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The Chronic Conditions Course: A Randomised Controlled Trial of an Internet-Delivered Transdiagnostic Psychological Intervention for People with Chronic Health Conditions

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Anxiety · Cognitive behaviour therapy · Depression · Randomized controlled trial · Chronic disease

Abstract

Introduction: Psychological adjustment to chronic health conditions is important, as poor adjustment predicts a range of adverse medical and psychosocial outcomes. Psychological treatments demonstrate efficacy for people with chronic health conditions, but existing research takes a disorder-specific approach and they are predominately delivered in face-to-face contexts. The internet and remotely delivered treatments have the potential to overcome barriers to accessing traditional face-to-face treatment. ***Objective:*** The current study examined the efficacy and acceptability of an internet-delivered transdiagnostic psychological intervention to promote adjustment to illness, based on cognitive behaviour therapy principles. ***Methods:*** In a two-arm randomised controlled trial, participants (n = 676) were randomly allocated to the 8-week intervention or a waitlist control. Treatment included five core lessons, homework tasks, additional resources, and weekly contact with a psychologist. Primary outcomes included depression, anxiety, and disability, assessed at pre-treatment, post-treatment, 3-month follow-up, and 12-month follow-up. ***Results:*** The treatment group reported significantly greater improvements in depression (between-groups d = 0.47), anxiety (d = 0.32), and disability (d = 0.17) at post-treatment (all ps <0.001). Improvements were sustained over the 3-month and 12-month follow-ups. High treatment completion rates (69%) and levels of satisfaction (86%) were reported by participants in treatment. The intervention required a mean clinician time of 56.70 min per participant. ***Conclusions:*** The findings provide preliminary and tentative support for the potential of internet-delivered transdiagnostic interventions to promote adjustment to chronic health conditions. Further research using robust control groups, and exploring the generalisability of findings, is needed before firm conclusions can be drawn.

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Introduction

Chronic health conditions affect a significant proportion of the population, and their global prevalence is increasing [1]. Given the challenges associated with living in ill health, psychological adjustment to chronic health conditions is crucial [2], whereby individuals engage in appropriate self-management, retain adequate functioning, and do not report excessive psychological distress related to their condition [2, 3]. Poor adjustment to illness is a particularly problematic and costly outcome of chronic health conditions; factors like inadequate self-management and the presence of psychiatric comorbidity are associated with numerous adverse outcomes, such as treatment non-adherence, worse illness course, greater disability, and higher healthcare costs [4, 5]. There is growing evidence supporting the efficacy of psychological interventions, particularly cognitive behaviour therapy (CBT), in promoting adjustment to illness. The aim of CBT is to encourage adaptive appraisals of one's circumstances and establish helpful coping behaviours. Recent reviews of CBT for chronic health conditions have demonstrated significant improvements in psychological symptoms, disability, and quality of life [6–8]. Despite its promise, however, there are some notable issues and knowledge gaps regarding CBT for individuals with chronic health conditions.

Many people are unable to access timely and evidence-based care, due to barriers such as cost, mobility limitations, and difficulty accessing adequately trained clinicians [9, 10]. These barriers may be especially pronounced among people with chronic health conditions. Fortunately, internet and remotely delivered approaches are a promising solution to many of these barriers. Typically, these interventions deliver psychoeducation and management skills via internet platforms, and often include clinicians to support participants' progress [11]. A recent review examining internet-delivered CBT (iCBT) for individuals with health conditions demonstrated small improvements in depression and anxiety symptomatology [12]. Another issue is the dominance of a condition-specific approach. To illustrate, 24 of 25 studies in the above-mentioned review of iCBT in chronic health populations were tailored to specific conditions (e.g., rheumatoid arthritis, diabetes) [12]. This condition-specific approach presents barriers to the real-world implementation of such treatments. Not only is there a huge diversity of chronic health conditions, but multi-morbidity is common; an estimated 30% of people with a chronic health condition have two or more [13]. Importantly, pursuing numerous condition-specific interventions may overlook lesser-known or rare conditions, where there is also often a significant unmet psychosocial need [14]. Though a minority of intervention studies have been conducted in people with diverse chronic health conditions, the evidence so far suggests that such studies are equivalent in their efficacy [8, 12]. Hence, there is a need to understand the efficacy of transdiagnostic psychological interventions for people with a broad range of chronic health conditions.

The aims of the present study were to examine the efficacy and acceptability of a transdiagnostic internet-delivered program designed to promote adjustment to illness by providing psychoeducation alongside widely used cognitive and behavioural skills. Using a randomised controlled trial, the current study determined whether patients in the intervention reported improvements in depression, anxiety, and disability immediately post-treatment, compared to a waitlist control (WLC) group. The secondary aim was to determine the efficacy of the intervention regarding patients' subjective wellbeing and quality of life. Finally, the current study sought to examine whether improvements were maintained at 3 months and 12 months post-treatment.

Materials and Methods

Design

The current study was a two-arm parallel RCT with a WLC group. Participants read about the study and applied to participate via the eCentreClinic website (www.ecentreclinic.org, a specialist research clinic that provides access to treatment via participation in clinical trials). The intervention was promoted on the eCentreClinic website, advertised via social media, and promoted through a range of non-governmental organisations that support adults with chronic health conditions. Participants were also informed of the course via word-of-mouth recommendations and health professional referrals.

After providing informed consent, participants completed an online screening assessment containing demographic information and questionnaires assessing inclusion and exclusion criteria. Participants were also asked to list all diagnosed chronic health conditions, as well as the health condition that was having the greatest impact on their emotional wellbeing and day-to-day life (where >1 health condition was reported). This was coded as participants' primary health condition. Study clinicians then telephoned eligible participants to further describe the study and confirm enrolment. Randomisation was performed using http://www.random.org, using permuted blocks of 16 to ensure a balanced design. The allocation sequence was concealed from study investigators. Those randomised into the treatment group commenced an 8-week treatment period, after which those allocated to the WLC started treatment. Importantly, participants in the treatment and WLC groups were not prohibited from continuing with their existing

healthcare, changing their current healthcare, or seeking additional healthcare during the trial. The study was approved by the Human Research Ethics Committee of Macquarie University, Sydney, NSW, Australia, and prospectively registered on the Australian and New Zealand Clinical Trials Registry (ACTRN12616001214426).

Participants

Eligible participants were: (1) aged 18 years or older, (2) lived in Australia, (3) reported a diagnosis of a chronic physical health condition, and (4) reported that their health condition had a significant impact on their emotional wellbeing and quality of life. Participants were excluded if they reported very severe symptoms of depression (i.e., scoring >24 on the Patient Health Questionnaire-9; PHQ-9 [15]) or if they reported suicide plans or a recent suicide attempt. Participants not under the care of a medical doctor were also excluded for safety reasons.

Intervention

The intervention (the Chronic Conditions Course) is a remotely delivered intervention that aims to provide psychoeducation and skills to promote adjustment to chronic health condition(s). The intervention is based on CBT and transdiagnostic principles. Specifically, the content and skills included in the course were chosen based on their relevance and utility for individuals with a broad range of chronic health conditions (e.g., activity pacing, activity scheduling, cognitive challenging). The intervention was developed alongside similar interventions for people with chronic pain [16–18]. Preliminary feasibility studies have examined the intervention for people with epilepsy [19], gastrointestinal conditions [20], and spinal cord injuries [21], with encouraging results.

The intervention comprises 5 lessons with accompanying homework exercises, with each lesson taking approximately 20 min to complete. Lessons are presented in slideshow format with both didactic information and real-world case examples. The intervention also includes additional resources containing supplementary information and guidance in areas such as managing sleep and working with health professionals. Finally, case stories are provided which present example participants with various chronic health conditions (e.g., spinal cord injury, chronic kidney disease) who demonstrate applying the information and skills from the lessons.

Participants accessed the intervention in an online format, via the eCentreClinic software platform, using a unique username and password. Some participants ($n = 4$) were provided with hardcopy workbook versions of the course materials because their chronic conditions prevented or significantly affected their ability to use the online format. To encourage steady engagement and provide time for participants to integrate and practice skills, course materials needed to be completed in a sequential order (i.e., participants could not view lesson 2 without first completing lesson 1), and materials were released on set days across the course. See online supplementary Table 1a (for all online suppl. material, see www.karger.com/doi/10.1159/000522530) for a summary of the course timetable, content, and skills taught within the Chronic Conditions Course. See online supplementary Table 1b for a description of the treatment components.

Participants were allocated a clinician for the duration of the intervention. All course clinicians were nationally registered psychologists or clinical psychologists, with prior CBT experience. All clinicians were provided with training and orientation to the course and provided with one-on-one weekly and as-needed supervision with a senior clinical psychologist (B.F.D.). Clinicians made weekly contact with participants via telephone or secure messaging. Their role was to support participants to work through the intervention and help participants apply the course skills to their circumstances. Typical areas of clinical support included reviewing course content, encouraging skills practice, monitoring and reinforcing progress, eliciting feedback on the course, and normalising challenges. Alongside clinical contact, participants were sent automatic e-mails throughout the course, which served to inform participants about new content and promote engagement with the course.

Measures

Primary Measures

Primary outcomes were assessed with widely used self-report questionnaires that demonstrate good clinimetric properties [22, 23]. Depression symptoms were assessed using the PHQ-9 [17], a widely used measure to assess the severity of depression symptoms [15]. Items on the PHQ-9 correspond with DSM criteria for major depressive disorder [24], with scores ≥10 indicating the presence of clinically significant depression [25]. PHQ-9 scores also indicate the severity of depression symptoms (scores of 0–4 indicate minimal depression, and 5–9 mild, 10–14 moderate, 15–19 moderately severe, and ≥20 severe symptoms). The PHQ-9 also demonstrates sensitivity to change alongside treatment [26]. Anxiety symptoms were assessed using the Generalized Anxiety Disorder 7-item (GAD-7) [27], which was validated to detect symptoms of general anxiety disorder, and has demonstrated adequate sensitivity to detect all anxiety disorders [28]. Scores ≥8 indicate clinically significant anxiety, while scores of 0–4 indicate minimal anxiety, 5–9 mild, 10–14 moderate, and ≥15 severe anxiety symptoms. Disability was assessed using the 12-item World Health Organization Disability Assessment Schedule 2.0 (WHODAS-12) [29]. The WHODAS-12 was designed and validated for use in patients with health conditions, as a measure of their functioning and disability across six domains (communication, self-care, mobility, interpersonal relationships, life activities, and community participation) [30]. Scores on the WHODAS-12 range from 0 to 48, with higher scores indicating greater disability.

Secondary Measures

The EQ-5D-5L was used to assess health-related quality of life [31]. This is a brief, 5-item measure that that is widely used at a population level [32]. The EQ-5D-5L assesses respondents' health state across five dimensions (mobility, self-care, usual activity, pain/discomfort, and anxiety/depression). Responses on this measure can be compared to population norms and can be converted into utility values for cost-effectiveness analyses [32]. These utility values were calculated using an algorithm for the Australian population [32]. Participants' overall life satisfaction was assessed using the Satisfaction with Life Scale (SWLS) [33]. This is a 5-item measure that assesses life satisfaction. Scores on the SWLS range from 5 to 35, where higher scores indicate greater life satisfaction.

Treatment satisfaction and acceptability was also assessed at post-treatment using a purpose-built questionnaire. Participants' engagement in treatment was also calculated as the number of lessons completed during the intervention period. Participants completed all outcome measures at pre-treatment, post-treatment, 3-month follow-up, and 12-month follow-up.

Table 1. Baseline participant demographic characteristics

	Treatment (n = 326)	Control (n = 350)	Overall (n = 676)
Sex			
Female	292 (90)	310 (89)	602 (89)
Male	34 (10)	39 (11)	73 (11)
Other	0	1 (0.3)	1 (0.2)
Age	48.1±13.6	47.2±12.9	47.6±13.2
<29 years	37 (11)	40 (11)	77 (11)
30–39 years	52 (16)	56 (16)	108 (16)
40–49 years	83 (25)	102 (29)	185 (27)
50–59 years	82 (25)	83 (24)	165 (24)
60–69 years	52 (16)	56 (16)	108 (16)
>70 years	20 (6)	13 (4)	33 (5)
Employment			
Full-time work	58 (18)	59 (17)	117 (17)
Part-time/casual work	78 (24)	118 (34)	196 (29)
Student	44 (13)	37 (11)	81 (12)
Unemployed	73 (22)	54 (15)	127 (19)
Registered disability	78 (24)	79 (23)	157 (23)
Retired	53 (16)	58 (17)	111 (16)
Stay at home parent	31 (10)	27 (8)	58 (9)
Relationship status			
Single	75 (23)	97 (28)	172 (25)
Married/de facto	190 (58)	184 (55)	384 (57)
Widowed/divorced/separated	45 (14)	48 (14)	93 (14)
Education			
Year 12 or less	74 (23)	64 (18)	138 (20)
Trade certificate/apprenticeship diploma	117 (36)	121 (35)	238 (35)
Bachelor's degree	98 (30)	123 (35)	221 (33)
Master's/doctoral degree	37 (11)	42 (12)	79 (12)

Data are presented as n (%) or the mean ± SD.

Statistical Analysis

Sample size was determined based on previous clinical trials of internet-delivered interventions for people with chronic pain and other chronic conditions [12, 18–20]. Specifically, a small-to-moderate between-groups difference (d = 0.40) [12] on the primary outcomes was expected between treatment and WLC; to achieve power = 0.9 at a 0.05 (two-tailed) level of statistical significance, a total sample of 266 was required. However, substantially more participants were recruited to enable future exploratory analyses aimed at identifying potentially important clinical and demographic moderators of treatment engagement and response. The current trial was also funded for a set 5-year period and recruitment of additional participants (i.e., beyond what was required for statistical power) enabled free access to the treatment for the participants who might otherwise not have been able to access treatment. For all analyses, alpha was set at 0.05. No Bonferroni corrections were applied to account for multiple primary outcomes.

Statistical analysis was conducted in SPSS v.25. Firstly, descriptive statistics were calculated regarding baseline demographic and clinical characteristics. Consistent with many existing studies, efficacy analyses were conducted using a modified intent-to-treat approach that excluded participants who never completed the baseline assessment, and those who did not start treatment in the treatment group. The Multiple Imputation procedure was applied to address missing data. Consistent with recommendations [34], the imputation accounted for participants' baseline symptom severity, and the number of treatment modules completed.

Generalised estimation equation (GEE) models were used to examine symptom change over time in the treatment and control group [35]. A gamma distribution with a log link function was specified on account of skewness within the dependent variables [36], along with an unstructured working correlation matrix to account for the different rates of change over time. GEE analyses were conducted for the primary and secondary measures among the treatment and control groups from pre- to post-treatment. To determine whether post-treatment improvements were maintained in the treatment group, all outcomes were examined at the 3- and 12-month follow-up.

Clinical Significance and Deterioration

Using the estimated marginal means from GEE analyses, the average percentage change (and 95% CIs) from pre- to post-treatment was calculated for treatment and control groups, and also calculated at 3- and 12-month follow-up for the treatment group. The proportion of participants achieving a clinically meaningful response, defined as ≥30% and ≥50% improvement in scores at

Table 2. Baseline clinical characteristics

	Treatment (n = 326)	Control (n = 350)	Overall (n = 676)
Primary health condition			
Chronic Pain[1]	168 (52)	178 (51)	346 (51)
ME/CFS	38 (12)	35 (10)	73 (11)
Multiple sclerosis	17 (5)	24 (7)	41 (6)
Ehlers-Danlos syndrome	10 (3)	9 (3)	19 (3)
Epilepsy	12 (4)	2 (1)	14 (2)
Parkinson's disease	6 (2)	7 (2)	13 (2)
Cancer	6 (2)	6 (2)	12 (2)
POTS	2 (1)	10 (3)	12 (2)
Asthma	4 (1)	6 (2)	10 (1)
IBS	6 (2)	2 (1)	8 (1)
Other	78 (24)	94 (27)	174 (26)
Duration of primary condition, years	9.28±8.09	10.51±8.14	9.90±8.12
Number of chronic conditions			
1	59 (18)	67 (19)	126 (19)
2	77 (24)	73 (21)	150 (22)
3	65 (20)	68 (19)	133 (20)
4 or more	125 (38)	141 (40)	266 (39)
Overall self-reported health rating			
Very good	1 (0)	6 (2)	7 (1)
Good	26 (8)	30 (9)	56 (8)
Moderate	116 (36)	123 (35)	239 (35)
Poor	136 (42)	150 (43)	286 (42)
Very poor	47 (14)	41 (12)	88 (13)
Current and past service use			
Ever seen mental health professional	272 (83)	350 (84)	566 (84)
Currently seeing mental health professional	103 (32)	127 (36)	230 (34)

Data are presented as n (%) or the mean ± SD. Participants could endorse more than one primary health condition, if they felt two health conditions were having an equivalent impact on their emotional wellbeing and day-to-day life. ME/CFS, myalgic encephalomyelitis/chronic fatigue syndrome; POTS, postural orthostatic tachycardia syndrome; IBS, irritable bowel syndrome. [1] Chronic pain included the following conditions: inflammatory arthritis, osteoarthritis, fibromyalgia, neuropathic pain, endometriosis, headache/migraine, temporomandibular joint dysfunction, and musculoskeletal pain conditions (e.g., lower back pain).

post-treatment, was calculated for the primary outcomes. The number needed to treat (NNT) was calculated using these clinical outcomes. The rate of deteriorations (defined as a symptom increase of ≥30%, and resultant scores in the clinical range) were also calculated at post-treatment. Generalised linear models were used to compare the proportions of participants reporting improvements or deteriorations in the treatment and control groups.

Subgroup Analysis

Subgroup analysis was conducted among participants based on the baseline severity of the primary outcomes. For both depression and anxiety, the effect size and percentage change were calculated separately for participants reporting mild, moderate, and severe symptoms. For depression symptoms, participants scoring in the "moderately severe" and "severe" range on the PHQ-9 were placed into a single "severe" subgroup. For self-reported disability, treatment outcomes were compared based on participants scoring between 11 and 20, 21 and 30, and ≥31.

Results

Tables 1 and 2 display the baseline demographic and clinical characteristics of the sample (n = 676). No marked differences were observed in the demographic or clinical characteristics of participants in the treatment and control groups. See Figure 1 for participant flow, lesson completion, and attrition.

Adherence and Attrition

Of 326 participants who started treatment, 225 (69%) completed all five lessons within the intervention period. During the intervention, 6 participants in the treatment group formally withdrew; 3 reported extenuating circumstances, 2 found the course unsuitable, and 1 felt they no

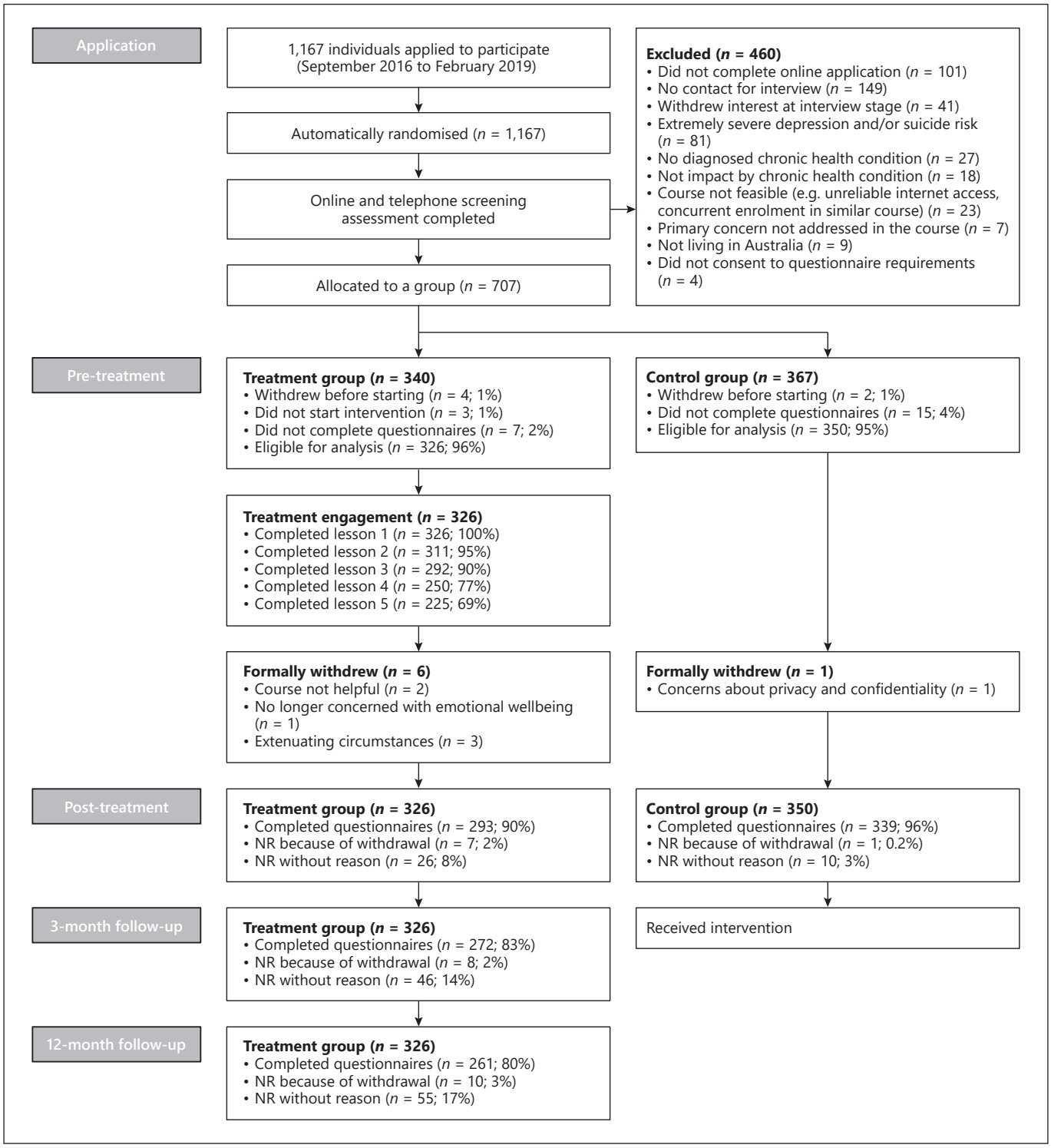

Fig. 1. Participant flow from application to 12-month follow-up.

Table 3. Estimated marginal means and percent improvement for primary and secondary outcomes

	N	Estimated marginal means (SE) of outcome variables							Percent improvement (95% CI)		
		Pre	Post	$P_{between}$	3MFU	$p_{post\ to\ 3MFU}$	12MFU	$p_{post\ to\ 12MFU}$	Post	3MFU	12MFU
Primary outcomes											
Depression											
Treatment	326	12.26 (0.28)	8.65 (0.29)	<0.001	8.81 (0.33)	0.59	8.38 (0.31)	0.38	29 (25, 34)	28 (23, 33)	32 (27, 37)
Control	350	11.36 (0.29)	11.04 (0.28)		–	–	–	–	3 (–2, 8)	–	–
Anxiety											
Treatment	326	8.76 (0.28)	6.39 (0.27)	<0.001	6.17 (0.30)	0.43	5.53 (0.27)	<0.001	27 (21, 33)	30 (23, 36)	37 (31, 43)
Control	350	7.88 (0.28)	7.94 (0.28)		–	–	–	–	–1 (–8, 6)	–	–
Disability											
Treatment	326	22.55 (0.50)	18.84 (0.58)	<0.001	17.95 (0.62)	0.06	17.66 (0.59)	0.01	16 (11, 22)	20 (15, 26)	22 (17, 27)
Control	350	21.05 (0.50)	20.51 (0.51)		–	–	–	–	3 (–2, 7)	–	–
Secondary outcomes											
Satisfaction with life											
Treatment	326	14.17 (0.38)	15.81 (0.40)	<0.001	16.61 (0.45)	0.03	17.04 (0.43)	<0.001	18 (9, 26)	27 (17, 36)	31 (22, 40)
Control	350	14.76 (0.38)	14.97 (0.36)		–	–	–	–	2 (–9, 5)	–	–
Health-related quality of life											
Treatment	326	0.33 (0.02)	0.40 (0.02)	0.04	0.42 (0.02)	0.23	0.43 (0.02)	0.04	20 (9, 30)	26 (15, 37)	30 (17, 35)
Control	350	0.36 (0.02)	0.39 (0.02)		–		–		7 (–16, 3)	–	–

The percentage change from baseline statistics are estimates of relative change derived from the GEE models conducted separately for each outcome. For satisfaction with life, a constant of 5 was subtracted from the total scores when calculating percentage change estimates. 3MFU, 3-month follow-up; 12MFU, 12-month follow-up.

Psychother Psychosom 2022;91:265–276
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Table 4. Rates of clinical improvement ≥30 and ≥50% and effect size (Cohen's *d*)

	≥30% improvement (95% CI)			≥50% improvement (95% CI)			NNT at post-treatment		≥30% deterioration at post-treatment	Between-group Cohen's *d*	Within-group Cohen's *d*		
	Post-treatment	3MFU	12MFU	Post-treatment	3MFU	12MFU	≥30%	≥50%			Post-treatment	3MFU	12MFU
Depression													
Treatment	52 (45, 58)	51 (45, 57)	56 (48, 64)	26 (20, 32)	33 (25, 40)	37 (31, 42)	2.7	4.8	7 (4, 10)	0.47 (0.32, 0.62)	0.72 (0.56, 0.88)	0.66 (0.50, 0.82)	0.76 (0.60, 0.91)
Control	15 (11, 19)	–	–	5 (3, 7)	–	–			11 (7, 14)		0.06 (-0.09, 0.21)	–	–
Anxiety													
Treatment	47 (40, 54)	52 (45, 59)	59 (52, 65)	31 (26, 37)	35 (29, 41)	48 (40, 55)	4.2	5.0	6 (3, 8)	0.32 (0.17, 0.47)	0.49 (0.33, 0.64)	0.52 (0.36, 0.67)	0.68 (0.52, 0.83)
Control	23 (19, 28)	–	–	11 (8, 15)	–	–			16 (12, 20)		−0.01 (−0.16, 0.14)	–	–
Disability													
Treatment	32 (27, 38)	40 (35, 46)	41 (34, 49)	16 (12, 20)	23 (18, 28)	23 (18, 28)	5.3	7.7	4 (2, 7)	0.17 (0.02, 0.33)	0.39 (0.24, 0.55)	0.48 (0.33, 0.64)	0.51 (0.36, 0.67)
Control	13 (10, 17)	–	–	3 (1, 5)	–	–			6 (4, 9)		0.06 (-0.09, 0.21)	–	–

$p < 0.001$ for all between-group comparisons of ≥30 and ≥50% improvements at post-treatment. Deterioration was defined as both symptom deterioration ≥30% and a resultant score in the clinical range. Numbers needed to treat (NNT) calculated using: NNT = 1/ARR, where ARR = CER – TER. ARR, absolute risk reduction; CER, control group event rate; TER, treatment group event rate; 3MFU, 3-month follow-up; 12MFU, 12-month follow-up.

longer needed treatment. One participant in the control group withdrew during treatment, due to concerns about confidentiality.

Primary Outcomes

Table 3 displays the estimated marginal means, standard errors, percentage change, and 95% confidence intervals for primary and secondary outcomes. Table 4 displays the percentage of participants experiencing clinical improvements ≥30 and ≥50%, and effect sizes.

Estimated marginal means revealed larger improvements in depression symptoms from pre- to post-treatment in the treatment group compared to control. GEE analyses revealed a significant group by time interaction at post-treatment ($p < 0.001$, $d = 0.47$). The rates of participants experiencing clinical improvements were significantly higher among the treatment group, compared to controls ($p < 0.001$). At post-treatment, 7% of participants in treatment and 11% of control participants reported a symptom deterioration, and this difference was non-significant ($p = 0.13$). From post-treatment to 3- and 12-month follow-up timepoints, there was no significant effect of time in the treatment group, suggesting treatment-related improvements were maintained.

For anxiety symptoms, a significant group by time effect was also observed ($p < 0.001$), with participants in the treatment group showing significantly lower scores at post-treatment compared to controls. The proportion of participants experiencing clinical improvements was significantly higher among those in treatment compared to controls ($p < 0.01$). Regarding deterioration, 6% in treatment and 16% in control reported symptom deteriorations across the treatment period, which was statistically significant ($p < 0.001$). There was no significant time effect comparing post-treatment to 3-month follow-up scores ($p = 0.43$). However, significant further improvements were observed between post-treatment and 12-month follow-up ($p < 0.001$) for the treatment group.

GEE analyses also revealed a similar pattern of results for self-reported disability, with a significant group by time effect ($p < 0.001$). At post-treatment, a significantly higher proportion of treatment participants reported clinical improvements compared to controls ($p < 0.001$). There was a non-significant difference in deteriorations reported at post-treatment (4% in treatment, 6% in control, $p = 0.06$). There was evidence for improving disability scores at both follow-up timepoints among those in treatment. From post-treatment to the 3-month follow-up, the effect indicating greater improvement failed to

reach significance ($p = 0.06$), while participants reported significantly lower disability scores from post-treatment to the 12-month follow-up ($p = 0.01$).

Secondary Outcomes

There were significant group, time and group by time interactions for both self-reported life satisfaction and health-related quality of life. There was a significant between-groups difference regarding life satisfaction at post-treatment ($p = 0.01$). We also observed significant improvements in life satisfaction from post-treatment to the 3-month follow-up ($p = 0.03$) and 12-month follow-up ($p < 0.001$). Finally, a significant between-groups difference was observed at post-treatment regarding health-related quality of life ($p = 0.04$). These improvements from pre- to post-treatment were maintained at the 3-month follow-up, evidenced by a non-significant difference in scores at the follow-up timepoint ($p = 0.23$). At the 12-month follow-up, participants reported significant improvements on the EQ-5D-5L utility score compared to post-treatment level ($p = 0.04$).

Treatment Satisfaction

At post-treatment, participants reported high levels of satisfaction with the treatment course overall. Of those completing post-treatment questionnaires ($n = 289$), 249 (86%) reported they were "satisfied" or "very satisfied" with the course. Similarly, 86% ($n = 281$) reported the course was worth their time, and 83% ($n = 270$) reported that they would recommend it to others.

Clinician Time

The average total clinician time per participant was 56.70 min (SD = 39.66, range 6–241) over the 8-week treatment period. This comprised of an average of 41.63 min (SD = 41.01) answering and making telephone calls (total number of calls = 2,264, mean = 6.94, SD = 2.91, range 0–14), and an average of 15.06 min (SD = 12.56) reading and responding to secure e-mails (total messages = 1,818, mean = 5.58, SD = 2.53, range 0–12). Almost all participants received both telephone and secure e-mail contact; only 8 received calls only, and 1 received secure e-mail only.

Subgroup Analyses

Online supplementary Table 1 provides estimated marginal means, standard errors, percentage change, and 95% confidence intervals for participants categorized by baseline severity. Similar patterns of findings were observed among participants with differing severity of depression, anxiety, and disability at pre-treatment. For depression, significant between-group effects were observed among those with mild ($p = 0.04$), moderate ($p < 0.001$), and severe baseline symptoms ($p < 0.001$). Similarly, significant between-group effects were observed among participants with anxiety symptoms that were mild ($p < 0.001$), moderate ($p < 0.001$), and severe ($p < 0.001$) at baseline. Among participants whose pre-treatment scores on the WHODAS were 31 or greater, we did not observe a significant effect of treatment ($p = 0.51$). However, among participants scoring between 11 and 20 and between 21 and 30 on the WHODAS, there was a significant effect of treatment ($ps < 0.001$).

Discussion

The results of the current study provide preliminary support for the efficacy and acceptability of an internet-delivered intervention designed to promote psychological adjustment among people with chronic health conditions. The treatment group reported significant improvements in primary outcomes (depression, anxiety, and disability) compared to those in the control group, with improvements maintained or further improving to 3- and 12-month follow-up timepoints. These results were both statistically significant and clinically meaningful. Regarding secondary outcomes, the treatment group reported greater improvements in life satisfaction and health-related quality of life compared to controls. The results also suggest the intervention was acceptable, with good rates of lesson completion and post-treatment satisfaction.

These results extend on preliminary examinations of this intervention, where significant within-group improvements were observed [19–21]. Importantly, the use of a control group in this study means that these improvements can be attributed to the intervention, rather than any other factors like natural remission. These results are also consistent with other RCTs of remotely delivered interventions for people with chronic health conditions that demonstrate significant effects on depression and anxiety [12]. However, this study found significant treatment-related effects for a large sample of participants with diverse chronic health conditions.

The positive findings support the potential of transdiagnostic approaches, and suggests that targeting certain psychological and behavioural mechanisms (through strategies such as cognitive challenging, graded exposure, and activity pacing) may be efficacious within a diverse illness population. The effects observed are similar to

studies which adopt a disorder-specific approach [5, 12]. The current study also found small but significant improvements in disability, which is an important outcome of adjustment to illness. Beyond symptom reduction, the current study also demonstrated improvements to broader outcomes, including life satisfaction and health-related quality of life [37]. It is also noteworthy that these results were achieved with an average clinician time of 57 min (SD = 39) per participant. This further supports the promise of internet-delivered interventions as both efficacious and likely cost-efficient, while also being highly accessible.

Subgroup analyses suggest that participants appeared to experience treatment-related benefits regardless of the initial severity of their depression or anxiety symptoms. Given there are questions about the suitability of remotely delivered treatment for people with severe symptomatology [38], these results suggest that people with severe symptoms can benefit consistent with the broader iCBT literature [39, 40]. It should be noted that there was no evidence of a unique treatment effect among people reporting very high levels of baseline disability. However, it is also important to recognise that for some health conditions it would not be expected that improved self-management would also lead to improvements in disability (for example, among people with progressive conditions).

It is worth noting certain aspects of the participant population, which have implications for the current study and future research. First, a high degree of multimorbidity was observed; 81% of participants reported two or more chronic health conditions, and 39% of participants reported four or more health conditions. People with multimorbidity report significantly greater psychosocial and functional impact [41], and are at twice the risk of depressive disorders [42]. This impact may explain why multimorbidity was particularly prevalent among course participants, as a help-seeking sample. Importantly, this further supports the value of an intervention that is not targeted to a single disorder. However, the high rates of multimorbidity are also a limitation on the results, as they precluded any examinations of efficacy within particular conditions or subgroups. While it is beyond the scope of this study, it is important that future research examines whether the type of chronic health condition affects participants' response to treatment, and therefore whether the results of this study generalise to all chronic health condition groups.

The sample was also predominantly female (N = 602, 89%). It is not clear whether females are at particular risk of poor adjustment to illness, though it may be that rates of emotional distress are higher among females with chronic health conditions, as they are in the general population [43]. Despite this imbalance, 73 men were included in the study, which is a greater absolute number than many existing interventions [12].

The results of this study must also be considered in light of some methodological limitations. As those in the control group were provided with treatment after the 8-week intervention period, it cannot be determined whether the improvements sustained at the 3- and 12-month follow-up are a result of the intervention. In addition, the current study used an inactive WLC, which means that important non-specific treatment ingredients such as attention and expectation could not be controlled for [44, 45]. Due to the nature of the treatment and trial design, it also was not possible to blind participants or clinicians to group allocation. In light of this, and the growing criticisms of inactive WLCs in psychotherapy research [44–46], future studies ought to evaluate the efficacy of interventions with more robust control conditions, including psycho-education, non-specific support, and routine clinical management. Thus, the current findings need to be treated as preliminary and tentative at this point in time.

In conclusion, the findings of the current study provide preliminary and tentative support for the acceptability and efficacy of an internet-delivered transdiagnostic intervention for people with chronic health conditions. High rates of treatment satisfaction were observed, and participants in the treatment group reported significant improvements in depression, anxiety, and disability over and above any improvements seen in the control group. The intervention also resulted in improved health-related quality of life and life satisfaction. Notably, treatment-related improvements were maintained over time. Future research is needed to understand the participant and treatment-related factors associated with treatment efficacy in order to understand the generalisability of the findings and guide efforts to further improve treatment outcomes. Future research is needed to compare these types of intervention to more robust and active control groups and disorder-specific interventions, and to examine the generalisability of findings to different settings and broader groups of people with different chronic health conditions.

Statement of Ethics

This study protocol was reviewed and approved by the Macquarie University Human Research Ethics Committee (ref. 5201600560). Written informed consent was obtained from the participants.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

Blake F. Dear was responsible for conceptualisation and design of the study, registration of the protocol, data collection and curation, clinical contact with participants, statistical analysis, and preparation of the manuscript. Amelia J. Scott was responsible for data collection, statistical analysis, and preparation of the manuscript. Rhiannon Fogliati was responsible for data collection and curation, clinical contact with participants, and review of the manuscript. Milena Gandy, Joanne Dudeney, and Olav Nielssen were responsible for conceptualisation of the study and review of the manuscript. Eyal Karin was responsible for conceptualisation of the study, statistical analysis, and review of the manuscript. Sarah McDonald was responsible for data collection and curation, clinical contact with participants, and review of the manuscript. Andreea I. Heriseanu was responsible for data curation and critical review of the manuscript. Madelyne A. Bisby was responsible for data curation and critical review of the manuscript. Louise Sharpe was responsible for conceptualisation of the study and critical review of the manuscript. Michael P. Jones, Shehzad Ali, and Nickolai Titov were responsible for conceptualisation of the study and review of the manuscript.

Data Availability Statement

Data are available for validation purposes subject to ethical approval from an Australia Human Research Ethics Committee and an appropriate data management agreement.

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