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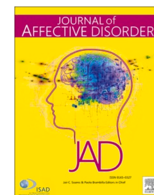

Research paper

Associations of prior treatment, waiting time, symptom severity, and session frequency with symptom change in CBT for depression and anxiety in primary care

Kasperi Mikkonen [a,b,*], Sakari J. Lintula [a,b], Tom Rosenström [b], Jari Lahti [b,c], Eeva-Eerika Helminen [a,d], Samuli I. Saarni [a,e,f], Suoma E. Saarni [a,e,g]

[a] *Department of Psychiatry, Helsinki University Hospital, Helsinki, Finland*
[b] *Department of Psychology, Faculty of Medicine, University of Helsinki, Finland*
[c] *Folkhälsan Research Centre, Helsinki, Finland*
[d] *Department of Psychiatry, Faculty of Medicine, University of Helsinki, Finland*
[e] *Faculty of Medicine and Health Technology, Tampere University, Tampere, Finland*
[f] *Department of Psychiatry, The Wellbeing Services County of Pirkanmaa, Tampere, Finland*
[g] *Family and Social Services, Psychiatry, Wellbeing Services County of Päijät-Häme, Lahti, Finland*

A R T I C L E   I N F O

Keywords:
Cognitive-behavioral therapy
Depression
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Routine clinical practice
Treatment outcomes

A B S T R A C T

Background: Depression and anxiety are among the most prevalent mental health problems globally, with psychotherapy serving as a first-line treatment. Initial symptom severity, prior treatment history, waiting time, and session frequency may influence treatment effectiveness in routine care.

Methods: We analyzed session-by-session data from clients receiving a seven-session cognitive-behavioral therapy (CBT) program for depression ($N = 2627$) or anxiety ($N = 3929$) in primary care. Symptoms were assessed using the PHQ-9 and GAD-7 at each session. The magnitude and rate of change were examined using pre-post comparisons and linear mixed models.

Results: Clients showed significant reductions in both depressive (mean change −4.45 PHQ-9 points, 95% CI −4.69, −4.22) and anxiety symptoms (mean change −4.36 GAD-7 points, 95% CI −4.54, −4.17). Higher initial symptom severity was associated with faster reductions, while prior psychiatric care or previous very long-term psychotherapy were associated with smaller pre-post gains. Waiting time and session frequency were not consistently related to outcomes.

Conclusions: In routine CBT, clients with higher baseline severity benefited substantially, supporting equitable access to CBT regardless of initial symptom level. Clinical improvement was driven by the total number of attended treatment sessions rather than by the rate of attendance (i.e., the number of sessions per unit of time). This supports flexible scheduling without compromising outcomes. Longer waiting times did not systematically predict poorer results, suggesting that client- versus system-driven delays may have distinct implications. Considering prior treatment history may help tailor interventions for individuals with more persistent or treatment-resistant symptom patterns.

1. Introduction

Globally, depression and anxiety rank among the most prevalent public health problems (GBD, 2019 Mental Disorders Collaborators, 2022). While psychotherapy is an effective treatment for both conditions (Van Dis et al., 2020; Cuijpers et al., 2023), a significant proportion of individuals suffering from depression and anxiety do not receive adequate care (Alonso et al., 2018; Santomauro et al., 2024). Among those who receive treatment, the response to psychotherapy varies both in terms of overall benefit and the rate of recovery (Varadhan et al., 2013; Owen et al., 2015). Prior studies have identified distinct trajectory classes of symptom change, differentiating patients who have little or no improvement, gradual improvement, or rapid improvement during the course of therapy (Skelton et al., 2023). These findings underscore the

* Corresponding author at: Department of Psychiatry, Helsinki University Hospital, Helsinki, Finland.
E-mail addresses: kasperi.mikkonen@hus.fi, kasperi.mikkonen@pm.me (K. Mikkonen).

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importance of investigating which treatment and patient related variables are associated with treatment effectiveness and rate of recovery.

Several variables are associated with the effectiveness of psychotherapy including initial symptom-level, prior treatment history, waiting time to treatment and treatment session frequency. Previous unsuccessful therapy experiences can alter the expectations and engagement-levels in subsequent treatments (Alfonsson et al., 2024). Furthermore, knowledge of patients' prior treatment history can influence the therapist's expectations which can, in turn, have an impact on the therapeutic alliance and the therapy outcome (Låver et al., 2024). The role of initial symptom severity in treatment outcomes is mixed: while higher baseline symptoms have been linked to poorer recovery in some studies, others have found that greater initial severity is associated with larger symptom reductions (Bower et al., 2013; Amati et al., 2018; Mohr et al., 2021). Moreover, meta-analytical evidence suggests that baseline depression severity does not moderate the relative effects of psychotherapy and pharmacological treatments (Tröger et al., 2024).

Waiting time and session frequency may be a significant factor influencing the treatment effectiveness. Longer waiting time to enter treatment has also been observed to be a significant predictor of worse treatment outcomes in large-scale service contexts (Clark et al., 2018). Moreover, decreasing the waiting time has been associated with positive impacts in terms of health-related quality of life and costs of treatment in both depression and anxiety (Catarino et al., 2023). When treating depression, shorter durations of untreated illness have been associated with better treatment response and higher remission rates (Ghio et al., 2014; Van Dijk et al., 2023). Treatment session frequency (i.e. how tightly the therapy is scheduled, e.g. weekly or biweekly sessions) has also been recognized as an important variable in terms of treatment outcomes (Erekson et al., 2015). Previous findings indicate that more frequent therapy is associated with faster recovery and especially low frequency of sessions at the beginning of treatment have been linked with less favorable outcomes when treating anxiety and depression (Erekson et al., 2015; Tiemens et al., 2019; Ciharova et al., 2024). Furthermore, more frequent therapy has been associated with increased chances of early improvement and shorter duration of symptoms (Lin et al., 2024). These findings suggest that treatment should be initiated promptly and delivered intensively. However, the findings of spontaneous short-term improvement in some patients may indicate that such an intensive approach is not necessarily required as a default in all cases. For example, 12.5–23% of patients with depression have been reported to improve without treatment over the course of a few months (Whiteford et al., 2013; Mekonen et al., 2022). For anxiety disorders in treatment seeking populations, improvement is seen in 13.1–15.4% of untreated patients with significant differences across different specific anxiety disorders (Scott et al., 2022). Thus, understanding the effects of waiting time and session frequency is important for optimizing clinical outcomes, identifying critical periods of intervention, and informing treatment resource allocation.

While prior studies have more frequently examined how prior treatment history, initial symptom severity, waiting time and session frequency relate to the overall magnitude of symptom change from pre- to post-therapy, less is known about their influence on the session-by-session rate of symptom change. Second, analyzing symptom change trajectories entails methodological challenges of their own. Although it is well established that the rate of change during psychotherapy varies among patients, majority of previous research relies mostly on pre- and post-treatment measurements, making it impossible to capture individual differences in change trajectories (Schiepek et al., 2022). Session by session data suggests that the change during therapy might also follow a nonlinear course (e.g. a quadratic pattern) (Hayes and Andrews, 2020; Shalom and Aderka, 2020). On the other hand, when granular time-course data have been available, prior research has examined symptom trajectories using growth mixture models or latent class growth analysis to identify distinct classes of recovery patterns (Skelton et al., 2023). While these models are valuable in describing heterogeneity in response patterns, they also have important limitations. They are designed for classification rather than estimating the person-specific change patterns or the influence of different predictors on these (Bauer and Curran, 2003). Moreover, class membership can be highly sensitive to model specification, number of classes (Shader and Beauchaine, 2022), assumed data distributions in the classes (Fraley and Raftery, 2002) and sample size (Tein et al., 2013), raising concerns of the stability and replicability of findings (Watson et al., 2022). Third, most prior research has considered treatment-trajectory moderating factors in isolation, raising questions about their relative contributions when examined simultaneously. Fourth, most previous studies have been conducted in controlled settings, leaving open generalizability of findings to natural treatment settings. Therefore, to complement such data, it is crucial to conduct research using real-world data. Real-world data can capture the diversity and complexity of clinical populations, reflect actual patterns of care, and reveal factors influencing effectiveness and accessibility that may not be captured in controlled settings (Castonguay et al., 2021).

This study builds on previous research by examining individual trajectories of depressive and anxiety symptom change during cognitive-behavioral therapy (CBT) delivered in a routine primary care, and the associations of those trajectories with initial symptom level, prior treatment history, waiting time, and treatment frequency while controlling these treatment factors for each other. By utilizing session-by-session data and linear mixed models, this study models individual-specific nonlinear symptom trajectories across CBT sessions and directly estimates the effects of key treatment- and patient-level variables. The use of real-world data from a nationwide therapist training program enables evaluation of the associations among these key variables in a population relevant for healthcare planning and clinical decision-making.

Research questions

1. Is initial symptom level, prior treatment history, waiting time, and session frequency associated with symptom change in depression and anxiety from pre- to post-treatment during CBT delivered in routine primary care?
2. Are the same variables independently associated with the rate of symptom change in depression and anxiety during CBT delivered in routine primary care?

2. Methods

2.1. Sample

The data were collected as a routine practice within a national CBT training program delivered to Finnish primary care practitioners working with adult populations. The training program has been developed and implemented since 2020 as part of a large-scale structural change in the mental healthcare system aimed at improving access to evidence-based psychotherapy (the First-line Therapies -initiative). The training is delivered in a blended learning format, combining self-directed e-learning, clinical supervision, and clinical practice with primary healthcare. Among other symptom-specific models, the training includes CBT treatment programs for generalized anxiety symptoms and depressive symptoms. The treatment programs are designed to be

completed in approximately seven sessions. The trainees are required to collect session by session data with each client including routine outcome monitoring using validated symptoms measures. The data collected during the training programs is primarily used in the accreditation process of each trainee.

In this study, we used this register data from treatment programs targeted at generalized anxiety and depression, as they are the most frequently utilized treatment programs in routine care. The sample includes 2627 clients in the depression treatment program, of whom 2385 had finished treatment by the date of data collection. Of these, 1991 (83.5%) attended at least seven sessions according to therapist reports. Likewise, 3929 clients in the anxiety treatment program, of whom 3623 had finished treatment. Of these, 2967 (81.9%) attended at least seven sessions. The treatments were delivered by 984 therapists from all 21 wellbeing service counties and the city of Helsinki, representing a catchment area that covers over 99% of primary mental healthcare services for the Finnish adult population. All available data, including non-finished treatments, were used in the analyses, as we had no a priori reason to restrict the dataset to treatment completers only. However, symptom trajectories were modeled only through the 7th session, as this reflects the main treatment program attended by the vast majority of the clients. For clients who attended more than seven sessions, their data up to the 7th session were included in the analyses.

The study was approved by the HUS Regional Committee on Medical Research Ethics (HUS/322/2024) and conducted in accordance with the Declaration of Helsinki. The research used only anonymous register data and complied with national regulations on the secondary use of social and health data, which waive the requirement for informed consent.

2.2. Variables

Clients in both treatment programs self-reported symptoms of depression and anxiety, with depression symptoms serving as the primary outcome in the depression program and anxiety symptoms as the primary outcome in the anxiety program. Symptoms of depression were measured with the Patient Health Questionnaire 9 (PHQ-9) (Kroenke et al., 2001). PHQ-9 obtains values between 0 and 27, when scored so that each item obtains values between 0 and 3 (0 = "Not at all", 3 = "Nearly daily"). Symptoms of anxiety were measured with the Generalized Anxiety Disorder 7-item scale (GAD-7) (Spitzer et al., 2006). GAD-7 obtains values between 0 and 21, when scored so that each item obtains values between 0 and 3 (0 = "Not at all", 3 = "Nearly daily"). For both, PHQ-9 and GAD-7, recent large-sample psychometric analysis suggests that both can be used as unidimensional measures over longitudinal, repeated, measurements (Stochl et al., 2022).

The potentially trajectory-moderating variables of interest are prior treatment history, waiting time, and treatment session frequency. These categorical variables are reported by the clinician conducting each treatment, based on information from the client's electronic health record or, if necessary, from client interview. Prior treatment refers to care received immediately before the current treatment (i.e., not from a longer time ago) and is categorized into three response options: "No prior treatment", "Prior treatment in primary care", and "Prior treatment in psychiatric specialty care or very long-term psychotherapy". Very long-term psychotherapy refers to rehabilitative psychotherapy supported by the Social Insurance Institution in Finland with an average duration of two and half years (Selinheimo et al., 2024). Waiting time refers to the period between the assessment of current treatment need and the actual initiation of treatment and is indicated via the following options: "Less than two weeks", "Less than four weeks", "More than four weeks". Treatment intensity is collected via the following options: "Approximately once a week or more frequently", "Approximately every two weeks", and "Less frequently than every two weeks". On how initial symptom severity was included in the analysis, see Statistical methods.

No demographic information on clients was collected to enable centralized, nationwide routine data collection during training while remaining in compliance with Finnish legislation. All data have been deposited in Open Science Framework, accessible via https://osf.io/xwrz5/?view_only=51a3dbffbafc4ef5bc1048d2ea55759e.

2.3. Statistical methods

To analyze the magnitude of change in symptom scores, we computed pre- and post-treatment mean changes in PHQ-9, and GAD-7 for depression and anxiety intervention groups, respectively. Furthermore, we computed rates of reliable improvement and recovery. This was done by using the four following common and documented strategies for determining reliable improvement and reliable recovery: 50% symptom reduction, change from clinical (>9 points) to subclinical levels, a clinically significant reduction in symptom scores (5 points in the PHQ-9 and 4 points in the GAD-7), and both PHQ-9 and GAD-7

Table 1
Rates of reliable improvement and recovery, stratified by baseline symptom severity and outcome criteria.

	Improvement – Criterion 1a[a]	Recovery – Criterion 1b[b]	Improvement – Criterion 2a[c]	Recovery – Criterion 2b[d]
Depression (PHQ-9)				
Overall (N = 2627)	33.5% (31.4%, 35.8%)	–	46.9% (44.5%, 49.2%)	–
Clinical (>9 pts) (*N* = 2048)	31.9% (29.4%, 34.4%)	29.5% (27.1%, 32.0%)	53.0% (50.3%, 55.6%)	35.2% (32.7%, 37.8%)
Minimal/mild symptoms (0–9 pts) (*N* = 579)	39.4% (34.6%, 44.4%)	–	25.3% (21.1%, 29.9%)	–
Moderate symptoms (10–14 pts) (*N* = 796)	33.9% (30.0%, 38.1%)	33.4% (29.5%, 37.5%)	44.5% (40.3%, 48.7%)	42.8% (38.7%, 47.1%)
Moderately severe symptoms (15–19 pts) (*N* = 789)	33.1% (29.2%, 37.2%)	32.0% (28.1%, 36.1%)	58.1% (53.9%, 62.3%)	37.1% (33.1%, 41.3%)
Severe symptoms (≥20 pts) (*N* = 463)	25.8% (21.0%, 31.2%)	17.9% (13.7%, 22.7%)	59.3% (53.5%, 64.9%)	17.9% (13.7%, 22.7%)
Anxiety (GAD-7)				
Overall (*N* = 3928)	41.2% (39.3%, 43.1%)	–	56.2% (54.3%, 58.1%)	–
Clinical (>9 pts) (*N* = 2649)	41.6% (39.3%, 44.0%)	37.5% (35.2%, 39.7%)	65.7% (63.4%, 67.9%)	44.7% (42.4%, 47.0%)
Minimal/mild symptoms (0–9 pts) (*N* = 1279)	40.1% (36.8%, 43.6%)	–	35.9% (32.6%, 39.3%)	–
Moderate symptoms (10–14 pts) (*N* = 1422)	44.1% (41.0%, 47.3%)	41.5% (38.3%, 44.6%)	61.3% (58.2%, 64.4%)	52.4% (49.2%, 55.5%)
Severe symptoms (≥15 pts) (*N* = 1227)	38.6% (35.2%, 42.1%)	32.6% (29.4%, 36.0%)	70.9% (67.7%, 74.0%)	35.5% (32.2%, 38.9%)

[a] A 50% reduction in symptom scores.
[b] A 50% reduction in symptom scores and a change from ≥10 points to ≤9 points.
[c] A 5-point reduction in symptom scores on the PHQ-9 (depression) or a 4-point reduction in symptom scores on the GAD-7 (anxiety).
[d] A 5-point reduction in symptom scores on the PHQ-9 (depression) or a 4-point reduction in symptom scores on the GAD-7 (anxiety) and a change from ≥10 points to ≤9 points with both PHQ-9 and GAD-7 ≤ 9 points at the end of treatment.

scores below the clinical cut-off at the end of treatment (Kroenke et al., 2001; Spitzer et al., 2006; McMillan et al., 2010; Clark et al., 2018; Toussaint et al., 2020). These criteria are further referred as Criteria 1a, 1b, 2a and 2b as summarized in Table 1. Between-group differences in initial symptom scores and mean symptom changes, with respect to prior treatment, waiting time, and session frequency, were tested with ANOVA.

Linear mixed models (LMM) were compared based on their fit using the three statistics: the Bayesian Information Criterion (BIC), the Akaike's Information Criterion (AIC), and the likelihood ratio test (LRT). In terms of how model complexity is penalized, BIC favors simpler models and is the most conservative of the three statistics, while LRT is the most liberal statistic.

The effects of initial symptom severity on the rate of change were modeled using correlated random intercepts and slopes in a multilevel model. The random intercepts were deviations of subject-specific baseline scores from the mean baseline score[1]. Thus, the random intercepts are interpretable as relative symptom levels (deviations from the mean PHQ-9 or GAD-7 score). For example, a positive random intercept indicates that a given individual started with a higher-than-average initial symptom level. Specifically, correlation between the random intercepts and slopes enabled us to examine the association between relative initial symptom level (random intercepts) and rate of change (random slope (s)). For example, a negative correlation(s) would indicate that higher initial symptom level is associated with steeper symptom decreases.

To analyze if there was an association between prior treatment history, waiting time or treatment session frequency and rate of symptom change, a series of LMMs were fit in both the depression and the anxiety treatment groups separately. In all models, a within-subject random intercept and random slopes for the linear and, if included, quadratic terms were estimated, although these random effects are omitted from the descriptive model formulas below. The first model included a linear term of the treatment session and if modeled the outcome as:

$$M_1 : \beta_0 + \beta_1 \times (\text{treatment session}) + \epsilon,$$

where ϵ is a residual term. Treatment session was entered as values between 0 and 6, representing progression through treatment. The second model was created by adding a quadratic treatment session term and was thus defined incrementally as:

$$M_2 : M_1 + \beta_2 \times (\text{treatment session})^2.$$

Models M_1 and M_2 were then compared based on model fit; M_2 was retained if it showed an improved fit; otherwise, M_1 would be used in subsequent steps. In the third modelling step the variables of interest were added as additive terms, each separately, to inspect if they would improve model fit individually. The third model is:

$$M_3 : M_{1\ or\ 2} + \beta_3 \times (\text{variable of interest}),$$

for all variables of interest: waiting time, session frequency and prior treatment.

In the fourth modelling step, finally, we analyzed if there was an association between any variable of interest and rate of change. For all variables of interest separately, a model was created by including the interaction terms between the variable of interest with both, the linear and (if included) the quadratic session terms. The fourth model, for a given variable of interest, was then:

$$M_4 : M_{1\ or\ 2} + \beta_3 \times (\text{session frequency}) + \beta_4 \times (\text{prior treatment}) + \beta_5 \times (\text{waiting time}) + \beta_6 \times (\text{variable of interest} \times \text{treatment session}) + \beta_7 \times \left(\text{variable of interest} \times (\text{treatment session})^2\right),$$

for all variables of interest separately: waiting time, session frequency and prior treatment. Note that all variables of interest were kept in the fourth model as additive terms to control for each other, regardless of if they improved model fit in the previous steps. To test if there would be an association between the variable of interest and rate of symptom change, this model was then compared to a model without the interactions between the variable of interest and treatment session terms. A sensitivity analysis was conducted where all interactions were considered simultaneously.

For model comparisons, the models were fitted using maximum likelihood estimation. Restricted maximum likelihood estimation was used to fit models for creating predictions for plotting.

3. Results

3.1. Overall symptom change and group comparisons

The overall mean symptom change for depression was −4.44 points in the PHQ-9 (SD = 5.15) and for anxiety −4.33 points in the GAD-7 (SD = 4.94). The respective Hedge's *g* effect sizes were 0.775 (95% CI 0.728, 0.822) and 0.909 (95% CI 0.863, 0.955). Table 1 presents rates of reliable improvement and recover in depression and anxiety, stratified by baseline symptom severity and outcome criteria. Continuous symptom change and categorical improvement or recovery reflect distinct outcomes, and larger absolute symptom reduction do not necessarily translate into higher recovery rates when categorical thresholds are applied. Pre-treatment mean values and mean PHQ-9 and GAD-7 changes stratified by baseline symptom severity are presented in Supplementary Table ST1. For depression, overall rates of reliable improvement ranged from 33.5% (Criterion 1a) to 46.9% (Criterion 2c). Among participants with initial clinical level symptoms (PHQ-9 $>$ 9), reliable recovery was observed in 17.9%–42.8% based on symptom severity. For anxiety, overall rates of reliable improvement ranged from 41.2% (Criterion 1a) to 56.2% (Criterion 2c.). Among participants with initial clinical level symptoms (GAD-7 $>$ 9), reliable recovery was observed in 32.6%–52.4% based on symptom severity.

Analysis of variance suggested that, in both depression and anxiety treatment groups, prior treatment was significantly associated with higher initial symptom scores on the PHQ-9 and GAD-7 (depression $P = 0.012$; anxiety $P < 0.001$). Further, in the depression treatment group, more intensive prior treatment ($P < 0.001$) and longer waiting times ($P < 0.001$) were associated with smaller decrease in PHQ-9. In the anxiety treatment group, more intensive prior treatment ($P < 0.001$) and less frequent therapy ($P = 0.022$) were associated with smaller decrease in GAD-7. See Table 2 for mean symptom changes for depression and anxiety treatment groups, segregated by variables of interest.

3.2. Linear vs. quadratic change over treatment sessions

In the LMMs, the linear terms were significant for both depression and anxiety treatment groups. When included, quadratic terms improved model fit for both depression treatment (ΔBIC = − 762.1,

[1] The quadratic session terms were not centred to keep the baseline (pre-treatment measurement) as the "session 0" for, both, linear and quadratic session. This made the random intercepts interpretable as initial symptom level—session 0 values.

Table 2
Pre- and post-treatment PHQ-9 and GAD-7 seven scores in depression treatment and anxiety treatment groups according to prior treatment, waiting time and session frequency.

	Depression				Anxiety			
	N	Baseline PHQ-9 Mean (SD)	Mean PHQ-9 change	Completion[b]	N	Baseline GAD-7 Mean (SD)	Mean GAD-7 change	Completion[b]
Total	2627	14.15 (5.42)	−4.45 (−4.69, −4.22)	83.50%	3928	11.86 (4.66)	−4.36 (−4.54, −4.17)	81.90%
Prior treatment								
None	947	13.96 (5.46)	−5.19 (−5.59, −4.79)	81.00%	1538	11.83 (4.56)	−4.75 (−5.05, −4.46)	82.80%
Primary care	1387	14.11 (5.35)	−4.07 (−4.39, −3.75)	85.10%	1937	11.67 (4.64)	−4.07 (−4.33, −3.81)	82.70%
Psychiatric specialty care or very long-term. psych[a]	191	15.29 (5.68)	−3.87 (−4.78, −2.96)	85.10%	283	13.24 (4.98)	−3.92 (−4.67, −3.16)	73.00%
Missing	102	14.26 (5.53)	−4.60 (−5.76, −3.44)	80.20%	170	11.82 (4.92)	−4.82 (−5.98, −3.66)	78.40%
Waiting time								
<2 Weeks	1375	14.22 (5.37)	−4.72 (−5.04, −4.40)	82.90%	2130	11.97 (4.68)	−4.50 (−4.75, −4.24)	81.70%
<4 Weeks	742	14.09 (5.33)	−4.44 (−4.90, −3.97)	84.80%	1063	11.80 (4.59)	−4.24 (−4.60, −3.89)	81.70%
>4 Weeks	392	13.98 (5.70)	−3.36 (−3.94, −2.77)	84.30%	560	11.56 (4.62)	−3.91 (−4.37, −3.44)	82.40%
Missing	118	14.20 (5.75)	−5.28 (−6.41, −4.15)	80.20%	175	11.74 (5.06)	−4.85 (−5.90, −3.79)	83.90%
Session frequency								
Weekly	1262	14.10 (5.32)	−4.53 (−4.85, −4.20)	87.70%	1832	11.80 (4.59)	−4.34 (−4.59, −4.10)	87.30%
Biweekly	862	14.08 (5.49)	−4.31 (−4.72, −3.90)	82.60%	1325	11.99 (4.73)	−4.60 (−4.93, −4.27)	81.80%
Less than biweekly	217	14.22 (5.68)	−4.35 (−5.29, −3.41)	67.30%	387	11.75 (4.65)	−3.62 (−4.25, −2.99)	66.20%
Missing	286	14.51 (5.48)	−4.74 (−5.79, −3.70)	69.30%	384	11.75 (4.79)	−3.87 (−5.05, −2.69)	47.20%

[a] Very long-term psychotherapy.
[b] Percentage of clients who received the full seven-session treatment program as per therapist report.

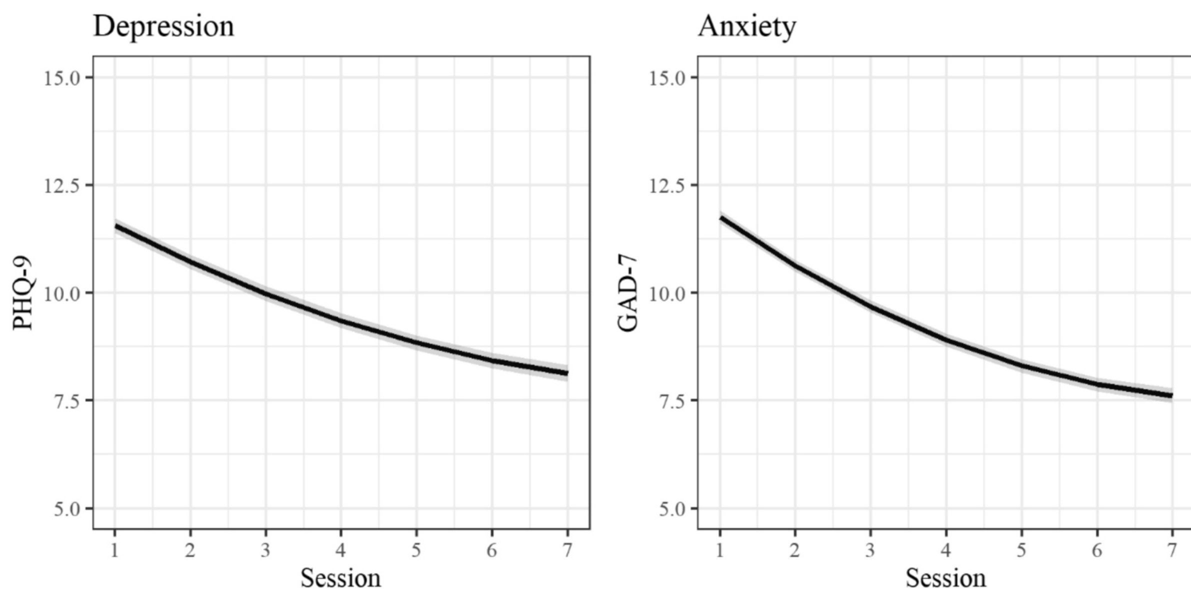

Fig. 1. Estimated mean depression and anxiety symptom change during treatment. Estimated mean trajectory and 95% confidence intervals based on the fixed effects only.

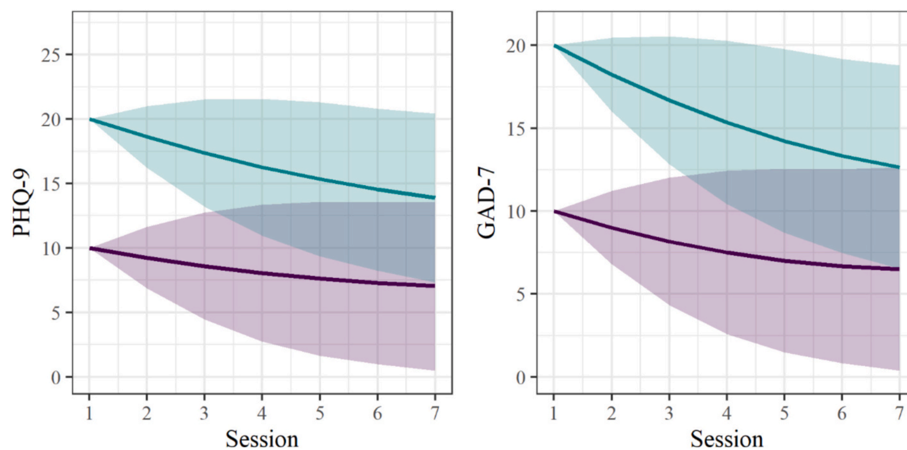

Fig. 2. Estimated distribution of the rate of depression and anxiety symptom changes during treatment, illustrated for initial GAD-7 and PHQ-9 values of 10 and 20. The random effects are correlated, which makes the trajectory steeper with larger first session scores compared to lower first session scores. The 95% confidence intervals are based on the random effects only.

ΔAIC = − 794.4, LRT $P < 0.001$, df = 4) and anxiety treatment (ΔBIC = − 853.0, ΔAIC = − 885.3, LRT $P < 0.001$, df = 4) groups. Thus, the quadratic model was retained for further analyses. For results and justification of excluding cubic models, see Supplementary Material. Namely, cubic models would make analysis of rate of change arguably unnecessarily complex. As seen in Fig. 1, the GAD-7 and PHQ-9 scores decreased across sessions. The rate of decrease attenuated as the treatments progressed in both groups. See Supplementary Table ST3 for model parameter estimates.

3.3. Initial symptom level effects on rate of change

Higher initial symptom level was associated with a faster rate of symptom reduction. The effect is visualized in Fig. 2, where treatment trajectories are estimated based on different initial values of PHQ-9 and GAD-7. This was due to correlated random effects: A high random intercept (indicating high initial symptom level) implied steeper slopes in expectation. For example, in the depression group, given an initial PHQ-9 score[2] of 20 or 10 the average change per session was −1.02 or −0.49 PHQ-9 points, respectively. Likewise, in the anxiety group, given initial GAD-7 score of 20 or 10 the average change per session was −1.22 or −0.58 GAD-7 points, respectively.

3.4. Interaction between rate of change, prior treatment, waiting time, and session frequency

Observed associations between prior treatment, waiting time, session frequency, and rate of symptom change were small (Fig. 3), and model fit criteria were inconsistent (BIC vs. AIC/LRT). The information criteria and LRT *P*-values of the third modelling step are given in Table 3, with Fig. 3 visualizing the effects or lack thereof. All reported associations between prior treatment, waiting time, session frequency, and the rate of change are independent of the baseline symptom severity and additive terms of other variables of interest. Results where interaction terms are included for all variables as well, are shown in Supplementary Table ST2 (similar results were observed). Additionally, in both treatment groups, the association between baseline symptom severity and rate of change was mostly unaffected by inclusion of the variables of interest and their respective interactions with rate of change.

4. Discussion

In this study, we examined the associations between initial symptom severity, prior treatment history, waiting time, and session frequency with depression and anxiety symptoms and their changes among clients undergoing CBT programs in a primary care context. Higher initial symptom severity was associated with larger and faster reductions in depression and anxiety symptoms but lower rates of recovery, reflecting the greater difficulty of crossing categorical recovery thresholds from high versus low initial symptom severities, despite substantial symptom improvement. Prior treatment in psychiatric specialty care or in very long-term psychotherapy was associated with higher initial symptoms and smaller reductions. Waiting time and session frequency showed no consistent association with initial symptom levels, overall symptom reduction, or the rate of change. Importantly, our findings suggest that in treatment-seeking populations, symptom improvement during routine CBT is more strongly associated with the number of sessions attended than with therapist-reported waiting time or session frequency.

On average, symptoms of depression and anxiety were improved during the associated treatment programs. The overall mean reductions, as well as the rates of reliable improvement and recovery, were broadly consistent with findings from meta-analytical evidence from routine clinical settings and other nationwide service operations (Wakefield et al., 2021; Oparina et al., 2024). This convergence supports the external validity of the current findings and suggests that the observed treatment effects are representative of outcomes attainable in routine practice. However, it is important to note that the rates of reliable improvement and recovery depended on the applied criteria. This highlights the need for more consistent and shared criteria for defining what constitutes a good or sufficient treatment outcome, both to increase comparability and for benchmarking across services systems.

The reported association of higher initial symptom severity with faster symptom reduction across both depression and anxiety treatment groups complements the earlier findings from community settings and digital mental health treatments (Amati et al., 2018; Mohr et al., 2021). These results suggest that clients with more severe initial symptoms can benefit at least as much from CBT delivered in primary care as those with lower symptom levels, indicating that symptom severity alone, as measured by symptom scales should not dictate treatment selection.

[2] Technically, this is not the initial PHQ-9 or GAD-7 score. Instead, in the computation a formula of $\beta_0 + \gamma_0 = 20$, or 10, is used to determine the random intercept value γ_0 given a fixed β_0 intercept value. In this way, an *estimated* PHQ-9 score is used in the actual computation. This is left from the main text for brevity, as the main point of this computation was to concretely show how much there might be a difference in symptom rate of change between individuals with different initial symptom levels, without overcomplicating the results section.

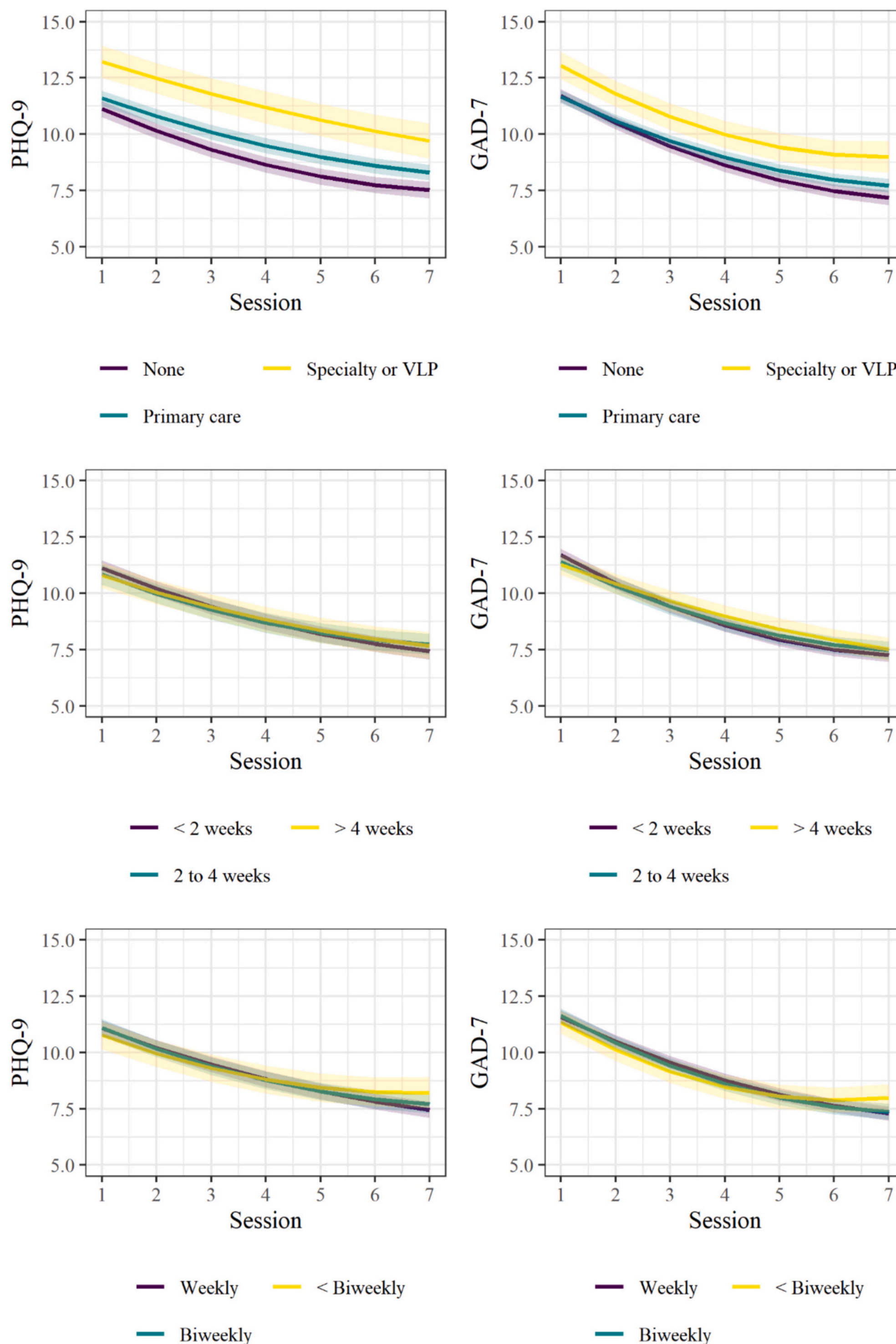

Fig. 3. Rate of symptom change during treatment segregated by waiting time (first row), session frequency (second row) and prior treatment (third row). Specialty or VLP refers to psychiatric specialty care or very long-term psychotherapy.

Furthermore, self-reported symptom severity does not fully capture the persistence or complexity of symptoms, as treatment response is also influenced by prior treatment history. Clients with prior treatment in psychiatric specialty care or in very long-term psychotherapy showed smaller reductions in depression and anxiety symptoms across the course of treatment, despite having higher initial symptom severity — which, on average, was associated with larger symptom reductions during treatment. Prior research on response to counseling has indicated that previous counseling and medication are associated with slower rate of symptom response (Boswell et al., 2012). Furthermore, within routinely delivered settings, re-referrals have been associated with lower recovery rates and higher dropout (Verbist et al., 2021). In the context of depressive symptoms, previous research has shown that initial symptom severity alone does not fully explain the relationship between previous treatment and subsequent response to treatment. Instead, this association may reflect mechanisms related to expectations and previous treatment experiences (Boswell et al., 2012). In our sample, the effect was evident only among clients who had received the

Table 3
Information criteria and likelihood ratio tests for models examining associations of waiting time, session frequency, and prior treatment with depression and anxiety symptoms, both as between-individual differences (additive terms) and as moderators for the rate of symptom change across sessions.

Model	Waiting time			Session frequency			Prior treatment		
	ΔBIC	ΔAIC	LRT	ΔBIC	ΔAIC	LRT	ΔBIC	ΔAIC	LRT
Depression									
Additive term[a]	20.0	3.9	0.987	20.0	3.9	0.959	−36.4	−52.5	<0.001
Rate of change[b]	28.2	−3.6	0.020	24.2	−7.2	0.003	31.2	−0.5	0.075
Anxiety									
Additive term[a]	20.0	4.0	0.964	20.0	4.0	0.978	−15.4	−31.4	<0.001
Rate of change[b]	19.7	−12.1	<0.001	19.2	−12.7	<0.001	26.7	−5.3	0.010

Negative ΔBIC and ΔAIC suggest improved model fit compared to the additive term model(s), LRT values are *P* values.
[a] The comparisons were are done to a model with session included as both a linear and a quadratic term. Additive term models include these terms and, in addition, the respective variable as an additive term.
[b] The interaction between the respective variable and, both, linear and quadratic session terms are added. The comparisons are done to the additive term models including *all variables of interest as additive terms*.

highest level of care. This may suggest that it is the symptom persistence or chronicity, or lowered expectations of treatment benefits based on prior experiences at the highest level of care that accounts for the association between previous treatments and subsequent treatment response – rather than pre-treatment symptom severity or the mere fact of having received prior treatment. However, it is important to note that even the group with the most intensive prior treatment still benefited from the subsequent treatment with CBT.

Beyond client status variables such as prior treatment and initial symptom severity, temporal factors such as waiting time and treatment intensity may play a significant role in treatment response. The findings from this study provide empirical support that in routine care settings, symptom improvement aligns more closely with the number of treatment sessions rather than with average session frequency. Differences in waiting time for treatment were not associated with differences in initial symptom severity. Further, in both groups, longer waiting times were not associated with the rate of symptom change in the adjusted linear mixed models, suggesting that treatment progresses similarly regardless of shorter or longer waiting times. The only finding supporting an association between waiting times and treatment outcomes was observed in the depression treatment group, where clients who waited the longest (>4 weeks) experienced markedly smaller symptom improvements. These findings are somewhat similar with some previous findings associating longer waiting times with worse outcomes. For example, Clark et al. (2018) found at the clinical unit level that longer waiting times from referral to treatment initiation were associated with poorer outcomes, suggesting that clients may remain more engaged towards treatment when waiting periods are shorter. This pattern was only evident in our study in the depression treatment group, which may suggest that the associations previously recognized partly reflect a phenomenon at the clinical unit level rather than the individual level – for example, units with shorter waiting times may also be those achieving better overall outcomes. We conducted a sensitivity analysis to examine the robustness of the observed lack of association between waiting time and the rate of symptom change. In this analysis, session frequency was excluded as a covariate, as waiting time and session frequency may reflect overlapping aspects of service delivery. The lack of association was observed also in this sensitivity analysis (see Supplement Table ST4).

The inconsistent findings on the relationship between waiting times and treatment outcomes highlight the need to distinguish more clearly between voluntary and system-imposed waiting. It may be that, in routine settings, many patients do not wish to start treatment immediately. In such cases, the waiting time is determined by patients' choice or by negotiation between the client and the healthcare provider and it could be argued that these delays do not have detrimental effects on treatment outcomes. It may also be that the effects of waiting time differ across problem areas, such as depression and anxiety symptoms, as suggested by our results. To the authors' knowledge, no studies have empirically examined the differences between voluntary and system-imposed waiting or across different clinical presentations. Nevertheless, long waiting times for mental health treatment are frequently associated with poor client experiences and self-reported negative psychological and behavioral consequences (Punton et al., 2022). In other healthcare contexts (e.g., brief waits in waiting rooms), the psychology of waiting for care has been examined. Qualitative findings indicate, that when clients perceive the upcoming treatment as high value – for example, believing the treatment is promising or well-suited – they are more willing to tolerate longer waits (Chu et al., 2019). It is unclear how such findings generalize to mental health care or to longer waiting times. It is important to note that in our study the timeframe for waiting period was relatively short. However, similar null findings have been reported in large naturalistic service-settings, where even waiting several months did not have a detrimental effect on rates of reliable improvement and recovery (Oparina et al., 2024). As the effect of waiting time remains uncertain – and may differ across symptom profiles – further research is warranted. To our knowledge, no experimental studies on this topic have yet been conducted (Helminen et al., 2025).

The average symptom decreases per sessions was similar between shorter and longer session intervals (e.g. once a week, once every two weeks). This stands in contrast to earlier research from naturalistic settings where more frequent therapy has been associated with steeper recovery curves over treatment sessions (Erekson et al., 2015). In our anxiety treatment group sample, less frequent therapy (i.e., less frequently than every two weeks) was associated with smaller overall symptom reductions. However, this group also demonstrated a roughly 15% lower completion rate and a smaller sample size. Consequently, we were unable to establish a robust association between session frequency and symptom reduction, as has previously been reported in the context of depression (Ciharova et al., 2024). Interestingly, in our sample, session frequency showed no effect on symptom change in the depression treatment group.

If clinical benefit follows treatment sessions rather than session frequency, it can have implications for service organization and treatment planning. In terms of scheduling, treatment organizations can be more flexible and remove pressure to always deliver sessions on a weekly basis if the appropriate treatment dose is assured. Furthermore, perhaps the frequency of treatment sessions could be increased beyond weekly sessions to achieve recovery rapidly, thereby limiting the time of experiencing symptoms (Ciharova et al., 2024). Emphasizing the provision of an adequate number of sessions rather than strictly minimizing waiting time may provide meaningful guidance for service planning.

4.1. *Strengths & limitations*

A key strength of this study is the use of a large, real-world clinical dataset with session-by-session data, which enabled us to model initial symptom severity, prior treatment, waiting time, and treatment

frequency more accurately within the same framework while controlling for their interrelationships. Furthermore, our dataset has broad national coverage: nearly a thousand therapists from Finnish public primary healthcare, representing a great majority of the country's primary mental healthcare systems. Such a coverage provides both representativeness and generalisability of the findings to routine care. This study also has important limitations. First, the data used in the study consisted only of treatments delivered by therapists in training. It is possible that the results would differ if the treatments were carried out by more experienced therapists. However, longitudinal studies suggest that change in effectiveness at therapist level might be minimal (Goldberg et al., 2016). Second, our data did not include demographic information on clients, in order to comply with legislation and to enable centralized national data collection. This may restrict our ability to evaluate how well the findings generalize across key demographic groups and clinically relevant subgroups. However, the data was collected under routine conditions in primary care, from users of public mental health services who represent an important population regardless of their demographic information. Third, data of our variables of interest could be improved in subsequent studies for more accurate analysis (e.g. by adding more detailed options for indicating waiting time and session frequency, collecting the timestamps of each treatment session) which could improve the accuracy of our analysis. Fourth, in routine care, treatment is often initiated based on the client's problem descriptor rather than a formal psychiatric diagnosis, which limits the comparability of our results to studies conducted with diagnostically defined groups. Fifth, the study did not include follow-up periods to determine the persistence of observed changes. In similar settings, treatment effects are reported to be maintained at 12 month post-treatment (Sæther et al., 2019). And finally, due to the lack of comparison group, our ability to make causal inferences in this study is limited as the sample is observational. However, our study offers complementary evidence from routine clinical settings, where data from real-world users has potential to provide insights that experimental studies may not capture.

5. Conclusions

Taken together, our findings suggest that in routine care, the organization of therapies should prioritize the consistent delivery of sessions as clinical benefit in both depression and anxiety symptoms appear to be driven by exposure to treatment sessions rather than their frequency, while allowing flexibility in intensity to accommodate individual symptom profiles. Our study challenges the assumption that waiting times are consistently related to worse outcomes, as there may be differences between different symptom groups and between system-imposed delays and those resulting from patient choice. Notably, clients with higher initial symptom levels benefited at least as much from therapy as those with lower levels, indicating that symptom severity alone should not guide treatment allocation. Furthermore, prior treatment history should be considered when initiating therapy, as clients with more extensive treatment backgrounds may show slower response trajectories and smaller benefits.

CRediT authorship contribution statement

Kasperi Mikkonen: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Conceptualization. **Sakari J. Lintula:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Data curation. **Tom Rosenström:** Writing – review & editing, Methodology. **Jari Lahti:** Writing – review & editing, Supervision. **Eeva-Eerika Helminen:** Writing – review & editing. **Samuli I. Saarni:** Writing – review & editing, Funding acquisition. **Suoma E. Saarni:** Writing – review & editing, Supervision, Funding acquisition.

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Declaration of competing interest

KM, EEH, SIS, and SES have participated in the development of the Finnish First-line Therapies model and the CBT training protocols related to this study; however, they receive no financial benefit from them. Other authors declare no competing interests.

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Appendix A. Supplementary data

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