Who benefits most from therapist-assisted internet-delivered cognitive behaviour therapy in clinical practice? Predictors of symptom change and dropout

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ABSTRACT

Internet-delivered cognitive behavioral therapy (ICBT) is effective for treating anxiety and depression, but not for all patients. Predictors of dropout and outcomes from ICBT remain unclear and the literature could benefit from study of response to ICBT among larger community samples using advanced statistical techniques. In this study, we sought to identify predictors of dropout and symptom change in a large community sample ($n = 1201$) who received therapist-assisted transdiagnostic ICBT targeting anxiety and/or depression. Logistic regression was used to assess dropout, and showed that those who fully completed ICBT lessons ($n = 880$) were older and endorsed lower psychological distress at intake than those who only partially completed ICBT lessons ($n = 321$). During the course of therapy, patients responded to the Patient Health Questionnaire-9 and Generalized Anxiety Disorder-7 at six time points. Autoregressive latent trajectory models were fitted to this data to assess the ability of demographic variables, program engagement, psychological and medical service usage, and psychological distress to explain individual variance in initial symptom levels and symptom change over time. Higher symptom scores at pre-treatment were predictive of greater symptom improvement. Symptom improvement was greater in those who were off work on disability and those without higher post-secondary education. Clinical implications are discussed.

1. Introduction

Cognitive behavior therapy (CBT) is an effective treatment for anxiety and depression (Butler, Chapman, Forman, & Beck, 2006), but obtaining access to this treatment is difficult for many people (Wang et al., 2007). Researchers have responded to this unmet need by developing alternative, cost-effective methods of delivering CBT, such as internet-delivered CBT (ICBT). Research shows that ICBT is effective at reducing symptoms of anxiety and depression, especially when offered with therapist assistance (Andersson, Cuijpers, Carlbring, Riper, & Hedman, 2014; Olthuis, Watt, Bailey, Hayden, & Stewart, 2016), and there is also evidence that the findings of research trials translate into routine clinic settings (e.g., Hadjistavropoulos, Nugent et al., 2016).

Unfortunately, not every ICBT patient experiences a positive outcome. Some patients leave therapy before completing treatment and others do not experience meaningful reductions in their symptoms. A recent review of data collected from nine studies ($N = 1282$) found a median completion rate of 69% for ICBT programs targeting depression (Andrews, Hobbs, & Newby, 2016). Although effect sizes are large in clinical trials (Cuijpers et al., 2013), examination of reliable recovery rates show a significant proportion of patients with clinically elevated pre-treatment symptom scores do not show large symptom improvement and remain in the clinical range post-treatment – 53% reliable recovery for depression and 64% reliable recovery for generalized anxiety (Hadjistavropoulos, Nugent et al., 2016). Some studies have investigated the relationship between patient characteristics and response to ICBT interventions, but findings are not consistent and what factors determine whether someone will respond well to ICBT remain undetermined (Andersson, 2016). Interpreting findings is complex; the programs being studied vary in length, content, the disorder being treated, and study findings can be affected by the sample size measured, the statistical approach used, and the context in which the study was conducted (e.g., research vs practice settings) (Beatty & Binnion, 2016).

The present study investigates predictors of patient outcomes when

delivering therapist-assisted ICBT to patients with depression and/or anxiety in clinical practice. Specific research on predictors of ICBT outcome in clinical practice settings is important because patients in these settings generally show greater severity and complexity, and compliance with treatment can be lower (Kazdin, 2015). Outcomes can be investigated both in terms of the changes in symptoms a patient experiences over the course of treatment and in terms of dropout from treatment. In the present study, we define dropout as withdrawing from therapy before completing all lessons of the treatment program and investigate what patient characteristics are associated with increased risk of dropout. Treatment adherence differs from dropout in that adherence includes not only staying in the treatment program but also actually following the treatment protocol (e.g., doing homework). The present study measures engagement with the ICBT program (e.g., the number of times a patient logs in) as a proxy for treatment adherence, and evaluates the utility of program engagement variables as predictors of symptom change. The relationship between symptom change and patient characteristics at intake (e.g., demographics) is also investigated.

A review of the literature revealed no studies that specifically examined predictors of outcome in transdiagnostic ICBT programs for anxiety and depression in clinical practice. In contrast to disorder-specific programs, transdiagnostic programs use materials that are applicable to both anxiety and depression generally. These programs have been shown to be as efficacious as disorder-specific programs (Dear et al., 2015; Newby, McKinnon, Kuyken, Gilbody, & Dalgleish, 2015; Newby, Twomey, Li, & Andrews, 2016; Titov et al., 2014; Titov et al., 2015) and have the added advantage of addressing the high co-morbidity between depression and anxiety (Kessler et al., 2005). When used in routine clinical practice, transdiagnostic programs also take therapists less time to learn and deliver than when they have to learn multiple disorder-specific ICBT programs (Hadjistavropoulos, Nugent et al., 2016). Given the present lack of research on predictors of outcome for transdiagnostic programs, we turn to results from research on similar disorder-specific programs to guide the construction of our hypotheses.

Using data collected from a large community sample of patients (N = 297) who participated in a therapist-assisted ICBT program for depression, Button, Wiles, Lewis, Peters, and Kessler (2012) examined if patient characteristics collected at screening could be useful in predicting post-treatment symptom scores. Greater pretreatment symptom severity and being separated/divorced/widowed predicted greater reductions in symptom scores. Age, education and history of depression were not related to post-treatment scores. These findings are limited by the fact that only symptom data gathered at post-treatment was analyzed using a simple multiple regression model. This study also did not examine predictors of treatment dropout.

In contrast to the approach used by Button et al. (2012), Hadjistavropoulos, Pugh, Hesser, and Andersson (2016) used latent growth curve analysis to predict treatment completion and outcomes in a community sample of patients who received a 12 week therapist-assisted ICBT program for depression (n = 83) or anxiety (n = 112). The researchers found that greater symptom severity pre-treatment and completion of more lessons predicted greater symptom improvement over time for both treatment programs. Among those with depression, more phone calls to patients predicted poorer outcomes. Among those with anxiety, psychiatric care was associated with poorer outcomes. Some demographic variables predicted dropout, but only for those with anxiety. Specifically, higher age and higher education were positively related to higher completion of lessons (Hadjistavropoulos, Pugh et al., 2016). These findings were limited by a relatively small sample size, the fact that symptom data was gathered at only three time points (at screening, at mid-treatment, and at post-treatment), and missing data.

El Alaoui et al. (2016) built longitudinal multilevel models to explore predictors of treatment outcome in symptom data collected from a much larger community sample (N = 1738) of outpatients who received a 10 week ICBT program for depression. By first dividing possible predictor variables into separate groups (socio-demographic characteristics, clinical characteristics, the patient's family history of mental illness, and treatment-related factors), El Alaoui et al. (2016) identified which individual predictors to include in one overall model. According to the final model, full-time employment, high ratings of treatment credibility and higher lesson completion predicted both faster improvement in symptoms and lower post-treatment symptoms. Higher pre-treatment ratings of depression symptoms and sleep problems were associated with faster rates of improvement in symptoms over treatment, but predicted higher post-treatment depression. Being single was related to higher post-treatment depression levels, but did not influence rates of change. History of psychotropic medication was associated with a slower rate of symptom improvement and higher post-treatment scores.

In a similarly designed study of a program for social anxiety disorder, El Alaoui et al. (2015) again used longitudinal multilevel modeling to analyze symptom data measured at twelve time points over the course of ICBT. In this relatively large community sample (N = 764), being male, family history of minor depression and holding a low opinion of the credibility of treatment predicted lower lesson completion. Higher lesson completion and high ratings of treatment credibility at screening predicted greater rates of symptom improvement over time. The finding that gender predicted outcome in this social anxiety program but not in the study of ICBT for depression described above suggests that predictors of ICBT response likely differ depending on the disorder being treated.

Research into outcome prediction within disorder specific programs for anxiety and depression suggests that which patient characteristics are important prognostic factors depends on the program type. That predictors of outcome appear to differ according to the disorder being treated makes it hard to hypothesize what factors may predict outcomes in transdiagnostic ICBT programs. Predictors of outcome for transdiagnostic programs may look more like results from depression programs, more like anxiety programs, or different entirely. The present study offers an analysis of predictors of treatment outcome in a large sample of patients who received therapist-assisted, transdiagnostic ICBT for anxiety and depression in a routine practice setting. Using the autoregressive latent trajectory (ALT) modeling technique described by Bollen and Curran (2004), symptom data gathered from participants who received transdiagnostic ICBT was analyzed with the goal of detecting any relationships between patient characteristics and symptom trajectory over time. Patient case records were randomly split into two sub-samples, allowing models to be built on data from the first sub-sample and findings to be replicated in the second sub-sample. Given the limited research on this topic, this study was largely exploratory in nature, however, some preliminary hypotheses were formulated based on the above research. We hypothesized that: 1) high initial symptom scores would predict a greater reduction in symptoms over the course of treatment; 2) engagement with treatment would predict greater change over time; and 3) demographic factors, in particular employment, gender, and marital status would predict dropout and symptom change.

The sum of this research serves to better inform clinical practitioners about who benefits most from transdiagnostic ICBT, as well as who is most likely to dropout. Prognostic factors (i.e., characteristics we can measure in patients at screening) that are identified as significantly related to dropout or symptom change could help practitioners make better referral decisions. Furthermore, after treatment has started, therapists could be particularly mindful of patients who are identified as be at particular risk of dropout or poor outcomes. Treatment engagement factors, such as the number of messages received from a client or the number of times a client has logged in to the ICBT website, differ from prognostic factors in that they are not known until a patient starts therapy, but they may also be related to ICBT outcomes. If any treatment engagement factors are identified as being significantly related to outcome, clinicians could then monitor these engagement as

treatment progresses to identify patients at risk of a poor outcome, allowing them to intervene early (e.g., refer or modify treatment).

A secondary purpose of this study was to demonstrate the utility of the autoregressive latent trajectory modeling approach to analyzing longitudinal data described by Bollen and Curran (2006). This approach is underutilized in this area but is well-suited to identifying predictors of symptom change in response to therapy. This approach to modeling should offer improved fit over standard growth curve models.

2. Method

2.1. Intervention

The intervention used in this study was a transdiagnostic ICBT program called *The Wellbeing Course*, which was developed by the eCentreClinic (www.ecentreclinic.org). *The Wellbeing Course* consists of five core Internet-delivered lessons designed to target symptoms of depression and/or anxiety (see Titov et al. (2015) for a description of lessons). Each lesson consists of psychoeducation, instruction on CBT-based strategies for symptom reduction, case examples and homework exercises. Patients complete lessons sequentially, as they become available gradually over an 8-week period. Patients also were assigned a therapist who contacted patients weekly via secure message or telephone to provide support and encouragement. Details of therapist contact are described elsewhere (Hadjistavropoulos, Nugent et al., 2016).

2.2. Participants

This study uses data from the case records of 1201 patients who were admitted to *The Wellbeing Course* between October of 2014 and June of 2017. The full sample included 458 patients from a previously-published open trial that compared the efficacy of transdiagnostic ICBT delivered by therapists working in a specialized online clinic to therapists working in nonspecialized community mental health clinics (Hadjistavropoulos, Nugent et al., 2016). Since this trial, the Online Therapy Unit has continued to offer *The Wellbeing Course* free of charge to residents of Saskatchewan.

Participants in the program began by completing a preliminary online screening questionnaire, which ensured they met basic inclusion criteria such as: 1) being 18 years of age or older; 2) residing in Saskatchewan, Canada, 3) endorsing symptoms of depression and/or anxiety; 4) being comfortable using a computer with access to the Internet; and 5) willing to consent to treatment and provide a medical contact for emergency purposes. Patients who met these basic inclusion criteria were then interviewed by a clinician over the telephone who asked a series of follow-up questions to further assess for ICBT suitability. Patients were excluded from ICBT if they were: 1) considered at high risk for suicide; 2) seeking primary treatment for another disorder (e.g., obsessive compulsive disorder, post-traumatic stress disorder, bipolar disorder, psychotic symptoms, alcohol or drug problems); 3) receiving regular in-person therapy; or 4) no longer interested in treatment. Based on the results of the telephone screening, a total of 1201 patients were accepted into treatment and were eligible for analysis.

2.3. Measures

2.3.1. Longitudinal measures

Patients completed separate measures of depression and anxiety at six time points during the course of treatment: during assessment, before lessons 2–5, and at post-treatment. This resulted in longitudinal data representing depression and anxiety levels for each patient over the course of treatment.

2.3.1.1. The patient health questionnaire 9-item scale (PHQ-9; Kroenke,

Spitzer, & Williams, 2001). The PHQ-9 is a measure of depression that has been shown to have good reliability and validity (Kroenke, Spitzer, Williams, & Lowe, 2010). To complete the measure, patients rate how often they experience each of the 9 items on a scale ranging from 0 (*not at all*) to 3 (*nearly every day*). The maximum score for the PHQ-9 is 27, and a cut-off score of 10 or greater is suggestive of a diagnosis of major depression (Manea, Gilbody, & McMillan, 2012). Internal reliability for the PHQ-9 in the current study was high (Cronbach's α = 0.84–0.90).

2.3.1.2. Generalized anxiety disorder 7-item scale (GAD-7; Spitzer, Kroenke, Williams, & Lowe, 2006). The GAD-7 is found to be a reliable and valid measure of anxiety (Bandelow & Brasser, 2009). To complete the measure, patients rate how often they experience each item (in the last two weeks) on a scale from 0 (*not at all*) to 3 (*nearly every day*). The maximum score is 21, and a score of 10 or greater is suggestive of a diagnosis of generalized anxiety disorder (Spitzer et al., 2006). Internal reliability for the GAD-7 in the current study was high (Cronbach's α = 0.87–0.90).

2.3.2. Measures of distress and disability

2.3.2.1. Kessler 10-item scale (K10; Kessler et al., 2002). The K10, measures psychological distress, and asks patients how often they have experienced 10 different types of distress over the last month. Each item is rated from 1 (*none of the time*) to 5 (*all of the time*). The K10 has been shown to have strong validity and reliability (Kessler et al., 2002), and scores of 17 and above are significantly related to diagnosis of an anxiety or depressive disorder (Andrews & Slade, 2001). Cronbach's α in the current study ranged from 0.87 to 0.92.

2.3.2.2. Sheehan disability scale (SDS; Sheehan, 1983). The SDS asks patients to rate the amount of disruption they are experiencing in three domains (work/school, social life, and family/home responsibilities) on a scale of 1–10. The SDS has been shown to have good reliability and validity (Sheehan, 1983). Cronbach's α in the current study ranged from 0.83 to 0.91.

2.3.3. Previous treatment-seeking activity

At assessment, patients were asked to report the number of times they had accessed various health services in the last eight weeks. Patients were asked specifically about the number of times they had visited/accessed: a psychiatrist, a psychologist or counselor, their family doctor or another general practitioner, and a hospital emergency room (including ambulance or other crisis response programs).

2.3.4. Intervention use

Program use was tracked by the web application and included: 1) the number of times the patient logged in to the website, 2) the number of days the patient accessed the course, 3) the number of lessons the patient started, 4) the number of messages sent by the patient to the assigned therapist, 5) the number of messages received by the patient from the assigned therapist, and 6) the number of phone conversations between therapist and patient.

2.4. Analytic plan

Descriptive statistics were run using SPSS Version 23 to summarize patient variables, which were collected from patients at screening (i.e., age, sex, university education or not, employed or not, on long-term or short-term disability or not, city or rural, in a relationship or not). The complete sample of 1201 patient records was large enough that we were able to randomly split the data into two equal-sized sub-samples to create a training sub-sample (n = 601) and a replication sub-sample (n = 600). Models were then created based on both datasets and findings were compared between the two datasets as a way to protect against type I error due to sample characteristics.

In order to assess whether any specific patient characteristics

predicted dropout, patients were divided into two groups: those who fully completed all five lessons and those who dropped out before completing all lessons. Logistic regression was run using SPSS, with full or partial lesson completion as the dependent variable, and demographic variables, treatment-seeking variables (e.g., recent visits to a psychiatrist), and all measures completed at assessment (i.e., PHQ-9, GAD-7, K10, & SDS) as predictor variables entered forward stepwise. The analysis was repeated in the training and replication sub-samples. Note that because only course completers have complete symptom data, using regression to analyze differences between completers and non-completers also provides us with a way to assess whether missing symptom data is systematically related to any of the candidate predictor variables.

Structural equation modeling was used to examine longitudinal changes in symptoms, as measured by the PHQ-9 and GAD-7. The R statistical environment version 3.2.3 was used with the lavaan latent variable analysis package for R (version 0.5-22; Rosseel, 2012) to determine predictors of symptom change. Separate models were created for each symptom measure using an autoregressive latent trajectory approach (Bollen & Curran, 2004, 2006). Using this approach, each case had a distinct intercept and slope, which allowed for the assessment of individual differences in symptoms over time while also accounting for correlation between repeated measures. An unconditional ALT model using a random intercept and random linear slope was fitted to the time series data using maximum likelihood estimation. The model was specified so that measurements at each time point are predicted by the intercept, the slope and the value at the previous time point. The unconditional model also specified covariance between the intercept and the slope, which provided information about the relationship between initial symptom level and the rate of symptom change.

After a basic unconditional ALT model was fitted, the model was then modified to include predictor variables. Four theoretically distinct groups of predictor variables (i.e., demographic, treatment-seeking, program engagement, and measures of distress/impairment) were tested in separate models for their ability to explain variability in the intercept and slope of the curve for each individual case. Within these models, coefficients were estimated for each individual predictor variable and the significance of its predictive value was calculated. Only predictor variables that were significant in each model, and replicated in both sub-samples, were then included in a final, overall model. The final model of anxiety symptoms is presented in Fig. 1.

Common indices of model fit were also computed for each model. Model χ^2 values compare the model to an ideal model, with smaller χ^2 values indicating a better fit. The Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI) provide an estimate of the model fit based on the χ^2 that ranges from 0 to 1, with 1 representing an ideal fit. The Root Mean Square Error of Approximation (RMSEA) was also computed, with smaller values indicating better fit. RMSEA values of 0.01, 0.05, 0.08, and 0.1 have been used to indicate *excellent, good, mediocre,* and *minimum acceptable* fit, respectively (Hooper, Coughlan, & Mullen,

Table 1
Summary of patient sample characteristics.

	Training Sample (n = 601) M (SD)	Replication Sample (n = 600) M (SD)	Overall Sample (n = 1201) M (SD)
Demographic Variables.			
Age	37.72 (13.05)	38.13 (12.64)	37.92 (12.84)
Male	30.60%	27.97%	29.29%
Urban	42.60%	46.67%	44.63%
In Relationship	62.14%	62.86%	62.50%
On Disability	7.49%	10.17%	8.83%
Unemployed	7.65%	9.33%	8.49%
University Degree	37.10%	34.5%	35.80%
Treatment-seeking Behaviours			
Physician	1.22 (1.45)	1.21 (1.54)	1.22 (1.49)
E.R./Crisis Response	0.17 (0.70)	0.21 (0.82)	0.19 (0.77)
Psychiatrist	0.37 (0.82)	0.42 (0.87)	0.40 (0.85)
Psychologist/ Counselor	0.63 (1.35)	0.81 (1.55)	0.72 (1.45)
Screening Measures			
K10	27.96 (7.46)	27.80 (7.55)	27.88 (7.51)
SDS	17.21 (7.48)	17.97 (7.89)	17.60 (7.70)
GAD-7	11.95 (5.28)	11.94 (5.10)	11.95 (5.19)
PHQ-9	12.13 (5.90)	12.36 (5.86)	12.25 (5.88)
Program Engagement			
Phone Conversations	0.74 (1.08)	0.73 (1.182)	0.74 (1.13)
Login Count	19.73 (12.00)	19.81 (12.149)	19.77 (12.07)
Days Accessing Program	93.15 (55.83)	92.82 (52.66)	92.99 (52.20)
Messages sent by client	3.92 (3.60)	3.95 (3.35)	3.94 (3.48)
Messages received by client	8.33 (2.17)	8.26 (2.11)	8.30 (2.42)
Completion of Lesson 5	72.71%	73.83%	73.27%

Note. K10 = Kessler 10-Item Scale; SDS = Sheehan Disability Scale; PHQ–9 = Patient Health Questionnaire-9.

2008; MacCallum, Browne, & Sugawara, 1996). Finally, a *p*-value was computed to test whether the RMSEA value for each model was significantly different from a close-fitting model (Hooper et al., 2008).

3. Results

3.1. Baseline data

Demographic information for all patients is presented in Table 1. The mean age of participants was 37.92 years old, with the majority being female (70.71%) and in a relationship (62.50%). The sample was almost evenly split between urban (44.63%) and small town or rural (55.37%) participants. Over one third (35.80%) of patients indicated they had completed post-secondary education. 8.49% of patients
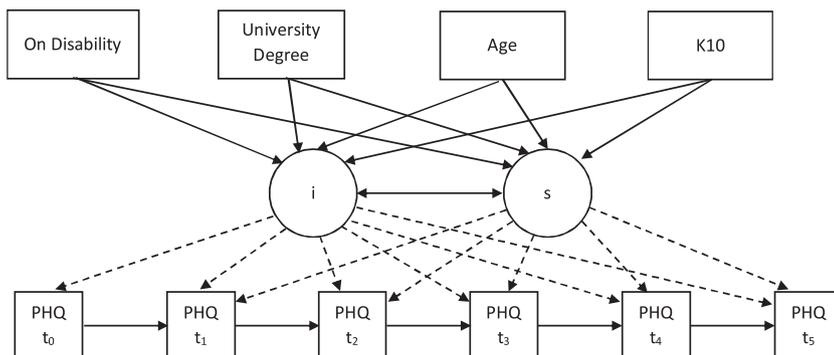

Fig. 1. Final autoregressive latent trajectory growth model for GAD-7 time-series data. Predictor variables in the top level are free to influence both the intercept ("i"), and slope ("s") of each patient's symptom trajectory.

indicated they were unemployed and 8.83% indicated they were on short or long term disability. Of the patients who were accepted into treatment ($n = 1201$), most patients ($n = 1180$) accessed at least one lesson. Approximately 73.27% ($n = 880$) of patients began all five lessons.

3.2. Predictors of dropout

Running logistic regression analysis with course completion status as the dependent variable and demographic variables, initial symptom scores, and recent treatment seeking measures entered stepwise as predictors resulted in a model where only age ($β = 0.021$, $SE = 0.06$, $p < 0.001$) and initial K10 scores ($β = -0.032$, $SE = 0.09$, $p < 0.001$) were significant predictors. The resulting model using age to predict dropout had an overall prediction success of 74.6%, and a test of the model compared to the constant-only model indicated it was statistically significant ($χ^2 = 28.566$, p < 0.001). Nagelkerke's R^2 was 0.036, indicating that this only accounted for a small amount of the overall variance. The Wald criterion confirmed that age and initial K10 score were the only significant predictors of course completion ($p < 0.001$), with older individuals and those with lower K10 scores being more likely to complete the course. Conducting logistic regression within the training and replication sub-samples separately did not produce notably different results. Results also did not change when completion was defined as completing 4 out of 5 lessons.

3.3. Predictors of symptom change

Complete symptom data was collected from 837 of the 880 patients (97.1%) who completed the course. ALT models were fitted to this symptom data using maximum likelihood estimation to address the small amount of missing data. A common feature of all models was that there was statistically significant negative covariance between the intercept and the slope, which indicated that higher GAD-7 and PHQ-9 scores at assessment were associated with greater reductions in symptoms over the course of treatment. Table 2 presents the fit measures for each model in the training data sub-sample. CFI and TLI indicated reasonably good fit for all models, while RMSEA was under 0.011 for all models and varied between 0.037 (good) a 0.89 (moderate) for conditional models. Fit measures for the replication data sub-sample produced no notable differences.

3.3.1. Generalized anxiety

Four conditional ALT models were created to test predictor variables for the GAD-7, the details of which are presented in Table 3. Individuals who were younger ($β = -0.068$, $SE = 0.020$, $p = 0.001$), on disability ($β = 2.212$, $SE = 1.028$, $p = 0.031$), and did not hold a

university degree ($β = -1.468$, $SE = 0.545$, p = 0.007) had higher baseline GAD-7 scores. These variables were also associated with symptom change, with greater rates of symptom reduction during the course of treatment being associated with younger age ($β = 0.022$, $SE = 0.007$, $p = 0.001$), being on disability ($β = -0.723$, $SE = 0.333$, $p = 0.03$), and not holding a university degree ($β = 0.477$, $SE = 0.177$, $p = 0.007$). These findings were replicated in the second sub-sample.

The treatment seeking model revealed that reporting a greater number of visits to a general practitioner in the previous eight weeks was related to higher initial symptom scores ($β = 0.540$, $SE = 0.190$, $p = 0.004$) and greater symptom improvement over treatment ($β = -0.173$, $SE = 0.061$, $p = 0.005$), although this result was not replicated in the replication dataset. In the distress model, higher K10 scores at intake were associated with higher initial GAD-7 scores ($β = 0.487$, $SE = 0.031$, $p < 0.001$) and greater reductions in GAD-7 scores during the course of treatment ($β = -0.126$, $SE = 0.010$. $p < 0.001$), and this finding was replicated in the second sample. All other predictor variables in the ALT models were not statistically significant.

The final model, built using only significant predictors of both initial symptoms and symptom change over treatment from each separate model, included age, on disability, university degree, and K10 scores at screening. In the final model, higher ratings of psychological distress at screening, as measured using the K10, were predictive of higher initial anxiety symptoms ($β = 0.499$, $SE = 0.026$, p < 0.001) and greater reductions in symptoms over the course of therapy ($β = -0.131$, $SE = 0.009$, p < 0.001). Younger age was related to higher initial symptom scores and greater symptom improvement in the replication sample, but only approached statistical significance in the training sample. Employment, education, and recent visits to a psychiatrist were not significant predictors in the final model.

3.3.2. Depression

Four conditional ALT models were created to test predictor variables for the PHQ-9. Table 4 shows results from models for both the training sub-sample and the replication sub-sample. In the demographic model, initial PHQ-9 scores were higher for individuals who reported being on disability ($β = 3.405$, $SE = 1.148$, $p = 0.003$), but these patients' symptoms improved more over therapy ($β = -0.834$, $SE = 0.297$, $p = 0.005$). Patients who reported holding a university degree started with lower symptoms ($β = -1.555$, $SE = 0.612$, $p = 0.011$) and experienced smaller reductions in symptoms over treatment ($β = 0.509$, $SE = 0.157$, $p = 0.001$). These results were also found in the replication sub-sample. There was an inconsistent relationship between reporting unemployment and a patient's symptom trajectory between the two samples. All other predictor variables were not significantly related to symptom trajectories.

Table 2
Fit indices for autoregressive latent trajectory models of longitudinal measures

Model	$χ^2$	df	CFI	TLI	RMSEA (90% CI)	RMSEA p value
Depression (PHQ-9)						
Unconditional	30.90	11	0.992	0.989	0.068 (0.040–0.096)	0.134
Demographic	59.60	39	0.992	0.988	0.037 (0.015–0.055)	0.880
Treatment-seeking	71.82	27	0.983	0.975	0.065 (0.047–0.083)	0.084
Engagement	86.69	31	0.973	0.961	0.069 (0.052–0.086)	0.032
Distress	36.96	19	0.994	0.991	0.049 (0.024–0.072)	0.497
Final Model	78.253	27	0.979	0.970	0.069 (0.052–0.088)	0.036
Anxiety (GAD-7)						
Unconditional	63.67	11	0.976	0.967	0.110 (0.085–0.137)	0.000
Demographic	103.93	39	0.970	0.956	0.065 (0.050–0.081)	0.046
Treatment-seeking	88.91	27	0.972	0.959	0.076 (0.059–0.094)	0.007
Engagement	67.48	31	0.986	0.979	0.055 (0.037–0.072)	0.312
Distress	77.93	19	0.976	0.966	0.089 (0.069–0.110)	0.001
Final Model	70.69	35	0.988	0.982	0.051 (0.033–0.068)	0.445

Note. PHQ–9 = Patient Health Questionnaire-9; GAD–7 = Generalized Anxiety Disorder-7.

Table 3
Results from autoregressive latent trajectory modeling of GAD-7 scores.

	Training Model		Replication Model	
	Initial Symptoms[a] β (SE)	Symptom Change[b] β (SE)	Initial Symptoms[a] β (SE)	Symptom Change[b] β (SE)
Demographic Characteristics				
Age	−0.07 (0.02)**	0.02 (0.01)**	−0.07 (0.02)**	0.02 (0.01)**
Male	0.00 (0.58)	0.01 (0.19)	−0.66 (0.58)	0.19 (0.18)
Urban	0.13 (0.54)	−0.03 (0.18)	0.16 (0.53)	−0.05 (0.17)
In Relationship	0.54 (0.57)	−0.15 (0.19)	1.14 (0.56)*	−0.38 (0.18)*
On Disability	2.21 (1.03)*	−0.72 (0.33)*	2.04 (0.87)*	−0.63 (0.28)*
Unemployed	−0.49 (1.14)	0.17 (0.37)	1.77 (0.92)	−0.52 (0.29)
University Degree	−1.47 (0.55)**	0.48 (0.18)**	−1.45 (0.55)**	0.47 (0.17)**
Treatment-Seeking Behaviors				
Physician	0.54 (0.19)**	−0.17 (0.06)**	−0.02 (0.20)	0.01 (0.06)
E.R./Crisis Response	−0.82 (0.51)	0.26 (0.16)	−0.03 (0.32)	−0.01 (0.10)
Psychiatrist	0.33 (0.34)	−0.10 (0.11)	0.64 (0.31)*	−0.18 (0.10)
Psychologist/Counselor	0.15 (0.20)	−0.05 (0.07)	−0.04 (0.20)	0.01 (0.06)
Distress & Impairment				
SDS Total	0.03 (0.03)	−0.01 (0.01)	0.03 (0.03)	−0.01 (0.01)
K10 Total	0.49 (0.03)***	−0.13 (0.01)***	0.44 (0.03)***	−0.14 (0.01)***
Program Engagement				
Phone Conversations	0.19 (0.26)	−0.05 (0.08)	0.49 (0.22)*	−0.15 (0.07)*
Login Count	−0.01 (0.03)	0.00 (0.01)	−0.01 (0.03)	0.00 (0.01)
Days Accessing Program	−0.00 (0.01)	0.00 (0.002)	−0.00 (0.01)	0.00 (0.002)
Messages sent by client	−0.03 (0.09)	0.01 (0.03)	−0.08 (0.10)	0.02 (0.03)
Messages client received	0.13 (0.16)	−0.04 (0.05)	0.32 (0.17)	−0.10 (0.05)
Overall Model				
Age	−0.03 (0.01)	0.01 (0.004)	−0.03 (0.02)*	0.01 (0.01)*
On Disability	−0.24 (0.75)	0.04 (0.21)	0.57 (0.66)	−0.17 (0.21)
University Degree	−0.13 (0.39)	0.05 (0.11)	−0.72 (0.40)	0.23 (0.13)
K10 Total	0.50 (0.03)***	−0.13 (0.01)***	0.45 (0.03)***	−0.14 (0.01)***

Note. GAD–7 = Generalized Anxiety Disorder-7; SDS = Sheehan Disability Scale; K10 = Kessler 10-Item Scale.

[a] β values are parameter estimates of the relationship between each predictor variable and symptom scores at intake. Positive β values indicate a relationship with higher initial symptoms of depression.

[b] β values are parameter estimates of the relationship between each predictor variable and the slope of symptom change over therapy. Negative numbers indicate greater symptom improvement.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

Results from the treatment-seeking behaviours model show that individuals with higher baseline depression scores reported more frequent recent visits to a psychiatrist ($\beta = 1.309$, $SE = 0.374$, $p < 0.001$) and more visits to a psychiatrist was also associated with greater reductions in symptoms over therapy ($\beta = -0.343$; $SE = 0.096$; $p < 0.001$). Number of visits to a general practitioner was associated with symptom trajectories in the training sample, but this finding was not replicated in the second sub-sample.

In the psychological distress model, higher K10 scores ($\beta = 0.549$, $SE = 0.031$, $p < 0.001$) and higher SDS scores ($\beta = 0.119$, $SE = 0.030$, $p < 0.001$) were significantly associated with higher baseline PHQ-9 scores. Greater reductions in PHQ-9 scores during the course of treatment were also associated with higher K10 scores ($\beta = -0.139$, $SE = 0.010$, $p < 0.001$) and higher SDS scores ($\beta = -0.031$, $SE = 0.008$, $p < 0.001$).

Findings from the treatment engagement model suggest that individuals who start with higher PHQ-9 scores go on to have significantly more phone conversations with their e-therapist ($\beta = 0.751$, $SE = 0.289$, $p = 0.009$). A greater number of phone calls from the e-therapist was also associated with greater reductions in symptoms over treatment ($\beta = -0.178$, $SE = 0.073$, $p = 0.014$). A significant relationship between initial PHQ-9 scores and the number of messages received by a client was found in the training sub-sample, but this finding was not replicated in the second sub-sample. All other predictor variables in the treatment engagement model were not significantly related to patient symptom trajectories.

The final model for depression symptoms included holding a university degree, reporting being on disability, number of visits to a psychiatrist, SDS score, K10 score, and number of phone conversations. Only SDS and K10 scores significantly predicted symptoms in this final model, with higher initial symptoms being associated with higher SDS scores ($\beta = 0.116$, $SE = 0.030$, $p < 0.001$) and higher K10 scores ($\beta = 0.536$, $SE = 0.031$, $p < 0.001$), and greater reductions in symptoms over treatment were predicted by higher SDS scores ($\beta = -0.030$, $SE = 0.008$, $p < 0.001$) and K10 scores ($\beta = -0.135$, $SE = 0.010$, $p < 0.001$). No other variables were significant in the final model. The model was consistent for the replication sample.

4. Discussion

A clinician who is considering referring a patient to a transdiagnostic ICBT program for anxiety and depression does not currently have a great deal of research available to help them determine whether the patient is likely to benefit from this type of program. The current study sought to fill this gap by conducting a thorough analysis of treatment outcome data collected from a large community sample of patients who participated in a transdiagnostic ICBT program. The goal of this analysis was to identify characteristics that were significantly related to dropout or rate of symptom improvement.

When examining the differences between those who completed the course and those who did not, patient age was found to be a significant predictor of course completion – older individuals were significantly more likely to complete all course lessons. This finding is consistent with the results of a previous study of a disorder-specific ICBT program

Table 4
Results from autoregressive latent trajectory modeling of PHQ-9 scores.

	Training Model		Replication Model	
	Initial Symptoms[a] β (SE)	Symptom Change[b] β (SE)	Initial Symptom[a] β (SE)	Symptom Change[b] β (SE)
Demographic Characteristics				
Age	0.01 (0.02)	−0.00 (0.01)	−0.01 (0.02)	0.00 (0.01)
Male	1.22 (0.65)	−0.29 (0.17)	−0.31 (0.66)	0.07 (0.20)
Urban	−0.80 (0.60)	0.25 (0.16)	−0.57 (0.61)	0.19 (0.17)
In Relationship	−1.51 (0.64)[*]	0.41 (0.16)[*]	−0.54 (0.64)	0.12 (0.19)
On Disability	3.41 (1.15)[**]	−0.83 (0.30)[**]	3.22 (1.00)[**]	−0.87 (0.29)[**]
Unemployed	−2.00 (1.30)	0.52 (0.33)	2.99 (1.05)[**]	−0.86 (0.30)[**]
University Degree	−2.01 (0.61)[**]	0.51 (0.16)[**]	−1.27 (0.63)[*]	0.38 (0.18)[*]
Treatment-Seeking Behaviors				
Physician	0.72 (0.21)[**]	−0.18 (0.05)[**]	0.38 (0.23)	−0.11 (0.07)
E.R./Crisis Response	−0.62 (0.57)	0.15 (0.14)	−0.39 (0.36)	0.10 (0.10)
Psychiatrist	1.37 (0.37)[***]	−0.34 (0.10)[***]	0.85 (0.35)[*]	−0.21 (0.10)[*]
Psychologist/Counselor	−0.26 (0.23)	0.06 (0.06)	0.12 (0.21)	−0.04 (0.06)
Distress & Impairment				
SDS Total	0.12 (0.03)[***]	−0.03 (0.01)[***]	0.09 (0.03)[**]	−0.02 (0.01)[**]
K10 Total	0.55 (0.03)[***]	−0.14 (0.01)[***]	0.56 (0.03)[**]	−0.16 (0.01)[***]
Program Engagement				
Phone Conversations	0.75 (0.29)[**]	−0.18 (0.07)[*]	0.60 (0.25)[*]	−0.17 (0.07)[*]
Login Count	0.01 (0.03)	−0.00 (0.01)	−0.01 (0.03)	0.00 (0.01)
Days Accessing Program	−0.01 (0.01)	0.00 (0.002)	0.00 (0.01)	−0.00 (0.002)
Messages sent by client	−0.14 (0.10)	0.04 (0.03)	0.07 (0.11)	−0.02 (0.03)
Messages client received	0.38 (0.18)[*]	−0.10 (0.05)[*]	0.21 (0.19)	−0.07 (0.06)
Overall Model				
On Disability	−0.05 (0.75)	0.04 (0.20)	0.59 (0.62)	−0.14 (0.17)
University Degree	−0.61 (0.38)	0.16 (0.10)	−0.72 (0.37)[*]	0.22 (0.10)[*]
Psychiatrist Visits	0.31 (0.24)	−0.08 (0.06)	−0.04 (0.21)	0.04 (0.06)
SDS Total	0.12 (0.03)[***]	−0.03 (0.01)[***]	0.09 (0.03)[**]	−0.02 (0.01)[**]
K10 Total	0.54 (0.03)[***]	−0.14 (0.01)[***]	0.56 (0.03)[***]	−0.16 (0.01)[***]
Phone Conversations	0.22 (0.18)	−0.05 (0.05)	0.13 (0.15)	−0.03 (0.04)

Note. PHQ–9 = Patient Health Questionnaire-9; SDS = Sheehan Disability Scale; K10 = Kessler 10-Item Scale.

[a] β values are parameter estimates of the relationship between each predictor variable and symptom scores at intake. Positive β values indicate a relationship with higher initial symptoms of depression.

[b] β values are parameter estimates of the relationship between each predictor variable and the slope of symptom change over therapy. Negative numbers indicate greater symptom improvement.

[*] p < 0.05.

[**] p < 0.01.

[***] p < 0.001.

for depression, which found that younger age was related to higher attrition (Hedman et al., 2014). Hadjistavropoulos, Pugh et al. (2016) found a similar relationship between age and the number of treatment lessons started in a disorder specific program for anxiety, but not in a disorder-specific program for depression. Consistent with the findings of Hedman et al. (2014), no other demographic variables, including gender, education level, relationship status, and employment status, were associated with dropout in this sample. Although initial symptom scores on the PHQ-9 and GAD-7 were not related to dropout, higher levels of initial psychological distress, as measured by the K10, were also significantly related to dropout. Attrition rates were not significantly different for patients living in urban or rural areas. The only prognostic factors related to attrition in this type of program appears to be age and level of general psychological distress. Further research should investigate why young people and those with higher psychological distress drop out more and how treatment can be modified to reduce attrition in younger individuals. These results are similar to face-to-face therapy, where age and severity also show similar relationships to dropout (Swift & Greenberg, 2012).

In addition to predicting who is at risk for terminating treatment early, clinicians would also like to know who is most likely to experience a significant reduction in symptoms in response to a transdiagnostic ICBT intervention. In this study, all ALT models showed a consistent relationship between pretreatment severity and symptom change over treatment, with higher initial symptom scores being related to greater reductions in symptoms. This replicates earlier findings

from studies using growth models (Hadjistavropoulos, Pugh et al., 2016), and is similar to the finding by Button et al. (2012) that pretreatment severity moderated treatment response. High psychological distress at pretreatment, as measured by the K10, was also associated with higher initial symptom scores and greater reductions in symptoms over time. The findings make sense in that patients who have more severe symptoms have more room to improve.

In terms of demographic characteristics, being on disability and not holding a university degree were consistently associated with higher starting symptoms and greater improvement over treatment for both anxiety and depression symptoms. In contrast to a study of response to an ICBT intervention for depression conducted by El Alaoui et al. (2016), which found that being single was associated with a worse endstate, relationship status was not consistently related to symptom trajectories in this sample. Gender and the patient's place of residence (operationalized as urban vs. rural) were also not related to symptoms of anxiety or depression. Age was significantly related to anxiety symptoms, with younger individuals starting out with higher anxiety scores and showing a greater reduction in symptoms over treatment. Age was not related, however, to depressive symptoms. That younger age was also associated with a somewhat higher dropout rate could have influenced these results, and the fact that younger age is associated with both greater risk of dropout and greater reductions in symptoms over treatment complicates using age in clinical decision making. Future research should investigate the reasons why young people leave therapy more than their older counterparts and attempt to

modify treatment to improve retention rates. Of note, recent efforts have been made to reduce the length of the Wellbeing Course to improve course completion rates in university students (e.g., 3 vs 5 lessons). At this time, the optimal structure of ICBT for this younger population remains unknown.

The present study also found that the more times a patient had visited a psychiatrist in the eight weeks prior to screening, the greater their initial depression symptom scores were, and the greater their symptom reduction was over time. This is consistent with earlier findings that patients who reported receiving concurrent psychiatric care at screening showed greater reduction in symptoms over time (Hadjistavropoulos, Pugh et al., 2016). The number of recent visits to a physician reported by patients was also associated with symptom trajectories, but the result was not replicated in the second sub-sample.

Higher initial depression symptom scores were significantly related to a greater number of phone calls between patient and therapist. A similar relationship appeared between initial anxiety symptoms and number of phone calls, but only reached the significance threshold in the replication sample. The lack of a stronger relationship between program engagement and symptom trajectories warrants further investigation. Previous studies have found that program engagement measures, such as the number of phone conversations and the number of lessons started, significantly predicted symptom change (Hadjistavropoulos, Pugh et al., 2016; Hedman et al., 2013). A significant relationship between program use and symptom reduction is consistent with the expected dose-response relationship (i.e., the more exposure to the intervention, the greater the improvement in symptoms), however, this study did not find a relationship between how much users accessed the website and their symptom trajectory. One possible explanation is that we are not adequately measuring treatment usage – the number of logins to the website, for example, does not capture the activities of users who review course materials/concepts offline. Future studies should investigate program engagement further by measuring engagement in different ways or by experimentally manipulating engagement variables to determine their effect on symptom change.

One strength of the present study is that it measured a large community sample who received a transdiagnostic ICBT program that was delivered in a routine clinical setting. The sample size was sufficient to examine findings in a training sample and a replication sample. Past research has primarily focused on disorder-specific programs for either depression or anxiety and this study examines which of these findings apply to a transdiagnostic ICBT program designed to treat both types of symptoms. With approximately half of patients reporting they resided in a rural area within the Canadian province of Saskatchewan, this study also provided the opportunity to investigate predictors of outcome that might be unique to the local population.

A second strength of the present study is that the ALT modelling approach achieved a better fit to the longitudinal symptom data than the simple growth models that were used in previous studies (Hadjistavropoulos, Pugh et al., 2016). While model fit indices suggest adequate to good fit, it must be acknowledged that any conclusions drawn from these models remain limited by how well the model fits the data. Furthermore, the models used in this study assumed a linear relationship between the latent slope and symptom measurements, which means any non-linear relationships between predictors and symptom change were less likely to be identified in the present study. When interpreting results, we must also consider how missing symptom data resulting from attrition may have affected the results. Older individuals and those with lower psychological distress at intake were found to be somewhat more likely to complete the program, and the possibility that cases with missing symptom data differ in some systematic way represents a threat to internal validity. The generalizability of these findings may also be affected by the exclusion criteria of the study, which included suicidality, high levels of drug or alcohol abuse, and primarily seeking treatment for a disorder other than depression or

anxiety. Finally, although comparing symptom trajectories provides an interesting way to examine how individuals respond to therapy, we must remember it is possible for a patient to have a decreasing symptom trajectory but not experience a clinically significant change in response to therapy. A symptom trajectory with a negative slope does not alone guarantee a good outcome − how treatment has impacted their quality of life, psychological distress, and impairment must also be considered before therapy can be considered successful.

Taking all findings into account, it is quite striking that there are so few predictors of outcomes in ICBT. There are a number of potential explanations for this. An optimistic explanation is that transdiagnostic ICBT works well for everyone, perhaps because the wide range of content covered in transdiagnostic ICBT meets the needs of most types of clients. Another explanation is that the screening practices used in ICBT, which exclude patients from treatment for various reasons (e.g., high suicide risk, significant use of drugs and alcohol), impose limits on the variability available in the sample for analysis by removing cases that would likely result in poorer outcomes. A third possible explanation is that this study did not investigate the predictors that are most relevant to understanding treatment outcomes. This study adds to the literature, but ultimately additional research is needed to confirm the generalizability of these findings in other populations and for other ICBT programs. Future research into predictors of ICBT outcome should also explore other potential predictors beyond basic demographic and background characteristics. For example, individual differences in beliefs about therapy, motivation for change, and reasons for seeking treatment, may be more predictive of treatment outcome than demographic factors or initial symptom measures.

In terms of clinical implications at this time, clinicians considering whether a patient is appropriate for referral to a transdiagnostic ICBT program should find it useful to know that being younger is related to a somewhat elevated risk of dropout; however, age only accounted for a small amount of the variance in dropout. Many young patients did complete treatment and experience large reductions in symptoms. Clinicians must therefore consider age as one factor among many when considering referring a case to a transdiagnostic ICBT program. The results of this study also suggest that both men and women benefit from ICBT, that it works for individuals who are single or in a relationship, and that ICBT can be effective when administered to patients living in either urban or rural environments. Individuals who are on disability or do not have a university education are likely to have higher initial symptom scores, but will experience larger symptom improvements in response to ICBT. The clinical utility of the K10 as a screening measure is also evident here − high K10 scores were related to high initial symptoms of both anxiety and depression, to an increased risk of dropout, and to greater reductions in symptoms in response to ICBT.

5. Conclusions

This study identified patient characteristics that were significantly related to dropout and symptom change in a transdiagnostic ICBT program for anxiety and depression. Younger age and greater psychological distress at intake were associated with increased risk of dropout. Education background and reporting being away from work on disability leave were associated with both anxiety and depression symptom trajectories. Future research should attempt to understand the nature of these relationships and what the implications are for ICBT practice. For example, the present study found that younger people were more likely to dropout of therapy, but why young people dropout more and what can be done to attenuate this effect remain open questions.

Acknowledgements

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