patient-level differences, such as depression symptom severity, might account for the observed relationship between compliance and outcome—rather than a direct effect of compliance on outcome, *per se*. Therefore, the present study aimed to evaluate the relationship between homework compliance and next-session depression symptom severity, while accounting for patient-level differences.

Methods Within the Sequenced Treatment Alternatives to Relieve Depression (STAR*D) trial, 113 patients received CT after failing to remit from an initial course of citalopram treatment, with 73 receiving citalopram plus CT and 40 receiving CT only. We specified a multilevel growth model to analyze the relationship between homework compliance and next-session depression severity change. We also conducted dynamic panel structural equation modeling as a sensitivity analysis.

Results Higher homework compliance significantly predicted lower next-session Quick Inventory of Depressive Symptomatology-Self-Rated (QIDS-SR) score. Treatment group was not significant.

Conclusions The present study found that higher homework compliance in the preceding session was directly linked to depression severity improvement at the following session. These findings emphasize the importance for therapists to encourage their patients to complete their assigned homework.

Keywords Cognitive therapy · Homework compliance · Homework adherence · Depression severity · Cognitive behavioral therapy

Introduction

Cognitive therapy (CT) has been shown to be an efficacious treatment for patients with major depressive disorder (MDD) (Cuijpers et al., 2023), and has been recommended as a first-line treatment for MDD (NICE, 2022).

Within CT, homework refers to “activities the client carried out between sessions, selected together with the therapist, in order to aid progress towards therapy goals

(Kazantzis et al., 2012, p. 3). Beck et al., (1979, p. 272) describe it as an “integral, vital component of treatment.” Indeed, Kazantzis et al.’s (2000) meta-analysis found that not only did assigning homework in therapy predict better outcomes, but also patient’s compliance with completing their assigned homework did as well. Subsequently, Mausbach et al.’s (2010) and then Kazantzis et al.’s (2016) meta-analyses of studies published between 2000 and 2015 corroborated Kazantzis et al.’s (2000) findings that higher homework compliance was associated with improved treatment outcome.

One set of criticisms of the demonstrated relationship between homework compliance and improved treatment outcome concerns the timing of measurement (Addis & Jacobson, 2000). For example, compliance might have been measured retrospectively following a course of therapy, introducing recall bias; or outcome and compliance were not assessed session-by-session (e.g., outcome was only assessed at pre- and posttreatment), thereby failing to

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account for individual patient differences. While some studies did measure both compliance and symptom severity at each therapy session, or used composite scores (e.g., average percent of homework across the total number of psychotherapy sessions attended; Coon & Thompson, 2003), they did not analyze the relationship between compliance and outcome session-by-session. Therefore, patient-level differences, such as depression symptom severity, might account for the observed relationship between compliance and outcome—rather than a direct effect of compliance on outcome, *per se*. For example, a patient with severe depression may be less likely to engage in homework and more likely to have a worse posttreatment outcome (Cohen et al., 2019; Worthington, 1986).

Conklin and Strunk (2015) explored the session-to-session relationship between homework engagement and depression severity change for 53 patients who received CT. Using ratings from the first five CT sessions and from observers blinded to the subsequent outcome, they found that the between-session intervals in which patients showed higher homework engagement were associated with greater severity improvement. Haller and Watzke (2021) applied multilevel mixed models to examine between- and within-patient variability of homework engagement and next-session depression symptom severity for 22 patients receiving telephone-based cognitive behavioral therapy (CBT) for mild to moderate depression. Their findings were consistent with those from Conklin and Strunk (2015).

Yew et al. (2021) examined the relationship between depression severity change and the following predictors: therapist competence in using homework; client perceptions of homework; and client perceptions of the homework's consequences. Using data from 50 patients who received CBT, they applied cross-lagged and multilevel modeling to explore mediators and moderators of next-session depression severity change. In their mediation analyses, their cross-lagged panel analysis did not find homework engagement to predict next-session severity change. Furthermore, their multilevel analysis indicated that homework engagement might even predict worse next-session depression severity.

The Sequenced Treatment Alternatives to Relieve Depression (STAR*D) study is the largest treatment study to date in evaluating treatment effectiveness—albeit primarily of antidepressant treatment—for outpatients with MDD (Rush et al., 2006). Within the STAR*D trial, patients who did not remit after an initial course of citalopram treatment had the opportunity to receive CT. Furthermore, patients provided measurements of not only depression symptom severity, but also homework compliance throughout their course of

therapy. Callan et al. (2019) previously applied a propensity score approach to classify patients in the STAR*D trial as either “high [homework] adherers” or “low adherers” by using each patient's averaged homework compliance over their course of CT treatment. They found that high adherers were associated with higher response and remission rates than low adherers. While Callan et al. were able to identify between-patient differences in homework compliance on symptom improvement across the course of treatment, they were not able to examine the within-patient relationship of homework compliance and next-session depression severity improvement.

The present study aimed to use a larger sample of patients and a more representative sample of moderately-depressed patients to extend Conklin and Strunk's (2015) analysis beyond early sessions of CT to the full course of treatment, and to replicate Yew et al.'s (2021) finding that there may be no relationship between homework engagement and next-session depression severity change. Therefore, the present study used data from the STAR*D trial to evaluate the relationship between homework compliance and next-session depression symptom severity, while accounting for patient-level differences. We hypothesized that higher homework compliance would predict depression severity improvement.

Methods

STAR*D Research Design

The STAR*D trial aimed to provide guidance for clinicians and patients in selecting the best next-step treatment for the many “real-world” patients who fail to remit or respond after their first, and/or subsequent antidepressant treatment (Rush et al., 2004; Warden et al., 2007). Within the study, patients who experienced an unsatisfactory clinical outcome from their course of treatment had the option to enter the subsequent step and receive a new type of treatment. Each step consisted of 12 weeks of treatment, with an additional two weeks for patients deemed close to remission. Further details of the STAR*D rationale, design, and description of treatment settings can be found elsewhere (Rush et al., 2004).

Participants

Patients enrolled in the STAR*D trial were 18–75 years old, diagnosed with nonpsychotic MDD, and seeking care at 18 primary and 23 psychiatric care clinical sites across the

United States (Warden et al., 2007). As described by Warden et al., (2007, p. 1190):

“A pretreatment score ≥ 14 on the 17-item Hamilton Depression Rating Scale (HAM-D) was required for study entry. Broad inclusion and minimal exclusion criteria were used to ensure a comprehensive representative cohort of “real world” patients to maximize the generalizability of findings...patients with most psychiatric and medical comorbidities could be enrolled as well as patients who were suicidal or abusing substances. Patients with a clear history of intolerance to the medications used in the first two levels of treatment were excluded as well as patients with a lifetime history of bipolar disorder, psychotic disorder, current anorexia nervosa, or a current primary diagnosis of bulimia or obsessive compulsive disorder (OCD). Patients were excluded if they were receiving antipsychotics, anticonvulsants, mood stabilizers, CNS stimulants, or nonstudy antidepressant medications or if they were breastfeeding or pregnant.”

Treatment

Patients enrolled in the STAR*D trial first received citalopram treatment (Rush et al., 2004). Patients who did not remit or could not tolerate citalopram were eligible to enter step 2 of the trial. There were seven treatment options in step 2 for patients to receive: four switch options (including CT) and three augmentation options (including citalopram plus CT). Patients could opt to exclude certain treatment options (Rush, Trivedi, Wisniewski, Stewart, et al., 2006); then from the available treatment options, patients were randomly assigned their step 2 treatment.

CT sessions were provided twice weekly for the first month, and then weekly until treatment termination (Friedman et al., 2004). If a patient met remission criteria prior to the end of the 12-week treatment period, sessions could occur biweekly for the patient's convenience.

After following the original STAR*D pre-registered inclusion criteria as applied by Pigott et al. (2023), we identified a total of 113 patients from both the CT only and citalopram plus CT conditions.

Therapists

44 certified STAR*D CT therapists provided treatment in the study. Of these, 31 held doctorates, 11 held Masters degrees, and two had nursing backgrounds. One criterion to be considered as a STAR*D CT therapist was: “a strong preference that candidates have CT certification (e.g., Beck Institute, Academy of Cognitive Therapy certification) or its

equivalent in clinical experience” (Friedman et al., 2004, p. 823). All STAR*D CT therapists attended a two-day training workshop, in which the theoretical assumptions of CT were reviewed, and therapists were oriented to the STAR*D protocol and measures. Therapists were also asked to submit audiotapes of three consecutive CT sessions in which the tapes were rated using the Cognitive Therapy Scale (Vallis et al., 1986), a measure of CT fidelity. Therapists needed to meet a level of competence (Cognitive Therapy Scale score > 39) on two of the three tapes to be able to provide treatment in the study. During the STAR*D trial, each therapist met monthly for telephone-based supervision to review their active CT cases. Therapists aimed to ask about homework at the start of each session, and assign homework at the end of each session. See Friedman et al. (2004) and (2009) for more details.

Measures

The 16-item Quick Inventory of Depressive Symptomatology-Self-Rated (QIDS-SR) scale (Rush et al., 2003, 2004), a measure of depression symptom severity, was completed at baseline and at weeks 2, 4, 6, 9, and 12 (Wisniewski et al., 2006).

For each therapy session following the first session, clinicians provided a rating of their patient's level of compliance with homework assigned from the last session (Friedman et al., 2004). The ratings ranged from 0 to 3 (0 = “not done”; 1 = “did some of what was planned”; 2 = “did most of what was planned”; and 3 = “did all of what was planned”).

Because therapy sessions occurred more frequently (twice per week in the first month of treatment) than QIDS-SR ratings (assessed at weeks 2, 4, 6, 9, and 12), we aggregated the homework compliance scores from the preceding therapy sessions of each QIDS-SR rating to estimate the effect of homework compliance on QIDS-SR score. Specifically, we calculated the averages of homework compliance within each of the five QIDS-SR observation windows (baseline to week 2; week 2 to 4; week 4 to 6; week 6 to 9; week 9 to 12). For example, HW_{0-2} denotes the average of the homework compliance scores between the timepoints of baseline QIDS-SR, or $QIDS-SR_0$, and week 2 QIDS-SR, or $QIDS-SR_2$, excluding homework compliance scores rated the day of $QIDS-SR_2$. If a QIDS-SR rating for a week was missing, we extended the window to the next available QIDS-SR score, and then calculated the average homework compliance score. For example, HW_{2-6} denotes the average of the homework compliance scores between the timepoints of $QIDS-SR_2$ and $QIDS-SR_6$ (excluding the homework compliance scores rated the day of $QIDS-SR_6$), as $QIDS-SR_4$ was missing (see Fig. 1). Thus, each QIDS-SR score was estimated from homework compliance ratings

a) Patient with complete data

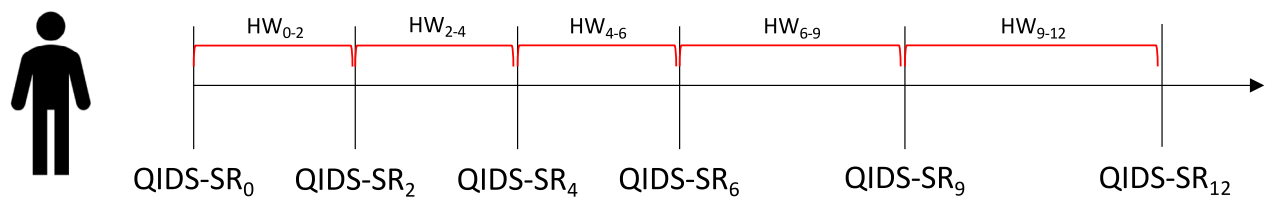
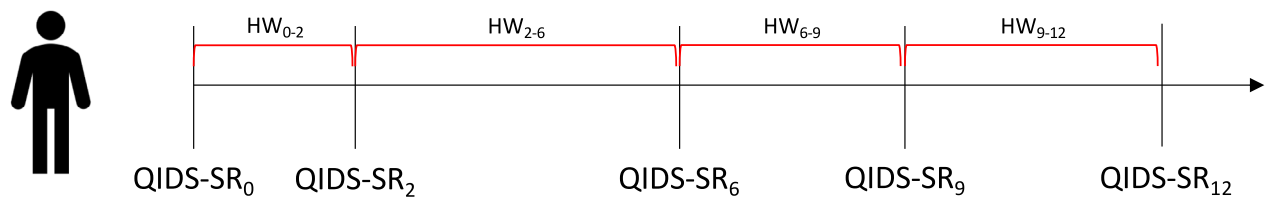
b) Patient with missing QIDS-SR₄ score

Fig. 1 Analysis scheme for the multilevel growth model. Note that each QIDS-SR score was estimated from homework compliance ratings preceding that QIDS-SR observation, and subsequent to the last QIDS-SR observation. For example, HW_{0-2} denotes the average of the homework compliance scores between the timepoints of baseline

QIDS-SR, or QIDS-SR₀, and week 2 QIDS-SR, or QIDS-SR₂, excluding homework compliance scores rated the day of QIDS-SR₂. In **b**), homework compliance ratings between QIDS-SR₂ and QIDS-SR₆ are used to predict QIDS-SR₆ (excluding the homework compliance scores rated the day of QIDS-SR₆).

preceding that QIDS-SR observation, and subsequent to the last QIDS-SR observation.

Statistical Analyses

Multilevel Growth Models

We specified a multilevel growth model to analyze the relationship between homework compliance and next-session depression symptom severity (Raudenbush, 2004). The dependent variable was QIDS-SR score, with week entered as a fixed effect predictor and homework compliance as a time-varying covariate. A random slope of week and a fixed slope for homework compliance were modeled for each patient. Thus, our growth model was able to estimate the relationship between homework compliance and within-patient changes in QIDS-SR over time (McCoach & Kaniskan, 2010; Raudenbush, 2004). The model specification was the following:

$$QIDS-SR_{ij} = \pi_{0i} + \pi_{1i}(\text{week}) + \pi_{2i}(\text{homework compliance}) + e_{ij}$$

$$\pi_{0i} = \beta_{00} + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

$$\pi_{2i} = \beta_{20}$$

We also ran a model with treatment group (citalopram plus CT vs. CT only) entered as a covariate to control for treatment-level differences.

Dynamic Panel Model, a Sensitivity Analysis

At the request of reviewers, we ran a sensitivity analysis by applying structural equation modeling (SEM) to examine the cross-lagged effects of homework compliance on depression symptom severity. Specifically, we applied a dynamic panel model approach (using the R package, “dpm”; Long et al., 2024). This approach has been shown to be less biased and more efficient than SEMs fitted with generalized method of moments (GMMs), and offers advantages in handling missing predictor data through the use of full information maximum likelihood (Allison et al., 2017). We specified a model with an autoregressive path from QIDS-SR score to next-session QIDS-SR score, and a cross-lagged path from homework compliance to next-session QIDS-SR score (see Fig. 2). We also ran a model with treatment group entered as a covariate.

Results

Table 1 presents the demographics and clinical characteristics of our sample. 465 QIDS-SR observations and 1067 homework compliance observations were obtained from

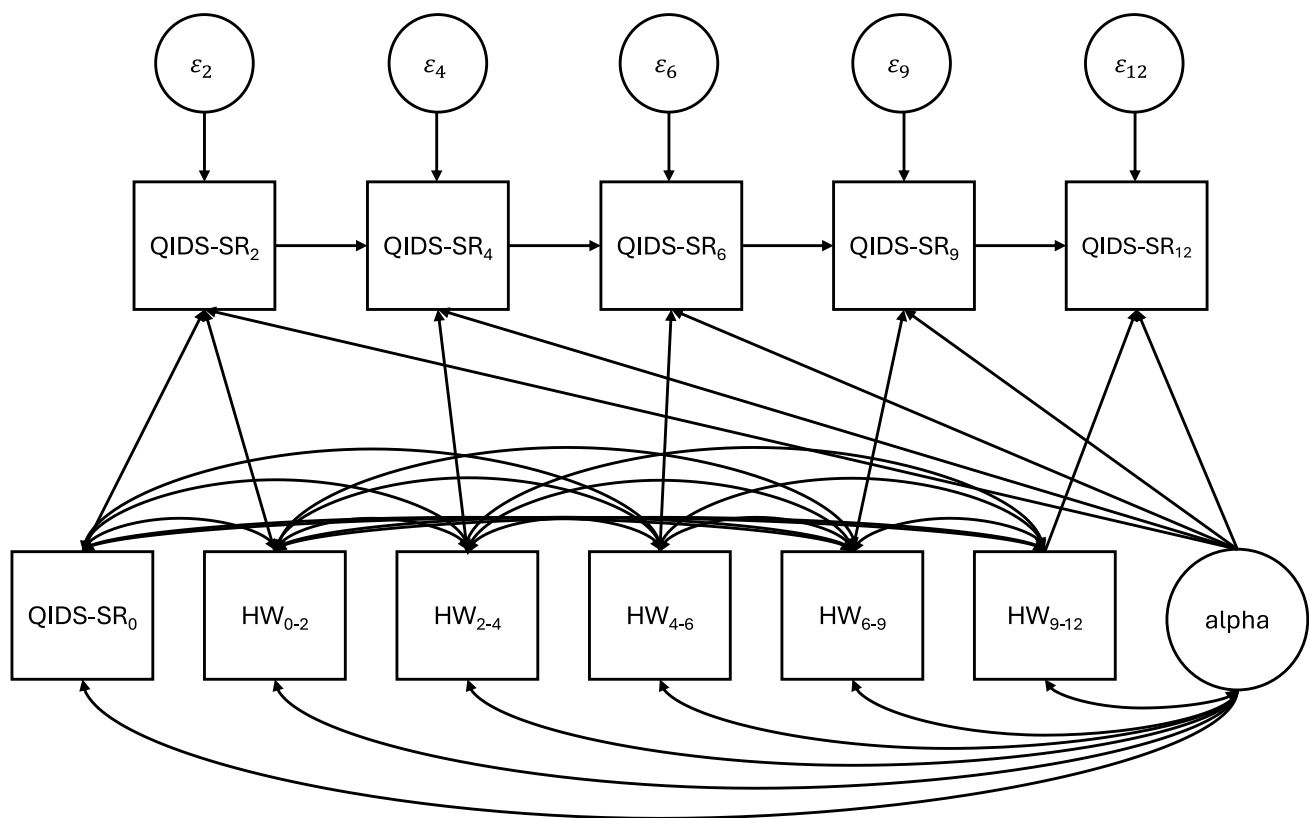


Fig. 2 Dynamic panel model specification. Note that “QIDS-SR” denotes the Quick Inventory of Depressive Symptomatology-Self-Rated scale, and “HW” denotes therapist-rated homework compliance.

113 patients. The homework compliance observations were aggregated to 333 averages of homework compliance scores. Table S1 presents the percentage of missing QIDS-SR scores and missing average homework compliance ratings by week. Of the 113 patients, 73 received citalopram plus CT and 40 received CT only.

Homework Compliance and Next-Session QIDS-SR Score

Week was significantly associated with QIDS-SR score ($b = -0.24$, $t = -4.59$, $p < 0.001$). The effect of homework compliance on next-session QIDS-SR score was significant ($b = -0.50$, $t = -2.33$, $p = 0.022$).

Homework Compliance and Next-Session QIDS-SR Score, Controlling for Treatment Group

Treatment group was not significant ($b = -0.50$, $t = -0.58$, $p = 0.562$). Week was significantly associated with QIDS-SR score ($b = -0.24$, $t = -4.60$, $p < 0.001$). The effect of homework compliance on next-session QIDS-SR score was significant ($b = -0.49$, $t = -2.28$, $p = 0.025$).

Dynamic Panel Model

Preceding QIDS-SR scores significantly predicted next-session QIDS-SR scores ($b = 0.50$, $z = 5.84$, $p < 0.001$). Homework compliance was marginally associated with next-session QIDS-SR score, in which higher homework compliance predicted lower depression symptom severity ($b = -0.64$, $z = -1.95$, $p = 0.051$).

Dynamic Panel Model, Controlling for Treatment Group

Treatment group was not significant ($b = -0.01$, $z = -0.02$, $p = 0.981$). Preceding QIDS-SR scores significantly predicted next-session QIDS-SR scores ($b = 0.52$, $z = 5.88$, $p < 0.001$). Homework compliance was significantly associated with next-session QIDS-SR score, in which higher homework compliance predicted lower depression symptom severity ($b = -0.75$, $z = -2.23$, $p = 0.026$).

Table 1 Demographics and clinical characteristics

	All patients (n = 113)	Citalopram plus CT (n = 73)	CT only (n = 40)
<i>Demographics</i>			
Age, mean $\pm$ SD	41.7 $\pm$ 12.0	41.5 $\pm$ 11.8	42.1 $\pm$ 12.4
Female, n	74 (65.5%)	47 (64.4%)	27 (67.5%)
<i>Race</i>			
White, n	91 (80.5%)	60 (82.2%)	31 (77.5%)
Black, n	9 (8.0%)	7 (9.6%)	2 (5.0%)
Other, n	13 (11.5%)	6 (8.2%)	7 (17.5%)
Hispanic or Latino, n	10 (8.8%)	7 (9.6%)	3 (7.5%)
<i>Clinical features</i>			
First episode occurrence before age 18, n	48 (42.5%)	33 (45.2%)	15 (37.5%)
Recurrent depression, n	76 (72.4%)	49 (73.1%)	27 (71.1%)
Family history of depres- sion, n	75 (67.0%)	53 (73.6%)	22 (55.0%)
Duration of current epi- sode $\geq$ 2 years, n	31 (27.4%)	21 (28.8%)	10 (25.0%)
Age at first episode (years), mean $\pm$ SD	24.4 $\pm$ 14.4	24.3 $\pm$ 14.5	24.5 $\pm$ 14.5
Illness duration (years), mean $\pm$ SD	17.6 $\pm$ 13.6	17.6 $\pm$ 13.5	17.6 $\pm$ 14.0
Number of major depressive episodes, mean $\pm$ SD	5.0 $\pm$ 5.3	5.2 $\pm$ 6.1	4.6 $\pm$ 3.3
Pretreatment QIDS-SR score, mean $\pm$ SD	12.2 $\pm$ 4.0	12.3 $\pm$ 4.0	12.2 $\pm$ 4.0

Discussion

Using multilevel growth models, we found a relationship between homework compliance and next-session depression symptom severity, while accounting for patient-level differences. Specifically, we observed that higher homework compliance predicted next-session depression severity improvement. These findings were further validated in our sensitivity analysis by a dynamic panel structural equation model.

Callan et al. (2019) found that patient-level differences between overall “high adherers” and “low adherers” predicted response and remission to CT in the STAR*D trial at posttreatment. We demonstrated that higher homework compliance is directly linked to next-session depression severity improvement. Thus, the findings from the present study emphasize further the importance for therapists to encourage their patients to complete their homework for their next session (Detweiler & Whisman, 1999).

The present study used a larger sample size to extend Conklin and Strunk’s (2015) analysis beyond early sessions of CT to the full course of treatment, and Haller and Watzke’s (2021) findings beyond telephone-based CBT for patients with mild to moderate depression to patients

receiving CT after an unsatisfactory course of antidepressant treatment for their moderate depression. While patients from the STAR*D trial were more likely to be a representative sample of moderately depressed patients than those found in efficacy trials, the present study’s findings remained consistent with those from Conklin and Strunk’s (2015) and Haller and Watzke’s (2021). Indeed, higher homework compliance in CT was directly associated with next-session depression severity improvement throughout the entire course of treatment.

Yew et al. (2021) found that homework engagement did not predict next-session depression symptom severity in their cross-lagged panel analysis, and observed that it predicted worse depression severity in their multilevel analysis. They suggested that a future study should examine this relationship using a larger sample size; the present study addresses this recommendation. In addition, we note that they used the 12-item Homework Rating Scale-Revised (HRS-II; Kazantzis et al., 2005) to measure homework engagement, homework beliefs, and perceived consequences of doing homework. It would be interesting for a future study to apply a cross-lagged panel analysis and multilevel analysis using the total HRS-II score and a composite score of only the homework engagement items from the HRS-II to model the relationship between homework compliance and next-session depression symptom severity.

One limitation of the current study is that it was not pre-registered in a public registry.

Future Directions

The homework compliance measure in the present study was rated by the clinician, while the depression symptom severity measure was rated by the patient. Yew et al. (2021) found that more positive patient beliefs about homework and its perceived consequences predicted greater homework engagement, suggesting the importance of subjective and motivational components of compliance (i.e., those reflected by the patient). A future study should conduct a similar study comparing the use of both patient and clinician-rated measures for homework compliance and outcome.

Future studies with a larger sample size could examine the mediators and moderators between homework compliance and depression symptom severity. For example, mediation analyses could examine whether patient motivation and beliefs about homework influence treatment outcome indirectly through their effect on homework compliance (Yew et al., 2021). Furthermore, moderator analyses could examine whether the phase of treatment, the type of homework activity (Kazantzis et al., 2000), the disorder being treated (e.g., anxiety vs. depression; Mausbach et al., 2010), or patient-reported outcome measures (Kim & Xu, 2025; Kim et al.,

2021a, 2021b) of homework (e.g., motivation or willingness; Neimeyer et al., 2008) differentially affect outcome.

Conflict of interest

The authors declare no competing interests.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10608-025-10665-3>.

Author Contributions T.K.: Writing—review & editing, Writing—original draft, Methodology, Investigation, Conceptualization. C.X.: Writing—review & editing, Methodology, Investigation, Formal analysis, Conceptualization.

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Data Availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

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