A systematic review of predictors of, and reasons for, adherence to online psychological interventions.

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Abstract

Purpose. A key issue regarding the provision of psychological therapy in a self-guided online format is low rates of adherence. The aim of this systematic review was to assess both quantitative and qualitative data on the predictors of adherence, as well as participant reported reasons for adhering or not adhering to online psychological interventions.

Methods. Database searches of PsycINFO, Medline and CINAHL identified 1721 potentially relevant articles published between 1st January 2000 and 25th November 2015. A further 34 potentially relevant articles were retrieved from reference lists. Articles that reported predictors of, or reasons for, adherence to an online psychological intervention were included.

Results. A total of 36 studies met the inclusion criteria. Predictors assessed included demographic, psychological, characteristics of presenting problem, and intervention/computer related predictors. Evidence suggested that female gender; higher treatment expectancy; sufficient time; and personalised intervention content each predicted higher adherence. Age, baseline symptom severity, and control group allocation had mixed findings. The majority of assessed variables however, did not predict adherence.

Conclusions. Few clear predictors of adherence emerged overall, and most results were either mixed, or too preliminary to draw conclusions. More research of predictors associated with adherence to online interventions is warranted.

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Introduction

Online self-guided psychological interventions is a rapidly growing area, with widely demonstrated efficacy for the treatment of many mental health conditions [1-4] and a growing evidence-base for distress arising from physical health conditions [5, 6]. Online, or web-based, interventions are defined as predominantly self-guided interactive programs that can be categorised into educational, self-guided therapeutic, or human-supported therapeutic subtypes [7]; both self-guided and human-supported therapeutic web-based interventions have the deliberate aim of producing cognitive, affective , and behavioural changes, are typically based on empirically supported face-to-face treatments; and require active engagement from participants (through the completion of web-based worksheets and activities), while the educational subtype typically contains information-only and is considered therapeutically inactive [7]. The benefits of online interventions include their ease of access, cost-efficiency and ability to reach a wide range of users [8, 4, 5]. While a promising avenue for increasing the dissemination of psychological treatments, research has demonstrated that low adherence is a limitation of such interventions [9, 4, 10]. For example, two studies that compared open access with clinical trial sites found completion rates were only 1% and 0.5% respectively [11, 12], when offered in an open access format.

Treatment-adherence, defined as the amount of a therapeutic intervention that an individual engages with or completes [10, 13], has clear clinical implications: poor adherence limits exposure to the full program, or the required 'dosage' of treatment [10]. Given that this in turn may potentially impact on physical / psychological health outcomes [14, 15, 9], understanding the predictors of, and reasons for, low adherence to online psychological interventions is fundamental for the development and provision of more effective online interventions [10]. However, limited data and understanding of the reasons for adherence exist [16]. To date, two reviews have assessed *dropout* from online interventions for psychological disorders [4, 17]; one included minimal data on adherence predictors [17], while the other assessed predictors of dropout but not adherence [4]. Therefore, the aim of this systematic review is to summarise the available quantitative and qualitative data on characteristics that predict adherence, and participant-reported reasons for adhering to online self-help psychological interventions.

Methods

Data Sources

Relevant studies were identified via two methods. First, three electronic databases were searched: PsycINFO, Medline and CINAHL (1st January 2000 - 25th November 2015). Four keyword search strategies

were used: (i) *terms relating to adherence:* "adher*" OR "engage*" OR "attrition"; (ii) *terms relating to internet-based:* "computer-based" OR "internet" OR "online"; (iii) *terms relating to self-help:* "self-help" OR "self-guided" OR "unguided"; and (iv) *terms relating to psychological therapy:* "treatment" OR "program" OR "intervention". Second, the reference lists of relevant articles were screened to identify further eligible articles.

Inclusion criteria

The title and abstract of each citation was analysed according to the following predetermined inclusion and exclusion criteria:

1.	Article was published in an English-language peer reviewed journal between January 2000 and November 2015, and was not a systematic review or meta-analysis.

2.	The intervention involved adults only (aged 18 years or over).

3.	Articles described the characteristics of adherence/non-adherence to an online psychosocial intervention, or reported qualitative data regarding reasons for adherence/ non-adherence. These characteristics were reported as either a primary or secondary outcome, or as a sub-analysis of an intervention efficacy study.

4.	The study involved an internet-based self-guided psychosocial therapeutic intervention targeting psychological outcomes for a mental or physical health condition.

Data Extraction

Data were extracted and recorded onto a coding sheet that incorporated relevant items recommended by the Cochrane Library [18]. The coding sheet included: study citation, authors, date, eligibility, country, study design, duration, aim, participants, target population, age, sex, intervention details, intervention efficacy measures, adherence definitions, adherence measures, adherence outcomes, and adherence predictors/correlates.

Quality assessment

A quality assessment of included studies was conducted, utilising the five criteria for empirically supported psychotherapies outlined by Chambless and Hollon [19]: (i) appropriate study design with control group, (ii) adequate sample size (defined as a minimum of 25 participants per group), (iii) specified target population and inclusion criteria, (iv) use of reliable/valid outcome measures, and (v) appropriate data analysis, defined as addressing missing data or utilising appropriate intention-to-treat analyses.

Data Synthesis

A narrative synthesis of results was utilised. Participants from included studies were either categorised on a continuum of adherence (e.g., high, low, or non-adherers (dropouts)), or dichotomously as 'dropouts'or 'adherers/treatment-completers', depending on the included studies' definitions. Predictors were summarised

into four broad categories: demographic characteristics, presenting problem-related factors, psychological factors, and intervention / computer factors. Within each category, predictors were summarised (i) in decreasing order of evaluation (i.e., number of studies that assessed that factor), and (ii) with quantitative and qualitative data (where available) summarised separately. The following definitions were then used to summarise the evidence base: "yes" if $\geq$ 50% of studies found evidence for the predictor; "no" if $\geq$ 50% of studies found no evidence for the predictor; "unclear" if more than 5 studies assessed the predictor but results were mixed; "inconclusive" if less than 5 studies assessed the predictor.

Results

Review process

A summary of the search and study selection process is outlined in Fig. 1. Electronic database searching yielded a total of 1721 citations (de-duplicated), with a further 34 articles identified through searching relevant reference lists. Titles and abstracts of 1755 articles were assessed, with 1658 excluded. A total of 97 articles were identified as potentially meeting the inclusion criteria, for which full text articles were obtained and reviewed. After assessing the full texts, 61 articles were excluded, resulting in 36 included articles.

Overview of Included Studies

Table 1 summarises the 36 included studies. The majority (n=20) targeted a psychological condition or problem behaviour: depression/anxiety (n = 13); insomnia (n = 5); bulimia nervosa (n=3); social anxiety disorder (n= 3); problem alcohol consumption (n = 2); bipolar disorder (n= 1); body dissatisfaction (n = 1); stress (n= 1); smoking cessation (n = 1); natural disaster survivors (n = 1); and public mental health patients (disorder not specified; n=1). The remaining three studies targeted psychological outcomes relating to a physical health condition: chronic pain (n=1); breast cancer (n = 1); carers of cancer patients (n = 1); and tinnitus (n = 1). Cognitive Behaviour Therapy (CBT) was the predominant model of therapy (n=32); the remaining four studies used Problem-Solving Therapy [21], Acceptance and Commitment Therapy (ACT) [22] or did not specify the therapeutic framework [23, 24]. Females were overrepresented in most studies (n=26), with percentages ranging from 38 – 100%. Countries represented included: Australia (n = 7); United Kingdom (n = 5); Netherlands (n = 5); Sweden (n = 5); USA (n = 3); Canada (n = 3); Ireland (n = 2); Germany (n = 1); Austria (n=1); Spain (n=1); Switzerland (n=1); China (n=1); and Hong Kong (n=1). RCTs were the most common design (n=26); the remaining 10 studies were comprised of: single-group case-series studies [n=4; 25, 26, 21, 27]; open access trials [n=3; 28, 29, 30]; a 3-treatment comparator study [31]; an effectiveness trial [32]; and one prospective cohort study [33]. The total number of participants tallied from the 36 studies included in this review was

102,263, with sample sizes ranging from 13 [25] to 82,159 [29]; open access trials accounted for large participant numbers. The mean age of all participants included in this review was 39.70 years.

There was a high degree of variability in adherence measurement: 28 studies included at least one measure of intervention usage; two studies compared 'adherers' (those who completed the intervention) with 'non-adherers' (those who did not complete the intervention) [31, 34]. Four studies compared program-adherence for participants who completed or did not complete the post-treatment assessment [28, 35, 27, 36]. One qualitative study reported data only from those who did not complete treatment [37], while another qualitative study reported barriers to adherence without providing a measurement-definition. The most commonly used measures of adherence in the quantitative studies included: number of modules / sessions / assessments completed (n = 25); duration of logins or time spent using the program (n = 4); number of logins (n = 2); number of homework assignments completed (n=1); and accessing the program (n=1). One study relied on a self-report adherence measure [13], while 2 studies (10%) did not specify the adherence measure used.

Methodological Quality

A summary of the methodological quality of included studies can be seen in Table 2. Only 13 (36%) of the included studies met all 5 research design criteria specified by Chambless and Hollon [19]. More specifically, 23 studies utilised appropriate control conditions, 33 had adequate sample size (defined by Chambless and Hollon as: n ≥ 25 per group), 32 identified clear participant inclusion criteria, 30 used valid and reliable measures, but only 19 (53%) studies used appropriate data analysis.

Demographic / Personal Predictors

Gender.

Gender was assessed in 22 studies (61%). As Table 3 summarises, while findings overall were mixed, 11of the 22 (50%) found higher adherence in females [29, 23, 38-41, 20, 42, 25, 32, 34]. Of the remaining studies, 10 (45%) found gender did not predict adherence [43, 13, 31, 35, 26, 44, 30, 21, 36, 22], and one found males completed more intervention modules than females [45].

Age.

Twenty studies (55.5%) examined age, with half (n=10, 50%) finding no significant relationship between age and adherence [23, 13, 26, 46, 30, 21, 32, 36, 22, 34]. Of the remaining studies, findings were inconsistent: 5 studies (25%) found older age was associated with higher adherence [31, 35, 40, 33, 20], 4 studies (20%) found younger age was associated with higher adherence [41, 25, 29, 44] and one study [45] obtained mixed findings within their analysis: although older age was associated with three adherence indices

(e.g. more time spent online, more logins, and more activities completed), there was no significant relationship between age and treatment completion overall. As Table 1 summarises, it should be noted that the five studies which found adherence increased with 'older' age had a mean-age range of 23-46 years, while the four studies of 'younger' age had a mean-age range of 39 to 49 years.

Five studies evaluated specific age brackets and adherence: three found that their middle-aged participants (i.e., aged >25/30/40 years respectively) had higher adherence than younger-adult participants [20, 31, 40]; one study found that middle-aged participants (*M*=48 years) had higher adherence than older-adult participants [56 years; 25]; with only one study finding that participants younger than 30 years were the most likely to complete 2 or more modules [29].

Level of education.

Education level was assessed in 18 studies (50%), with the majority (n=12; 67%) finding no significant relationship [43, 31, 20, 25, 26, 46, 21, 32, 36, 22, 34, 47]. Five studies (28%) found higher education was associated with higher adherence [40, 41, 29, 44, 30]. In contrast, one study found lower education was more than twice as likely to lead to higher adherence than higher education [38].

Marital status.

Marital status was examined in 12 studies (33%), with 10 (83%) finding the relationship not significant [43, 45, 25, 26, 46, 44, 21, 32, 22, 34]. The remaining two studies found being partnered was associated with higher adherence [41, 30].

Employment.

Eleven studies (30%) assessed the relationship between employment status and adherence; none found a significant relationship [43, 25, 26, 46, 41, 44, 30, 21, 32, 22, 34].

Ethnicity / Geographical location.

Seven studies (19.4%) explored geographical location or ethnicity as a predictor of adherence, however as each study used a different definition or measure conclusions cannot be drawn. On a global level, one study found community users located in the Oceania region or Europe were significantly more likely to complete modules than users in North America, Asia, Africa or South America [29]. Within Ireland or Australia, no differences were found between treatment completers and non-completers in terms of urban or rural location [25, 30, 34]. In the USA or the Netherlands, no differences in adherence occurred based on ethnicity/race [40, 22]. Donkin et al. [45] similarly found no relationship between ethnicity (measured by country of birth) and treatment adherence.

Personal predictors.

Six qualitative studies (17%) all found *time-related factors* influenced adherence: 'lack of time' or 'being too busy' was cited as a reason for low adherence in five studies [25, 37, 39, 20, 48], while the ability to engage with the intervention in their own time was cited by participants as a reason for increased adherence in one study [41]. *Privacy* was reported as an issue in two qualitative studies (9%): Participants' reported discomfort that others could see what they were doing [41], or that a lack of privacy hindered completion of activities [37]. Lastly, one qualitative study cited *unrelated personal reasons* as the most common reason for non-adherence [42].

Characteristics of the Presenting Problem

Baseline symptom severity (BSS).

BSS was assessed in 26 studies (72%), with half (n=13; 50%) finding it was unrelated to adherence [23, 43, 13, 31, 35, 33, 20, 26, 46, 49, 32, 34, 50]. Of the remaining studies, six found lower BSS predicted higher adherence [41, 44, 30, 21, 27, 51]; one found lower BSS predicted increased module completion but not other adherence measures [45]; and one qualitative study found that participants' depression itself formed the barrier to adherence due to difficulties with motivation and concentration [48].In contrast, five studies found higher BSS predicted higher adherence [25, 29, 24, 36, 47], with three of these studies being specific to insomnia.

Duration of problem.

Six studies (17%) assessed presenting problem duration, with results being mixed / inconclusive: three (50%) found longer duration predicted higher adherence [29, 31, 25]; the remaining three did not find a significant relationship [26, 32, 22].

Psychiatric Diagnosis.

Six studies (22%) examined whether having a formal psychiatric diagnosis predicted adherence: having a diagnosis of depression / anxiety was unrelated to adherence in four studies [31, 32, 36, 22]. Of the remaining two studies, having psychiatric comorbidity significantly predicted reduced adherence in one study of insomnia patients [24], while a diagnosis of alcohol dependence significantly predicted higher adherence among control participants in the second [42].

Referral source.

Three studies (8%) assessed whether referral source impacted adherence: two found that referral by a health professional (e.g., GP) predicted higher adherence than referral from other sources [20, 29], while a third

found that being referred via the media predicted higher adherence [30]. However, the paucity of studies examining this predictor means it is premature to draw conclusions.

Medications/alcohol.

Three studies (8%) examined whether medication usage or alcohol intake (excluding the studies that specifically targeted alcohol use disorders) predicted adherence: none of the studies found a significant relationship [30, 36, 22].

Improvements in condition.

One quantitative study examined the effect of mid-treatment changes in depression and anxiety on adherence [29]: either improvements or no changes in symptoms during the intervention significantly predicted module completion, compared to those whose condition deteriorated [29]. In contrast, two qualitative studies found that non-adherence in the intervention group was related to having experienced improvements in the presenting condition, with participants stating they felt sufficiently helped [20, 42]. Overall, there is insufficient evidence to draw conclusions.

Psychological Predictors.

Expectancy.

Nine studies (25%) examined treatment credibility (n=6) and/or treatment expectancy (expectation of efficacy, n=3) as predictors; 7 found significant associations with increased adherence [38, 13, 43, 28, 49, 21, 32], while two studies of insomnia-programs found no significant relationship [36, 47].

Motivation & Readiness to Change.

Seven studies (19%) assessed motivation related characteristics. Three assessed motivation/readiness to engage in therapy: twofound treatment readiness significantly predicted treatment completion [42, 30]; the other found no significant relationship [23]. Motivation/intention to complete treatment was examined in four studies; two found motivation significantly predicted adherence [44, 24], while the other two studies did not [40, 33].

Self-Efficacy/Self-Confidence.

Four studies (11%) examined whether self-efficacy or self-confidence predicted adherence: three did not find a relationship [30, 32, 24]; while the fourth found that 'self-directedness', or taking responsibility for one's own choices and having confidence in solving problems was associated with higher adherence to a bulimia self-guided program [52].

Intervention & Computer Related Predictors.

Computer factors (literacy, technical difficulties).

The impact of computer-related factors on adherence was described in 12 studies (n=7 quantitative, n=5 qualitative; 33%). Quantitatively, one study found 8% of non-adherers had difficulty with the website [39]; consistent with two studies that found higher adherence was associated with website usability-ratings [21], and having a positive attitude to computerised self-guided as a format [30]. In contrast, four studies did not find an association between computer literacy/attitudes and adherence [28, 31]. Qualitatively, a more consistent picture emerged: poor computer literacy contributed to intervention non-adherence in one study [41]; 14% of participants dropped out of the intervention due to computer or internet related problems (e.g. internet got cut off, computer broke) in another study [26]; and participants in three studies found the computer format too stressful or error-ridden [41, 25, 48]. Overall, computer factors appear to have a significant impact on adherence.

Guidance.

The influence of guidance or therapist-support on program adherence was evaluated in nine studies (eight quantitative and one qualitative), with six studies finding evidence of a relationship: Four quantitative studies (80%) found increased adherence for their guided interventions when compared to unguided versions [53, 49, 20, 50]; a fifth found phone support led to higher adherence than email support, although they did not utilise an unguided comparison group [33]; and three did not find a significant relationship [32, 54, 47]. Qualitatively, lack of human contact or feedback was associated with low adherence [41].

Program content.

Nine studies (25%: n=2 quantitative, n=7 qualitative) evaluated the impact of program content factors (i.e., therapy type, tailoring of content) on adherence. Quantitatively, one study found a gratitude intervention group was twice as likely to complete treatment than a monitoring and restructuring intervention group [13]. Another study varied intervention content systematically and found that increasing (i) the depth of tailored feedback to increase self-efficacy, and (ii) the personalisation of the intervention team (e.g. including a photo and words like "we"), significantly increased treatment adherence among participants who accessed all intervention components simultaneously [40].

Qualitatively, intervention content being perceived as helpful was a motivator for higher adherence in one study [41], and perception of the intervention being beneficial increased adherence in another study [26]. Negative perceptions of intervention content were also cited as reasons for low adherence, with the most commonly cited reason being that the online intervention was too 'impersonal' or not relevant to one's personal experience [n=6; 39, 37, 41, 20, 25, 48]. Other cited negative perceptions that contributed to low adherence

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included: finding the overall program content 'unhelpful' among 15% of non-adherers [39]; having negative experience with specific components [41, 48], being 'too intensive' for 10 participants who discontinued [42, 26]; 'too extensive' or 'delivered too fast' [37]; 'too general' or 'too limited' [20]. Program content therefore appears to have a significant impact on adherence.

Group membership.

Group membership was assessed as a predictor of adherence in seven studies (19%), with findings being mixed / unclear: Three (43%) found *control group* membership significantly predicted higher adherence than intervention group membership [23, 13, 37], with two of these studies utilising a waitlist-control methodology [37, 13]. Of the remaining four studies, one study found those in the *intervention group* were twice as likely to adhere than those in a control group [38]; one qualitative study found that being in the *intervention group* facilitated adjustment [48]; and two studies reported that intervention group membership was not significantly related to treatment adherence [43, 31].

Discussion

This review critically evaluated the literature on predictors of adherence to online psychological interventions. Significant quantitative predictors of increased adherence included female gender, higher treatment expectancy / credibility, and having guidance. While age and control group membership may also be predictors of adherence, the direction of these relationships are unclear. Qualitatively, not having enough time, dissatisfaction with program content, perceiving content as impersonal and computer difficulties were found to decrease adherence. For the large remainder of evaluated predictors, evidence indicated either no relationship, or was too mixed/insufficient to draw conclusions.

Female gender was the only clear demographic predictor of increased adherence. This is consistent with research on adherence to other online health interventions [55, 56], and broader research on health behaviours indicating that women are more likely to engage in health related behaviours than men [57, 38]. This contrasts with face-to-face psychological therapy, where males were more likely to adhere [58], and suggests gender preference differences in the format of psychological therapy.

Consistent with the established literature on medication-adherence in health-based interventions [59], and psychological treatment-adherence for substance use [60, 61], the current review found higher treatment expectancy or credibility predicted increased adherence. Given that low treatment expectancy has also been associated with decreased uptake of a self-guided intervention [62], this provides an avenue for improving

adherence: tailoring the information provided to prospective users in order to enhance treatment expectancy and credibility ratings.

The current finding that increased levels of guidance or support via phone or email led to increase adherence is consistent with other internet intervention studies targeting both clinical (distressed) samples, and non-clinical samples [63, 55]. Possible explanatory mechanisms include: guided support might increase motivation to participate [41], or increase accountability to adhere [33]. Some researchers have posited that the isolated nature of online interventions make it easier for participants to disengage [64], and many people report finding self-motivation to engage with online interventions difficult [65, 41], therefore guided support helps to overcome these participation barriers. This must be balanced against the qualitative findings in this review that suggested some participants have a preference for the anonymity and freedom of using an unguided intervention. This indicates that while guidance overall is beneficial, adherence will still be influenced by personal preferences.

Further to the key quantitative predictors identified, qualitatively, this review found consistent evidence that lack of time, computer issues, and dissatisfaction with program content (such as finding content impersonal or irrelevant), decreased adherence. This is consistent with evidence that positive responses to intervention content predict adherence to face-to-face psychological therapy [58]. Matching participants to self-guided CBT resources is an important aspect of treatment success [66], and participant satisfaction with an intervention will often impact on adherence [67].

One of the most commonly explored predictors, for which the evidence was mixed, was age: There were an almost equal number of studies finding either older age or younger age related to higher adherence, while a similar number of studies found no relationship. These seemingly discrepant findings may be explained by how 'younger' versus 'older' age was operationalised in the included studies: that is, the mean-age range of the 'older' and 'younger' participants in the included studies, who had higher adherence rates, actually fell in the same age bracket; middle-aged. Therefore the relationship between age and adherence may simply follow a normal distribution curve, with both younger-adults and much older participants being less likely to adhere. This hypothesis could be formally testsed in future studies.

Another quantitative predictor with mixed evidence in this review, control group membership, has also been reported consistently in trials of online interventions [17]. This is likely due to (a) the minimal demands on participants, and (b) the potential promise of receiving treatment at the conclusion of the study for those in the waitlist-control or delayed access conditions. Indeed, it is a well-established limitation of waitlist-control

conditions that participants are less likely to seek out other treatment options, compared to usual care, due to the promise of treatment to come [68]. These combined findings can help to inform future intervention development, as it speaks to the necessity of utilising web-based controls, and of balancing therapeutic dosing against content-brevity; while modules must contain sufficient detail to be therapeutic and address the presenting problems, this effect will be lost if the burden of participation leads to disengagement. It is notable that two of the other most commonly assessed predictors, baseline symptom severity and education, failed to demonstrate significance. This is commensurate with findings that baseline symptom severity is unrelated to attrition, as well as adherence, to online interventions for either mental or physical health conditions [44, 69, 70, 4, 55]. In terms of education, it has been suggested that higher education predicts higher online intervention uptake [71], however the majority of studies in this review indicated education was not significantly related. Additional characteristics that failed to demonstrate a significant relationship with adherence included marital and employment status. This is not surprising however, as these demographic predictors often unrelated to adherence [17]. For the remaining predictors assessed in this review, there was minimal data available with many being assessed in less than 5 studies. Therefore, more research is required to determine the impact of these predictors on adherence to online interventions.

The field of adherence research has some clear limitations. Only one-third (n=13) of the included studies met the full criteria for appropriate research design [19]. Many studies relied on small sample sizes and were underpowered, limiting their ability to detect statistically significant effects. Studies commonly failed to address missing data and did not utilise appropriate data analysis strategies to account for this. There was also marked heterogeneity of study methodologies and definitions: adherence research would benefit from consistent adherence measures that account for depth of exposure to intervention content, such as the completion of modules or exercises. It is also important to note the interventions assessed in this review ranged in length from a single exposure to 24 weeks. The length of intervention itself could account for variation in adherence; however this was not assessed in any of the included studies. Predominantly, research on adherence to date has focused on quantitative predictors, and the contribution of qualitative research in this review was minimal. Given the emerging nature of this field of research, qualitative studies are required to provide a more comprehensive and deeper understanding of the contributing factors that influence participant adherence. It should also be noted that this review focussed specifically on self-guided psychological interventions. While some inferences can be drawn on how these predictors might apply to all online interventions, one cannot

assume that findings from this review will generalise to adherence to behavioural, medical, or support-group online interventions.

In light of these limitations, and the findings from this review, a number of recommendations for future studies on monitoring adherence can be derived: (a) use multiple measures of adherence, in order to either create a composite measure or gain a deeper understanding of how these programs are used and viewed. Many of the included studies only compared treatment-completers with drop-outs, rather than evaluating a range of adherence measures, including: number of logins, login duration, modules completed, homework tasks completed, self-report adherence measures, or pages viewed; (b) routinely supplement quantitative with qualitative analysis of reasons for attrition and adherence; (c) carefully consider the methodological framework to be adopted: studies need to be appropriately powered, and use web-based control comparators where possible, as these control for treatment-expectancies and demand effects, where waitlist control and treatment as usual do not [68]; and (d) consider the sex and age of the sample to be recruited, as both appear to influence adherence. While it is premature to state that these programs are not appropriate for men, the elderly or young-adults, there may be additional barriers for these populations that need to be addressed. Whether these factors similarly influence *uptake*, as well as *adherence,* remains to be determined. While guidance shows promise for increasing adherence, further research is required prior to routinely incorporating this into treatment programs, as it remains as yet unknown for whom guidance benefits most, and what level of guidance is optimal.

In summary, this review found female gender, having guidance or support, having sufficient time, higher treatment expectancy, and higher satisfaction with intervention content to predict increased adherence. Baseline symptom severity, level of education, marital status, and employment status were unrelated to adherence. Age and control group membership had mixed evidence, and require further studies to clarify the directions of relationships. Evidence for all other predictors was too limited to draw conclusions. These results may begin to inform clinical practice in the area of online psychological therapy, enabling the tailoring of programs to increase adherence and subsequent treatment outcomes.

Declaration of Conflicting Interests

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┌─────────────────────┐     ┌─────────────────────┐
│ Records identified  │     │ Records identified  │
│ through electronic  │     │through reference    │
│ databases (N = 2216)│     │ lists (N = 34)      │
└─────────────────────┘     └─────────────────────┘
          │                            │
          ▼                            │
┌─────────────────────┐                │
│ Duplicated articles │                │
│ removed (N = 495)   │                │
└─────────────────────┘                │
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┌──────────────────────────────────┐     ┌─────────────────────┐
│ Article titles and abstracts     │────▶│ Excluded (N = 1658) │
│ screened for inclusion (N = 1755)│     └─────────────────────┘
└──────────────────────────────────┘
          │
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┌──────────────────────────────────┐
│ Full-text articles assessed for  │────▶
│ eligibility (N = 97)             │
└──────────────────────────────────┘
          │
          ▼
┌──────────────────────────────────┐
│ Articles included in the review  │
│ (N = 36)                         │
└──────────────────────────────────┘
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Full-text articles excluded (N = 61):
- Didn't report characteristics (n= 29);
- Not psychosocial intervention (n= 12);
- Support group only (n= 5);
- Not online (n = 4);
- Insufficient detail (n= 3);
- Uptake only (n= 2);
- not adults (n = 2);
- Face-to-face intervention only (n= 1);
- Systematic review (n= 1);
- not available in English (n=1);
- not adherence (n=1)

Figure 1. Study selection process.

Table 1

Summary of Characteristics of Included Studies

Author (Year, Country)	Study Design	Population, Setting	Intervention	Definitions/Measures of Attrition / Engagement	Outcomes*
Quantitative					
Al-Asadi et al. (2014) [30]	Open Trial	Population: anxiety disorders (GAD, SAD, OCD, PTSD, PD) N=9394 Mean age: males 38.43 (SD = 12.23), females 35.81 (SD=11.87) % female: 68.58 Country: Australia	Model: CBT Format: Online Duration: 12 weeks Guidance: unguided or guided (optional. Only n=105 of 3880 opted for guided)	Definition: 'pre-treatment attrition' = completed baseline, but did not enrol/commence treatment program (ie., 0 modules / non-user); 'withdrawers' - formally withdrew during treatment; 'non-withdrawers' – did not formally withdraw from treatment. Measures: accessing a treatment-program	Adherence: n=5514 (58.7%) completed 0 modules (ie., did not access program at all) and n=3380 commenced treatment (41.3%); n=142 formally withdrew (4.25%) and n=3199 did not withdraw. Sig. predictors of adherence (commencing treatment): ↑ interest in online program (OR: 2.9, CI: 2.65-3.18), ↑ education (OR: 1.29, CI: 1.10-1.52); media as referral source (OR: 1.35, CI: 1.14-1.59), ↑ readiness for change (preparation OR: 2.16, CI: 1.31-3.58;, action OR: 2.21, CI: 1.33-3.67; and relapse OR: 2.29, CI: 1.36-3.85) , ↓QOL (OR: 1.92, CI: 1.40-2.63); marital status (partnered/married, OR: 1.55, CI: 1.05-2.27); learning preferences (reading, OR: 1.18, CI: 1.06-1.34) , non-smoker (OR: 1.19, CI: 1.06-1.34). Sig. predictors of non-usage (0 modules): weight/eating disorder concerns (OR: 0.7, CI: 0.18-0.50), ↑distress (OR: .97; CI: 0.95-0.98) Sig. predictors of 'completing' (not withdrawing): ↑ anxious (OR: 2.34, CI: 1.38-3.98) ↑stressed (OR: 2.59, CI: 1.09-6.13), ↑ depression (OR: 2.30, CI: 1.09-4.86); ↓QOL (OR: 2.62, CI: 1.33-5.15); ↑social support (OR: 1.70, CI: 1.16-2.49); ↑readiness for change (preparation OR: 1.96, CI: 1.09-3.53; action 2.32, CI: 1.23-4.38). Non-sig. predictors: gender, age, employment status, self-efficacy, rural/urban setting, alcohol.
Batterham et al. (2008) [29]	Open Trial	Population: Depression & Anxiety N = 82,159 Mean Age: not reported (54% users < 35 years old) % female: 66 Ethnicity: Worldwide Country: Australia	Model: CBT Format: Online Duration: 5 modules Guidance: not specified	Definition: "no show" (non-user) = 0 modules, "early dropout" = 1 module, "late dropout" = 2+ modules Measures: no. modules completed, months duration of site use, no. exercises completed, time spent on first module, time spent on all modules.	Adherence: 63% = 0 modules complete, 27% = 1 module complete, 10% = 2+ modules complete. Sig. predictors of 2+ module completion: ↑ education (bachelor degree OR = 0.89, 95% CI = 0.82-0.96), ↓ age (aged ≤ 19 yrs OR = 1.61, 95% CI = 1.41-1.84), located Europe (OR = 1.08, 95% CI = 1.02-1.15) female (males OR = 0.94, 95% CI = 0.89-1.0), referral by health professional (OR = 1.32, 95% CI = 1.23-1.41), history of marked depression (OR = 1.05, 95% CI = 0.97-1.14), ↑ baseline severity (*d = 0.15*), ↑ anxiety (*d=*

					0.11) & ↑ dysfunctional thinking (d= 0.15)[a], improved condition, no change in condition. Sig. predictors across all adherence measures: ↑education, ↓ age, ↑ depression severity, ↑dysfunctional thinking.
Berman et al. (2014) [21]	Feasibility study (uncontrolled)	Population: Depression N=29 Mean Age: 53.0 (SD=12.6) % female: 58 Country: USA	Model: Problem Solving Therapy Format: Online Duration: 6 sessions over 9 weeks Guidance: 'virtual therapist' – simulation, no human guidance	Definition: 'full treatment completer' = 6 sessions; 'treatment completer' = 4+ sessions (i.e., received 'minimally adequate dose'), 'drop-out' = <4 sessions. Measures: no. modules completed.	Adherence: n=21 (72%) completed full treatment, n=23 (87%) 'treatment completer', n=6 (13%) dropout. Sig. predictors of adherence: non-completers – ↑ baseline depression; ↓ self-rated impairment (SF-36 role emotional), ↓program acceptability, ↓program usability, ↓ treatment credibility. Non sig. predictors of adherence: age, gender, marital status, employment, income, education, SF-36 physical function, SF-36 social function, anxiety, therapeutic alliance.
Bewick et al. (2010) [23]	RCT: Immediate access, delayed access, assessment only control	Population: Alcohol consumption N = 1112 Mean Age: 21.45 (SD = 5.19) % female: 73 Country: UK	Model: Not specified Format: Online Duration: 24 weeks Guidance: Self-guided with online personalised feedback	Definition: "nonassessment completers" = btwn 2-4 assessments, "completers" = all 5 assessments. Measures: No. of assessments completed.	Adherence: 26% completed all 5 assessments, 74% completed btwn 2-4 assessments. Sig. predictors of adherence: female (OR=2.10, 95% CI = 1.48-2.97), control group assignment (immediate intervention OR = 2.52, 95% CI 1.80-3.53; delayed intervention OR = 3.47, 95% CI 2.49-4.85). Non sig. predictors of adherence: age, baseline alcohol consumption, education institution and readiness to change.
Boettcher et al. (2013) [43]	RCT: structured diagnostic interview, no interview	Population: Social Anxiety Disorder N = 109 Mean age: 36.2 (SD = 11.97) % female: 55 Country: Germany	Model: CBT Format: Online Duration: 5 sessions/ 10 weeks Guidance: Unguided	Definition: "Completers" = finished post-assessment data, "non-completers" = did not provide post-assessment data. Measures: adherence composite = total time spent using program + number of modules completed + % self-help material completed	Adherence: 37.6% did not complete post-assessment data. Sig. predictors of adherence: ↑expectancy (R^2 $change$= 0.07). Non sig. predictors of adherence: baseline symptom severity, intervention group assignment, gender, marital status, employment status, education, baseline social anxiety severity, expectancy.
Carrand et al. (2006)[27]	Feasibility study, single arm	Population: Bulimia Nervosa n=41 in current Swiss sample analysis (*N=141 total, multi-country sample*), Mean age: 26.2 (SD: 4.44) % female: 100 Country: Switzerland	Model: CBT Format: Online Duration: 7 steps over 4 months Guidance: guided	Definition: 'completed treatment' (completed post-treatment evaluation) vs 'early dropout' (dropped out in first 2 months) vs 'drop-out' (did not complete post-treatment evaluation) Measures: Number of modules completed.	Adherence: 64% completed treatment; 36% (16/41) dropout; 24% (11/41) 'early' dropout. Sig. predictors of dropout: ↑disorder severity (more binges: (Z =−2.731, p = .006), more vomiting: (Z =−2.564, p = .010)) Non-sig. predictors of adherence: baseline distress, patient history, user acceptance.
Cavanagh et al. (2009) [28]	Open trial	Population: Depression & anxiety N = 219	Model: CBT Format: Computer -based	Definition: Completers = finished all 8 sessions, noncompleters = did not complete all 8 sessions.	Adherence: 60% completed intervention, 40% of those did not compete post-treatment assessment, 38% of total sample completed

PREDICTORS OF ADHERENCE TO PSYCHOLOGICAL SELF-HELP

Study	Design	Population	Intervention	Definition & Measures	Results
		Mean Age: 44 (SD = 12). % female: 60 Country: UK	Duration: 8 sessions (8 wks) Guidance: Unguided	Measures: Number of sessions completed.	post-treatment assessment. Sig. predictors of adherence: ↑perceived treatment credibility (d = 0.50)[b] Non sig. predictors of adherence: attitudes to CCBT
Donkin et al. (2013) [45]	RCT: credo, iCBT, attention control	Population: Depression N = 562 Mean Age: 57.39 (SD = 6.5: persisters), 57.68 (SD = 7.1: nonpersisters) % female: 62.1 (persisters), 60.6 (non persisters) Country: Australia	Model: CBT Format: Online, open access Duration: 12 modules Guidance: Not specified, unguided likely	Definition: "persister" = completed post intervention data, non "persister" = did not complete post intervention data. Measures: % modules completed, % activities completed, no. logins, total no. activities completed, time spent on program, avg. activites completed per login, avg. mins per login, avg. modules completed per login, combined modules/activities measure.	Adherence: 76.4% of total sample completed post-assessment data, of those: 62.1% completed all modules, 79% completed 10+ modules, 1% completed no modules. Sig. predictors of time online/logins/activites completed: ↑ age (ρ= 0.27 for time online; ρ= 0.19 for logins, ρ= 0.16 for activities completed)[c]. Sig. predictor of module completion: male[d], ↓ baseline symptom severity (ρ= -0.141) Non sig. predictors of all adherence measures: gender, baseline symptom severity, age, sex, country of birth, marital status, baseline depression severity
El Alaoui et al. (2015) [32]	Prospective effectiveness trial, single-arm	Population: Social anxiety disorder N=764 Mean age: 32.51 (SD=8.98) % female: 46 Country: Sweden	Model: CBT Format: Online Duration: 10 modules/weeks Guidance: guided	Definition: 'high' - one standard deviation above mean no. modules completed, 'low' – one standard deviation below. Measures; module completion	Adherence: s1 (88%); s2 (90%), s3 (87%), s4 (86%), s5 (80%), s6 (76%), s7 (75%), s8 (71%), s9 (70%), s10 (66%). Sig. predictors of *high* adherence: treatment credibility (b=.72), family history of social anxiety (b=.35). Sig. predictors of *low* adherence: ↑ADHD-like symptoms (b=-.56), male gender (b=-.42), family history depression (b=-.28), therapist-time per module (b=-1.01). Non-sig. predictors: age, education, employment, marital status, having children, baseline SAD severity, problem-duration, psychiatric diagnoses, age of onset, self-efficacy, medications.
Farrer et al. (2014) [44]	RCT: 4 groups, intervention, intervention + phone reminders, phone only, control.	Population: Depression N = 83 in substudy (N = 155 total) Mean Age: 39.7 (SD = 12.2)). % female: 68 Country: Australia	Model: CBT + psychoeducation Format: Online Duration: 6 weeks Guidance: Unguided	Definition: Adherence measured as continuous outcome. Measures: No. of modules completed (0-6).	Adherence: 16.9% (14/83) of substudy sample completed intervention, 107 (69 %) completed post-intervention survey, 92 (59 %) completed 6 month follow-up survey, 57 (37 %) completed 12 month follow-up survey. Sig. predictors of adherence[d]: ↓ age, ↑ education, ↑ motivation, ↓ baseline depression symptoms. Non sig. predictors of adherence: gender, employment status, marital status
Fernandez-Aranda et al. (2009) [51]	Controlled study (non-randomized), 2 groups, intervention, WLC	Population: bulimia nervosa N=62 Mean age: 23.7 (SD=3.60) % female: 100 Country: Spain	Model: CBT Format: Online Duration: 4 months Guidance: guided	Definition: 'dropout' – discontinued within first 8 weeks of program, Measures: Module completion.	Adherence: 25% dropped out in first month, 7% in second month, 3% third month, 10% after week 12. Cumulative of 35.5% drop out by week 8. Sig. predictors of dropout: ↑

					anxiety (OR 4.26, 95% CI: 1.03 to 17.65), ↓hyperactivity (OR: 0.12, 95% CI: 0.01 to 1.24), ↓minimum BMI (OR: 0.63, 95% CI: 0.36 to 1.11), ↓ reward-dependency (OR: 0.72, 95% CI: 0.51 to 1.01).
Geraghty et al. (2010) [13]	RCT: 4 groups, gratitude, monitoring/ restructuring, WL gratitude, WL monitoring /restructuring.	Population: Body dissatisfaction N = 479 Mean age: 36 (SD = 10) % female: 95.6 Country: UK	Model: CBT / other Format: Online Duration: 14 days Guidance: Unguided	Definition: "Dropouts" = did not complete post intervention data, "completers" = provided post intervention data. Measures: self-reported adherence (single item measure)	Adherence: 62% total sample dropped out, 75% from treatment groups, 48% from waitlist control. Sig. predictors of adherence: ↑ internal locus of control (OR = 1.08, 95% CI = 1.0-1.15), ↑ expectancy (OR = 1.39, 95% CI = 1.0-1.91), intervention content (gratitude group more likely to adhere, OR = 2.13, 95%CI = 1.14-3.96), waitlist group [d], Non sig. predictors of adherence: intervention difficulty, age, gender, baseline severity.
Hasson et al. (2010) [38]	RCT: 2 groups, intervention, control	Population: Stress N = 308 Mean Age: not specified (26% < 30 yrs, 38% 31-45 yrs, 36% > 46) % female: 38 Country: Sweden	Model: CBT Format: Online Duration: 12 months Guidance: Unguided	Definition: "Low users" = completed screening tool < 60 times over 12 mths, "High users" = completed screening tool > 60 times over 12 mths. Measures: frequency of replying to the screening tool during a 12-month period.	Adherence: mean no. replies to screening tool over 12 mths = 32.1 (range 0-214). Sig. predictors of adherence: intervention group membership (OR=2.02 , 95% CI=1.09–3.75), female (OR= 1.87, 95% CI = 1.01–3.46), ↓ education (highschool only) (OR = 2.28, 95% CI =1.20–4.34), ↑ expectancy (OR = 1.02, 95% CI = 1.01–1.03).
Herbert et al. (2010) [24]	RCT: 2 groups, intervention, WLC	Population: Insomnia N=94 Mean age: not reported % female: 62 Country: Canada	Model: not stated (likely CBT) Format: Online Duration: 5 weeks Guidance: unguided	Definition: attrition = loss of participants who had completed at least one module of the online program (0=completer; 1=dropout) Adherence = practice of homework assignments 4x per week. Measures: No. modules completed, homework assignment completion	Adherence: 83% treatment completers Sig. predictors of adherence: ↑ perceived behavioral control, ↑ social support, ↑intention to complete program. Sig. predictors of attrition: ↓ symptom severity (higher total sleep time), ↑ psychiatric comorbidity (e.g., depression, GAD).
Ho et al. (2014) [54]	RCT: 3 groups, guided (G); unguided (U); WLC	Population: insomnia N= 312 Mean age: 38.5 (SD:12.5) % female: 71.2 Country: China	Model: CBT Format: Online Duration: 6 weeks Guidance: Unguided vs guided	Definition: continuously measured. Completed session(s) 1; 2; 3; 4; 5; and completed treatment = 6 sessions. Measures: objective - number of sessions completed; self-report - number of sessions read, duration of program-use, compliance with instructions	Adherence: completed s1 94% / 95% (G/U); s1&2 84%/93% (G/U); s1-3 79%/82% (G/U); s1-4 71%/74% (G/U); s1-5 67%/69% (G/U); completed treatment 64%/66%). Attrition: cumulative attrition rates over 6-week treatment period in the G, U and WLC groups were 35.9%, 33.7%, and 32.4% respectively. Non sig. predictors of adherence: guidance
Lancee et al. (2013) [53]	RCT; 2 groups, support vs no support	Population: Insomnia N = 262 Mean Age: 48.3 (SD = 12.5) % female: 75.2 Country:Netherlands	Model: CBT Format: Online Duration: 6 weeks Guidance: Unguided vs guided	Definition: Completed = finished 6 modules, adequate dose = completed 4+ modules. Measures: No. of modules completed.	Adherence: support group -74.4% completed all modules, 82.9% completed 4+ modules. No support group – 39.8% completed all modules, 60.2% completed 4+ modules. Sig. predictors of adherence: Email

support. [d]

Nordgreen et al. (2012) [49]	3 RCTs, 1 open study: guided intervention, unguided intervention, WLC	Population: Social Anxiety Disorder N = 245 Mean Age: 34.42 (SD = 9.43: guided), 35.43 (SD = 9.97: unguided) % female: 67.1(guided) 62.5 (unguided) Country:Norway / Sweden	Model: CBT Format: Online Duration: 9 weekly modules Guidance: Unguided vs guided	Definition: "low adherence" = less than 75% treatment completed, "adherence" = 75% or more treatment completed. Measures: No. of modules completed.	Adherence: 73.2% completed $\geq$ 7 modules (guided), 54.4% completed $\geq$ 7 modules (unguided). Sig. predictors of adherence: ↑treatment credibility (unguided group only;OR =1.05, 95% CI = 0.99-1.12), guided intervention group membership[d]. Non sig. predictors of adherence: baseline symptom severity (both groups), treatment credibility (guided group only).
Pittaway et al. (2009) [31]	Feasibility study, consecutive number assignment method. 3 groups: *BtB*; *livinglifetothe full*; *overcoming low mood/ depression/ anxiety*; (consecutive numbers, not randomised)	Population: Depression & Anxiety N = 100 Mean Age: not specified (modal age band = 25 – 44 years) % female: 71 Ethnicity: 86% white British. Country: UK	Model: CBT Format: Online Duration: BtB = 8 weeks, LLtF = 13 modules, OLM/D/A = 8 weeks Guidance: Unguided / support calls / technical support	Definition: "completed" – not defined, "did not complete" – not defined. Measures: not specified.	Adherence: 38/100 did not complete study, 12 exclusions, data for 50 completers. Sig. predictors of adherence: ↑ age, ↑ duration of problem.[d] Non sig. predictors of adherence: intervention group membership, education, computer literacy, length support from GP, length support GP current episode, diagnosis, medication, gender, baseline symptom severity.
Richards & Timulak (2013) [35]	RCT: 2 groups, therapist delivered email CBT, self-help cCBT	Population: Depression N = 80 Mean Age: 25.65 (eCBT), 26,53 (cCBT) – SDs not reported % female: 70 (eCBT), 58 (cCBT) Country: Ireland	Model: CBT Format: Online self-help, email therapist guided Duration: 8 sessions Guidance: Guided / Unguided	Definition: "completers" = completed SAT measure, "noncompleters" = did not complete SAT measure. Measures: Mean no. sessions completed, SAT measure completion.	Adherence: 69% did not complete satisfaction measure; no. sessions completed M = 3.97 (SD = 2.2: eCBT), M = 4.05 (SD = 2.9: cCBT). For SAT completers, no. sessions completed M = 5.64 (SD = 2.2) – sig. higher than non SAT completers. Sig. predictors of adherence: ↑ age (cCBT group only; $d = 0.63$[b]). Non sig. predictors of adherence: gender, baseline depression severity.
Strecher et al. (2008) [40]	RCT: 5 groups, tailored feedback; efficacy expectations; success stories; personalization of source; and exposure schedule	Population: Smoking cessation N = 1,866 Mean Age: 46.3 (SD not reported) % female: 59.5 Country: USA	Model: CBT Format: Online Duration: Single program exposure OR 5 week sequential exposure. Guidance: not specified (unguided likely)	Definition: "program engagement" = no. web sections opened. Measures: cumulative no. web sections opened.	Adherence: 76% responded to 6-mth follow-up interview. Sig. predictors of adherence: ↑ education,↑age, female ("weekly exposure condition only). ↑personalised source, ↑ depth tailored self-efficacy components ("single" intervention only)[d]. Non sig. predictors of adherence: race, no. cigarettes per day, motivation, self-efficacy, intervention components (weekly exposure condition only).
Strom et al. (2004) [36]	RCT: 2 groups, intervention, WLC	Population: Insomnia N=109 Mean Age: 44.1 (SD = 12.0) % female: 65 Country: Sweden	Model: CBT Format: Online Duration: 5 weeks Guidance: guided	Definition: 'treatment completers' = completing the post-treatment assessment (ie., includes those who may not have used treatment-program) Measures: completion of post-treatment assessment (study did not collect any	Adherence: total attrition - n=28 (24%). Ceased after 0 modules (N=7), 1 module (n=3), 2 modules (n=1), 3 modules (n=7), 4 modules (0), at post-treatment (n=10). Sig. predictors of non-adherence: ↑ baseline sleep efficiency, ↑ baseline total sleep, ↓ overnight wake time.

					website usage indices).	Non sig. predictors of adherence: gender, alcohol, medication, age, education, baseline anxiety, baseline depression, treatment credibility.
Titov et al. (2013) [50]	RCT: 3 groups, email reminders, no reminders, WLC	Population: Depression & anxiety N = 257 Mean Age:41.3 (SD = 9.76)) % female: 74.4 Country: Australia	Model: CBT & iPT Format: Online Duration: 5 modules over 8 weeks. Guidance: email reminders vs no reminders	Definition: completion = completed all 5 modules. Measures: whether total no. modules completed or not.		Adherence: 58% email support group completed, 35.8% of no support group completed. Sig. predictors of adherence: Email reminders[d.] Non sig. predictors of adherence: Baseline symptom severity.
Trompetter et al. (2015) [22]	RCT, 3 groups, intervention (I), internet-control (iC), WLC	Population: Chronic pain N=237 Mean Age: I - 52.0 (SD= 13.3); iC - 52.3(11.8); WLC - 53.2 (12.0) % female: 76.8/75.9/75.3 (I/iC/WLC) Country: Netherlands	Model: ACT Format: Online Duration: 9 modules over 9-12 weeks Guidance: email support	Definition: Completers = completion of 6-9 modules Adherers = completers who did 3hrs ACT (or 2hrs expressive writing for iC) per week. Measures: module completion and self-reported time spent using intervention.		Adherence: 72% completed ACT; 63% iC; 48 % 'adhered' to ACT, and 47 % 'adhered' to iC. Sig. predictors of adherence: gender (female; $\chi^2(1) = 3.370$, p = .066) Non sig. predictors of adherence (completers/adherers): age, gender, education, marital status, race, employment, duration of complaints, diagnosis, days per week in pain, medication use, specialist visits.
Twomey et al. (2014) [34]	RCT, 2 arms, intervention (I), WLC	Population: public mental health service users N=149 Mean Age: 35.3 (SD=10.3) % female: 73.8 Country: Ireland	Model: CBT 'MoodGYM' Format: Online Duration: 5 sessions Guidance: unguided	Definition: 'completers' = completed all 5 sessions, 'drop-out' = non-completion of post-intervention assessment Measures: No. of modules completed		Adherence: 73% of MoodGYM did not complete all 5 sessions. Dropout – I: 45/80 (56.3%); WLC: 20/69 (29%). Sig. predictors of adherence: female gender (85% male MoodGYM participants dropped out v 58.3% female, (χ^2 [1] = 4.68; p < .05). Non sig. predictors of adherence: age, rural, marital status, education, occupational status, baseline distress.
Van den Berg et al. (2013) [46]	RCT: 2 groups, intervention, care as usual control.	Population: Breast cancer N = 70 Mean Age: 50.9 (SD 8.31) % female: 100 Country: Netherlands	Model: CBT Format: Online Duration: 16 weeks Guidance: Unguided	Definition: "continuous usage" = started using and continued through all 4 stages of intervention, "intermittent usage" = did not log on during all 4 stages of intervention. Nonusers, low users, high users. Measures: No. of logins, session duration, total duration, no. of opened intervention components.		Adherence: 10% never logged in, 44.3% adhered continuously, 45.7% adhered intermittently. Non sig. predictors of adherence: age, education, marital status, employment status, baseline distress severity, type of cancer treatment.
Wagner et al. (2015) [52]	RCT: 2 groups, internet self-help (I: ISH), bibliotherapy (C: BIB)	Population: bulimia nervosa N=126 Mean age : 24.17 (SD = 4.46)/25.02 (SD=3.84) I/C % female = 100 Country: Austria	Model: CBT Format: online vs print Duration: Guidance: guided	Definition: participating in treatment for ≥2 months, or completing ≥3 modules/≥6 chapters of internet/bibliotherapy programs respectively (completer = fulfilled criteria; drop-out = did not fulfil criteria). Measures: module completion		Adherence: mid-treatment attrition 26/70 (37.1%) internet self-help, 18/56 (32.1%) bibliotherapy. Sig. predictors of adherence: ↑ baseline depression, ↓ baseline self-directedness.

Wojtowicz et al. (2013) [33]	Prospective cohort study	Population: Depression, Anxiety, Stress N = 65 Mean Age: 23.2 (SD = 5.0) % female: 86.15 Country: Canada	Model: CBT Format: Online Duration: 5 modules Guidance: Support via email/phone	Definition: "Completers" = completed all 5 modules, "noncompleters" = did not complete all 5 modules. Measures: No. of modules completed.	Adherence: 42/65 (64.6%) total sample didn't complete all 5 modules: 80% of delayed access didn't complete, 56% of immediate access didn't complete. Sig. predictors of adherence: ↑ age[d], combined ↑ age and ↑perceived behavioural control (R^2=.10; 10% of variance explained), phone support group (d = 1.12). Non sig. predictors of adherence: baseline symptom severity, intention to complete, behavioural control alone.
Yeung et al. (2015) [47]	RCT, 3 groups, guided (G); unguided (U); WLC	Population: insomnia N=207 /312 (excluded the n=105 WLC participants from this analysis) Mean age: 37.7 (SD = 12.4) % female: 69 Country: Hong Kong	Model: CBT Format: Online Duration: 6 modules / 6 weeks Guidance: guided vs unguided	Definition: 'non-completion' - did not receive all 6 sessions, 'early drop-outs' – received 1-3 sessions. Measures: No. of sessions completed	Adherence: non-completion - 72/207 (34.4%) ; early dropouts - 42/72 (56.9%) Sig. predictors of adherence: non-completion predicted by less impaired sleep (↑total sleep time, ↓ insomnia severity), ↑ baseline depression. Early drop-out predicted by less impaired sleep (↑total sleep time). Non-sig. predictors of adherence: treatment credibility, educational level, acceptability of internet, guidance

Qualitative

Schneider et al. (2014) [48]	RCT: 2 groups, intervention, attention-control	Population: depression N=637 Mean age: T: 42.2 (SD=9.6) C: 42.7 (SD = 9.6) % female = 52 Country: UK	Model: CBT 'MoodGYM' Format: Online Duration: 5 modules/5 weeks Guidance: Guided (weekly telephone calls)	Definition: Attrition /adherence not clearly reported/defined Measures: number of sessions completed, assessment completion; online brief rating scales and open-ended questions re barriers to adherence	Adherence: Mean number of sessions completed = 8.35 (out of 20 maximum); 55% completed post-treatment assessment, 37% completed 12-week follow-up. Qualitative reasons for adherence: being assigned to Treatment vs control condition Key themes / barriers: (1) intrinsic, intrapersonal problems; (2) extrinsic technical problems; (3) generic negative perceptions/judgments or generalizations about online self-help; (4) specific issues about the trial's treatment/control conditions (e.g., wording).

Quantitative & Qualitative

Andersson et al. (2002) [37]	RCT: 2 groups, CBT, WLC	Population: Tinnitus N = 117 Mean Age: 48.5 (SD = 12.3; CBT) ; 47.2 (SD = 15.0; WLC) % female: 46 (CBT, 48 (WLC) Country: Sweden	Model: CBT Format: Online Duration: 6 modules/ 6 weeks Guidance: Unguided (with email support and questions)	Definition: Completed treatment, completed questionnaires, completed daily registrations pre & post treatment. Measures: Emails sent to non-responders probing for reasons for dropout.	Adherence: 27/53 (50.9%) completed treatment; 51% nonresponse rate (CBT), 0% nonresponse (WLC); 82% total sample completed follow-up questionnaires. Sig. predictors of adherence: WLC group membership (post treatment only)[d]. Non sig. predictors of adherence: Group membership (12mth follow-up only). Key themes: Lack of time; program too fast; lack of privacy in computer area; adhering to treatment but not completing

					assessments; program impersonal, program too extensive.
Gerhards et al. (2011) [41]	RCT: 3 groups, CCBT, treatment as usual, CCBT + treatment as usual.	Population: Depression N = 200 (qualitative interviews n = 18) Mean Age: 43.6 (SD 14.5) % female: 50 Country: Netherlands	Model: CBT Format: Online Duration: 8 weeks + booster Guidance: Unguided	Definition: "Non-starters" = didn't start treatment , "non-completers" = did not complete all sessions, "completers" = completed all sessions . Measures: open questions via semi-structured interview.	Adherence: 20% completed, 26% never started, 54% didn't complete. <u>Sig. predictors of adherence</u>: female, ↓ age, ↑ education, marital status, employment status, ↓baseline depression severity (*sig. not reported)[d]. <u>Key themes of adherence</u>: course content (e.g. positive experience, helpful,); computer factors (e.g. anonymity, freedom, self-efficacy); research aspects (e.g. questionnaires, email reminders, phone reminders, faith in science) <u>Key themes of dropout</u>: course content (e.g. mood diaries, not related to personal situation); computer factors (e.g. poor computer literacy, inconvenient computer location, online format); social aspects (e.g. lack of support, low self-discipline, lack of personal contact/feedback, lack of social support family/friends).
Nicholas et al. (2010) [20]	RCT: 3 groups, 2 active, 1 attention control	Population: Bipolar Disorder N = 370 Mean Age: not specified (28.8% < 30 years) % female: 69.8 Country: Australia	Model: Psycho-education Format: online Duration: 8 modules/ 8 weeks Guidance: Unguided / email support	Definition: "Adherence" = active use (completion and return of workbooks) + sufficient dose (4+ sessions). "noncompleters" = ≤ 3 completed workbooks. Measures: Completers versus non-completers, and qualitative interviews with noncompleters for reasons for attrition.	Adherence: 73.5% completed, 26.5% didn't complete, 26.5% returned ≤ 3 workbooks, 44.7% completed all 8 workbooks, 15.4% returned no workbooks. <u>Sig. predictors of adherence</u>: female, ↑ age, referral by health professional, supported intervention group membership.[d] <u>Non sig. predictors of adherence</u>: baseline symptom severity, education, level of symptomology. <u>Key themes</u>: Dropped out due to illness, preferred to avoid thinking about illness, program content (content too basic, already known, expected personalised feedback, some minority opinions about layout etc.), feeling well (feeling better or got what needed from program), time Pressures / competing demands.
Postel et al. (2010) [42]	RCT: 2 groups, intervention, WLC.	Population: Problem Drinking N = 156 Mean Age: 45.3 (SD = 9.8) % female: 54 Country: Netherlands	Model: CBT / motivational interviewing Format: Online Duration: approx 3 mths. Guidance: Therapist guided	Definition: "Completers" = finished all 12 modules, "dropouts" = completed less than 12 assignments. Measures: Mean no. sessions completed.	Adherence: 46% completed treatment, mean no. sessions M = 8.3 (SD = 4.2: e-therapy group); M = 5.1 (SD = 3.2; dropouts). <u>Sig. predictors of adherence for e-therapy</u>: ↑treatment readiness[d] <u>Sig. predictors of adherence for control</u>: female, diagnosis[d.] <u>Key themes for e-therapy group</u>: personal reasons (unrelated to treatment), intervention factors (i.e. too intensive), improvements made early in treatment, internet based therapist contact, changed to face2face treatment.
Price et al. (2012) [39]	RCT: 2 groups, intervention, assessment only control.	Population: Natural Disaster Survivors N = 1,249 Mean Age:	Model: Behaviour therapy/ motivational interviewing	Definition: "Nonuse attrition" = completed the baseline but didn't access website, "access attrition" = completed screening but	Adherence: 48% didn't access site, 30% dropped out after screening assessment. Of those that accessed a treatment module, 9% (control) and 20% (intervention) did not

		45.80 (SD = 17.28) % female: 50 Country: USA	Format: Online Duration: Unspecified Guidance: Unguided	no modules. "completion attrition" = accessed module but didn't complete. Measures: not specified.	complete module content. Sig. predictors of adherence previously used internet for health/ mental health information (OR = 2.81, 95% CI= 1.46 - 5.42), qualified for access to modules (no. modules screened into: OR = 1.19, 95% CI 1.06 to 1.34), less damage to property (OR = 1.67, 95% CI=1.14 - 2.43), female (for those who didn't qualify for access to modules (OR = 2.01, 95% CI =1.16 to 3.48). Key themes: too busy 18%; not useful 15%; security of website 3%, trouble using 8%, not personally relevant 41%.
Scott & Beatty (2010) [25]	Feasibility study	Population: Carers (of adult cancer patients) N = 13 Mean Age: 48.89 (SD = 21.46, completers); 56.0 (SD = 13.95, non-completers) % female: 66.7 (completers); 25 (non-completers) Country: Australia	Model: CBT Format: Online Duration: 6 weekly modules Guidance: Unguided	Definition: "completers" = completed btwn 2-5 modules, " noncompleters" = completed 0-1 modules. Measures: No. of modules completed, post-treatment assessment completion.	Adherence: 69% completed post-treatment data, 31% did not complete treatment, 5/13 (38.5%) completed all 6 modules, 4/13 (30.7%) completed btwn 2-5 modules, 4/13 (30.7%) completed 0-1 modules. Sig. predictors of adherence: ↓ age ($d = 0.37$), female, a loved one in concurrent study[d], more time since diagnosis ($d = 0.61$), ↑ baseline distress ($d = 0.49$), < QOL (range across 6 measures $d = -.028$ - -1.13). Non sig. predictors of adherence: marital status, location, education, employment status. Key themes: too much going on, programme not what they wanted, computer format 'too stressful'.
Topolovec –Vranic et al. (2010) [26]	Not RCT : all 34articpant in intervention.	Population: Depression (Traumatic Brain Injury) N = 21 Mean Age: 42.5 (SD not reported) % female: 38 Country: Canada	Model: CBT Format: Online Duration: 6 weeks Guidance: Unguided (+ weekly phone reminders)	Definition: "non starters" = completed 0 assessments, "non completers" = completed at least 1 assessment, "completers" = completed all 6 assessments. Measures: No. follow up assessments completed.	Adherence: 38% dropped out, 62% completed, 43% completed 12-month follow up. Mean website visits: M = 1.6 (wk 1) – 0.75 (wk 6). Non sig. predictors of adherence: baseline depression severity, age, gender, marital status, education level, employment status, injury severity, time since injury. Key themes: Internet/computer problems (e.g. internet cut off, computer broke); difficulties reading, remembering, understanding content.

*Note. * = effect sizes reported when available as phi for chi-square, cohen's d for differences between means, r^2 for correlations and either Odd Ratio (OR) or R^2 for regressions. [a,b]=Cohen's d calculated by author. [c]= Spearman rank correlations indicated by ρ.*
. [d]=Effect sizes not reported and unable to be calculated with information provided by publication..

PREDICTORS OF ADHERENCE TO PSYCHOLOGICAL SELF-HELP

Table 2

Methodological Quality Assessment of Included Studies

Study	Study Design	Control Comparison	Adequate sample size > 25 per group	Inclusion criteria specified	Reliable/ Valid outcome measures	Appropriate Data analysis
Quantitative						
Al-Asadi et al. (2014)	Open Trial	✗	✓	✓	✗	✓
Batterham et al. (2008)	Open Trial	✗	✓	✗	✓	✗
Berman et al. (2014)	Feasibility (single arm)	✗	✓	✓	✓	✗
Bewick et al. (2010)	RCT	✓	✓	✓	✗	✗
Boettcher et al. (2013)	RCT	✓	✓	✓	✓	✓
Carrand et al. (2006)	Feasibility (single arm)	✗	✓	✓	✓	✗
Cavanagh et al. (2009)	Open trial	✗	✓	✓	✓	✗
Donkin et al. (2013)	RCT	✓	✓	✓	✓	✗
El Alaoui et al. (2015)	Effectiveness trial	✗	✓	✗	✓	✓
Farrer et al. (2014)	RCT	✓	✓	✓	✓	✓
Fernandez-Aranda et al. (2009)	Non-randomised	✓	✓	✗	✓	✗
Geraghty et al. (2010)	RCT	✓	✓	✓	✓	✓
Hasson et al. (2010)	RCT	✓	✓	✗	✗	✗
Herbert et al. (2010)	RCT	✓	✓	✓	✓	✓
Ho et al. (2014)	RCT	✓	✓	✓	✓	✓
Lancee et al. (2013)	RCT	✗	✓	✓	✓	✓
Nordgreen et al. (2012)	3 RCTs / 1 open trial	✓	✗	✓	✓	✓
Pittaway et al. (2009)	Non-randomised	✗	✓	✓	✗	✗
Richards & Timulak (2013)	RCT	✗	✓	✓	✓	✗
Strecher et al. (2008)	RCT	✗	✓	✓	✗	✓
Strom et al. (2004)	RCT	✓	✓	✓	✓	✗
Titov et al. (2013)	RCT	✓	✓	✓	✓	✓
Trompetter et al. (2015)	RCT	✓	✓	✓	✓	✓
Twomey et al. (2014)	RCT	✓	✓	✓	✓	✗
van den Berg et al. (2013)	RCT	✓	✓	✓	✓	✗

PREDICTORS OF ADHERENCE TO PSYCHOLOGICAL SELF-HELP

Wagner et al. (2015)	RCT	✓	✓	✓	✓	✓
Wojtowicz et al. (2013)	RCT	✓	✓	✓	✓	✘
Yeung et al. (2015)	RCT	✓	✓	✓	✓	✓
Qualitative						
Schneider et al. (2014)	RCT	✓	✓	✓	n/a	✓
Qualitative & Quantitative						
Andersson et al. (2002)	RCT	✓	✓	✓	✓	✓
Gerhards et al. (2011)	RCT	✓	✓	✓	✓	✓
Nicholas et al. (2010)	RCT	✓	✓	✓	✓	✘
Postel et al. (2010)	RCT	✓	✓	✓	✓	✓
Price et al. (2012)	RCT	✓	✓	✓	✓	✓
Scott & Beatty (2010)	Feasibility (single arm)	✘	✘	✓	✓	✘
Topolovec – Vranic et al. (2010)	Not RCT	✘	✘	✓	✓	✘

PREDICTORS OF ADHERENCE TO PSYCHOLOGICAL SELF-HELP

Table 3

Summary of Evidence for Predictors of Adherence to Online Psychological Interventions

Predictor	Number of studies	Significant (*p* ≤ 0.05)	Not significant (*p* > 0.05)	Qualitative support	Status of evidence base [a]
Demographics					
Gender	22	11 (females) 1 (males)	10		Yes
Age	20	5 (older) 4 (younger); 1 (mixed)	10		Unclear
Education	18	5 (+) 1 (-)	12		No
Marital status	12	2 (partnered)	10		No
Employment	11	0	11		No
Ethnicity/ geographical location	7	1 (Oceania/Europe)	6		No
Lack of time	6	0	0	6 (-)	Yes
Lack of privacy	2	0	0	2	Inconclusive
Presenting problem characteristics					
Baseline symptom severity	26	5 (+) 6 (-)	13	1(-)	No
Duration of problem	6	3 (+)	3		Unclear
Improvement in condition	3	1	0	2 (-)	Inconclusive
Diagnosis	6	1 (+) 1 (-)	4		Unclear
Other problem characteristics	5	2 (ADHD symptoms)	3		Unclear
Referral source	3	2 (health professionals) 1 (media)	0		Inconclusive
Medications/alcohol	3	0	3		Inconclusive
Psychological					
Expectancy/ treatment credibility	9	7 (+)	2		Yes
Motivation / readiness to change	7	3 (+)	4		Unclear
Self-efficacy/confidence	4	1	3		Inconclusive
Intervention/computer factors					
Program content	9	2	0	7	Yes
Computer factors	12	3 ()	4	5	Yes
Intervention group membership	7	3 (control) 1(intervention)	2	1 (intervention)	Unclear
Guidance	9	5 (guided)	3	1 (unguided-)	Yes
Impersonal content	6	0	0	6 (-)	Yes

Note. Direction of relationship with adherence indicated in brackets (- = negative relationship, + = positive relationship). [a] Status of evidence base: Yes = ≥ 50% of studies found evidence for the predictor; No = ≥ 50% of studies found no evidence for the predictor; Unclear = mixed results; Inconclusive = < 5 studies reported on the predictor.