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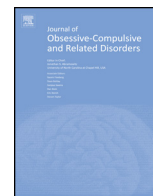
Outcomes for residential or inpatient intensive treatment of obsessive–compulsive disorder: A systematic review and meta-analysis

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ABSTRACT

Little data exist to inform the treatment of severe or treatment refractory obsessive–compulsive disorder (OCD) in an inpatient or residential setting. We aimed to determine effect size of inpatient, residential or day-patient program in people with OCD. Studies were selected if they were conducted in an inpatient, day-patient or residential setting; were using the Yale Brown Obsessive Compulsive Scale (Y-BOCS) as an outcome measure; treatment included cognitive behavior therapy; it involved adult patients; and had a sample size of at least 20. We identified 19 studies with a total of 2306 participants at admission. We extracted the mean and standard deviation pre-admission and at discharge. The overall reduction was 10.7 points (95% CI: 9.8–11.5, $z=24.2$ $p < 0.001$) with an effect size, Hedges g, of 1.87. Being married or cohabiting consistently predicted better outcomes, and symptoms of hoarding or comorbid alcohol misuse consistently predicted worse outcomes. Clients with severe or treatment refractory OCD can make significant improvements with intensive residential or inpatient therapy but little is known either about its long term benefits or cost effectiveness compared with an alternative. Programs are offered internationally with a variety of inclusion criteria. We discuss how such programs might be optimized.

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1. Introduction

Outcomes for residential or inpatient treatment of obsessive–compulsive disorder: a systematic review and meta-analysis.

Inpatient or residential treatment is more costly than outpatient care for obsessive–compulsive disorder (OCD) but may be more effective for certain clients. We present a historical account of how treatment for OCD was first developed in inpatient settings, before describing a stepped-care model. We then present a systematic review of the outcomes in the highest levels of stepped care in OCD.

Meyer (1966) first described the use of exposure and response prevention (ERP) in OCD in an inpatient setting at St. Luke's Hospital in London in 1966. Dr. Meyer and the nursing staff conducted exposure to contaminants that triggered anxiety and response prevention by switching off the water in the patient's room and severely limiting access to cleaning agents. The treatment sessions for the first case reported consisted of making the patient expose herself to anxiety provoking situations (e.g. touching door knobs,

handling dust bins, her child's toys, milk bottles). Staff conducted mild physical restraint of rituals but only when the patient consented. The patient's anxiety significantly decreased over a period of 12 weeks. Thus, the first description of ERP in OCD was conducted on inpatients and included significant control by the staff. They also discussed a theory that focused on modification of the patients' expectations of the disastrous consequences. This is consistent with the modern principles of exposure and testing the predicted consequences in a behavioral experiment (Craske, Treanor, Conway, Zbozinek, & Vervliet, 2014).

Early experimental studies on behavior therapy in the early 1970s continued with inpatients at the Bethlem Royal Hospital in London with increasing emphasis on self-exposure and response prevention (Marks, Hodgson, & Rachman, 1975; Rachman, Hodgson, & Marks, 1971; Rachman, Hodgson, & Marzillier, 1970; Rachman, Marks, & Hodgson, 1973) as well as in the USA (Foa and Goldstein, 1978). Outpatient, family based treatment (Mehta, 1990) and home treatment programs (Emmelkamp, Van den Heuvell, Ruphan, & Sanderman, 1989) or the use of computerized behavior therapy (Greist et al., 2002) were developed in the last two decades and are now the mainstay for the large majority of people with OCD. Nonetheless inpatient or residential treatment is still reserved for those with more severe symptoms or who are treatment refractory. In the UK, the National Institute for Health and

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Clinical Excellence guidelines (NICE, 2006) recommends that cognitive behavior therapy including exposure and response prevention should be offered to all people with OCD. There are various levels of stepped care for people with severe or treatment refractory OCD that have evolved over time. NICE (2006) recommended that inpatient services with specific expertize in OCD are appropriate for a small proportion of people with OCD in the state sector. This is usually based on clinical need, but geographical location and funding of care may also be factors in admission. The potential advantage of an inpatient or residential program is that more frequent CBT and assisted exposure or behavioral experiments can be provided than in an outpatient service. Alongside therapists, assistant therapists, nursing staff or other residents may also assist the client in frequent exposure in which there is modeling and positive reinforcement by others in the moment. The different levels of stepped care in different settings can be defined as follows.

(1) An *inpatient* setting with nursing staff is the highest level of stepped care. It may be a necessity for some people with OCD if there is suicide risk, severe self-neglect, low body weight, danger to others, extreme handicap that requires frequent support or a reversal of the sleep wake cycle. Sometimes comorbidity such as severe depression or schizophrenia necessitates admission. Private settings might however admit patients with less severe difficulties or where strictly the nursing care may not be required. Expert opinion considers it difficult to run an effective specialist OCD service on a general adult psychiatric ward. It is difficult to maintain a therapeutic environment for people with OCD to feel understood and safe since other patients may be severely disturbed; furthermore, the use of agency staff makes it difficult to ensure consistency and suitable staff training. Specialist inpatient services are not necessarily exclusive for clients with OCD, although they usually make up the majority of patients. Such units often admit patients with related problems such as body dysmorphic disorder or hypochondriacal disorder. Thus, the staff will predominantly specialize in treating obsessive–compulsive and related disorders.

An inpatient setting may include individual or group cognitive behavior therapy (CBT) or family therapy and occupational therapy that is relevant for a person's OCD (for example exposure with contamination carried out during activities such as cooking for others or gardening). Home visits normally occur to assess the degree of family involvement and the difficulties patients experience in their daily life. Some programs may include family therapy or involvement of a carer as co-therapist (Mehta, 1990). There may be an opportunity for family members to stay in the unit or close by, to become involved as co-therapists, or learn how to reduce accommodation of avoidance and rituals. Co-morbidity such as depression may be addressed by additional approaches, i.e. behavioral activation for depression (Dimidjian et al., 2006). Lastly, inpatient units have the ability to closely monitor medication changes or adherence.

(2) A specialist *residential* service, which has therapy and support staff during the day, but not at night, is one step below inpatient care. A residential service assumes that a resident is not actively suicidal, has a reasonable degree of self-care and ability to self-medicate, and does not require nursing staff either during the day or night. A residential service might be based in the grounds of a psychiatric hospital (with access to emergency care) or in the community. A residential unit may be appropriate if there has been no response to adequate trials of treatments in other settings – for example when adherence to homework as an outpatient has been poor; if a person has additional diagnoses, such as severe depression, that make outpatient treatment more complex; if the compulsions and avoidance behavior are so severe or habitual that their life has minimal structure, if there is social isolation or they

cannot undertake normal activities of daily living. Sometimes it may be helpful to separate the person with OCD from their family members if there is excessive accommodation or aggression by either party. Like inpatient care there may be individual or group CBT, family therapy and occupational therapy relevant for OCD and the ability to closely monitor medication changes or adherence.

(3) A specialist *partial hospitalization* or *day-patient* service is similar to a residential service. The main difference to a residential service is that clients do not stay overnight or may not attend daily. It may be appropriate if a patient lives locally and can travel to the service daily. A partial hospitalization program may have similar admission criteria and therapy services to a residential service and run in conjunction with an existing residential or inpatient service.

(4) A *home-based* treatment occurs when one or more therapists travel to the client's home. This is often appropriate when the obsessions are strongest in the home or where additional family therapy is needed. Indeed, admission to a residential unit or partial hospitalization service may be inappropriate as it may be an "OCD holiday" (that is, clients may appear to make gains during admission because of a reduction in responsibility or absence of triggers but their obsessions and compulsions return at discharge). Bringing cues from home may get around the problem of generalization but not if the gains have depended on frequent prompting and assistance of tasks by therapists. Thus, home-based treatment is particularly suited for hoarding disorder, and for some contamination or checking problems that are only triggered at home. However, hoarding disorder now has its own classification criteria (American Psychiatric Association, 2013), separate to OCD, and requires a different approach to treatment (see Tolin, Frost, Steketee, & Muroff, 2015).

A combination of all the above programs is a *time-intensive* residential, home-based or outpatient program which provides, on average, 16 hours of intensive CBT over one or two weeks (Abramowitz, Foa, & Franklin, 2003; Jónsson, Kristensena, & Arendtc, 2015; Oldfield, Salkovskis, & Taylor, 2011; Storch et al., 2007).

The main disadvantages of an inpatient, day-patient or residential unit compared to outpatient or home-based treatments are the costs of treatment. However, it may be more cost effective over time instead of repeated less effective outpatient treatments or emergency admissions. The second potential disadvantage is the different context in which the avoidance and compulsions occur. Thus, a change in context or a reduction in responsibility may mean reduced symptoms in the short–term or a lack of generalization of gains made. Admission may bring temporary relief to someone with severe hoarding disorder but must necessitate the client regularly returning to their home to de-clutter. Temporary relief of the problem may also occur if the family environment is highly critical, enmeshed, or has high levels of accommodation. If the family environment does not change, there is a high risk of relapse when the person with OCD returns home. Thus, very few programs mentioned an evaluation of the home and social environment or of family interventions, which would seem essential for some clients.

There have been no previous systematic reviews of inpatient, residential or day-patient (partial hospitalization) programs for OCD or related disorders. Our objectives for this study were therefore to conduct a systematic review and estimate the clinical effectiveness of inpatient, day-patient and residential treatment programs for the treatment of severe OCD. We reviewed all studies that included cognitive behavior therapy and reported their outcome on the Yale-Brown Obsessive Compulsive Scale (Goodman et al., 1989) whether there was randomization to a comparator or not. We also aimed to conduct a narrative review of the predictors of outcome or drop out, the duration of treatment, and the types of program offered.

2. Method

The methodology was specified before the review was undertaken. The review included any randomized, quasi-randomized or non-randomized studies that investigated the effects of inpatient, day-patient or residential unit treatment for people with obsessive–compulsive disorder. No publication date or publication status restrictions were imposed.

2.1. Eligibility criteria

Studies were included if they described: (a) an adult population, (b) specialist residential, day-patient or inpatient treatment for OCD; (c) a sample size of 20 or over; (d) provided behavior therapy or cognitive behavior therapy as the main treatment by practicing therapists (rather than academics) and (e) used the observer rated Yale-Brown Obsessive Compulsive Scale (Y-BOCS) (Goodman et al., 1989) as an outcome measure.

Studies were excluded if: (a) published in a foreign language (English abstract was allowed if the outcome data could be extracted), (b) OCD was not the main diagnosis of the client group (e.g. if they had OCD on an eating disorders service), (c) pharmacotherapy alone was being evaluated, (d) the self-report Y-BOCS was used. Studies that used the self-report scale were excluded as it has been found that clinicians tend to rate compulsions higher than patients do. Therefore, in order to compare both the self-report and observer-rated Y-BOCS scores, we would have needed to adjust the self-report scores in an upwards direction (Steketee, Frost, & Bogart, 1996). A moderate instead of a strong correlation between the observer-rated and self-report versions of the Y-BOCS was also found in a more recent study by Federici et al. (2010). The rationale of excluding the self-report version was therefore to ensure consistency between studies.

2.2. Measures

The Y-BOCS is a 10-item clinician-rated scale used to measure the severity of obsessive–compulsive symptoms and response to treatment. Each item is scored from 0 (no symptoms) to 4 (extreme symptoms), giving the total score with a range from 0 to 40. Higher scores indicate greater symptomatology of OCD. The scale has good inter-rater reliability ranging from $r=.95$ to $r=.98$, $p < .001$, and Cronbach's alpha between .88 and .90, indicating good internal reliability. The measure outcomes positively correlate with the Clinical Global Impression Scale ($r=.74$, $p < .0001$).

2.3. Information sources

Searching Medline, Embase, PsycINFO and Cochrane Database of Systematic Reviews (CDSR) (which lists previous systematic reviews) (Supplementary Table 1) identified relevant studies up to May 2015.

2.4. Search

The Medline search strategy was translated into comparable search strategies for Embase and PsycINFO and for previous systematic reviews in the Cochrane Database (CDSR).

2.5. Study selection

Full text articles were retrieved for any citation deemed relevant by any of the reviewers. All full text articles were reviewed for inclusion by at least two of the authors. Studies were selected if they fulfilled the eligibility criteria and reported the mean and standard deviations of Y-BOCS scores before and after the admission.

2.6. Data collection process

Information was extracted from each included trial on: (a) type of unit and period covered; (b) number of clients; (c) average length of stay; (d) inclusion and exclusion criteria; (e) components of treatment program; (f) outcome scores. We extracted the mean and standard deviation at admission and discharge. Results of comparable studies were pooled in meta-analyses.

2.7. Data items

Our main outcome of interest was the change in Y-BOCS score between admission and discharge. We calculated difference in means (pre and post) and extracted the standard deviation of the change score from the paper direct when available. If the standard deviation of the change was not available we calculated the standard error of the change score from the t-statistic and multiplied this by $\sqrt{N}$. If the test statistic was not available we emailed the author of the paper to retrieve the information. Finally, if no test statistic was available the standard deviation of the change was imputed assuming a correlation of $r=0.5$ between admission and discharge scores, using the formula, SD change$=\sqrt{[SD2 \text{ baseline}+SD2 \text{ outcome}-(2 \times r \times SD \text{ baseline} \times SD \text{ outcome})]}$. Further to this, a sensitivity analysis with correlations of 0.3 and 0.7 assessed the impact of the imputed correlations on the overall effect size. For studies, which included comparison groups, we pooled the separate treatment groups to get an overall estimate of effect size.

To get a standardized measure of effect size we calculated Hedges g by calculating Hedges g for each study, using the pre-treatment SD as the denominator in calculating Cohen's d and using Hedges g to correct for small sample size bias.

2.8. Synthesis of results

Analyses were conducted using both the Metafor package in R and the Metan and associated commands in STATA (Bradburn, Deeks, & Altman, 1987; Harris et al., 2008). We combined the outcome of the 19 studies to get an overall summary effect size (and 95% confidence interval) on the original Y-BOCS scale, using a random effects meta-analysis model, with each study change score weighted by the inverse of the variance (DerSimonian and Laird, 1986). We used a random effects model as we assumed that the included studies are a random sample of the population of studies. Further, as the clinical populations and treatments varied we expected treatment effects to be heterogeneous. Length of stay and year of study were assessed as moderators with meta-regression models.

Heterogeneity across studies was assessed visually with a Forest plot and statistically with the Q Statistic (Cochran, 1954) and I^2 Statistic (Higgins and Thompson, 2002). The Q Statistic approximates a $k-1$ (df) Chi-squared distribution if k is the number of included studies. I^2 gives the percentage of Chi-squared statistic not explained by within-study variation. This is equivalent to the extra variance due to variation between studies as for a set of studies in which there is only within-study variation, χ^2 statistic will be equal to the degrees of freedom (Higgins and Thompson, 2002). To identify unusual or particularly influential studies, we calculated the Cook's Distance for each study (that is, the effect of deleting each observation). In a sensitivity analysis, studies with large Cook's Distance were removed from the analysis and the overall effect was recalculated

2.9. Risk of bias across studies

Four procedures were followed to assess publication bias or the 'file drawer' problem (Rosenthal, 1991). Firstly, a funnel plot was

produced which plots the mean change of each study against the standard error of the treatment size. Asymmetries in the plot indicate potential publication bias. Secondly, Begg's Rank correlation test assessed whether there was a significant association between study effect size and variance. The trim and fill procedure (Duval and Tweedie, 2000) removes asymmetric studies from the right hand side of the funnel plot, and then re-computes the estimated treatment effect. To get a bias free measure of uncertainty, the procedure then reinstates the removed studies along with imputing equivalent studies on the left hand side of the funnel that are assumed to be missing. Finally, we computed the fail-safe *N*, that is, the number of studies with an effect-size of 0 which would be required to reduce the overall effect size to a non-significant level, weighted according to Rosenberg's Method (2005). Although there is some controversy over the use of the failsafe *N*, we include it here as part of the sensitivity analysis to illustrate the robustness of the treatment effect.

In addition, we also wanted to investigate predictors of treatment outcome and dropout rates. Studies that were excluded from the meta-analysis for reasons such as not providing outcome Y-BOCS scores, but that did provide information regarding predictors of dropout or outcome, were included in the review of predictors.

3. Results

3.1. Study selection

Fig. 1 provides a flowchart of the search and the number of studies that were screened for eligibility and excluded. We identified 41 studies that met our screening criteria of treatment of OCD in either an inpatient, day-patient or residential unit setting. Of these, 22 were excluded for failing to meet one of the criteria: one because patients were from an outpatient service (Olatunji et al., 2013); three for not using the Y-BOCS as an outcome measure (Kwee, Duivenvoorden, Trijsburg, & Thiel, 1986; Ruppert, Zaudig, Hauke, Thora, & Reinecker, 2001; Van den Hout, Emmelkamp, Kraaykamp, & Griez, 1988); four because they used the Y-BOCS self-report version (Cole Monaghan et al., 2015; Grøtte et al., 2015; Pozza, Coradeschi, & Dèttore, 2013; Simpson et al., 2013), two because they were adolescent services (Arai, Ichikawa, Ejiri, & Watanabe, 2006; Bjorgvinsson et al., 2008); two because they reported on treatment outcomes for an eating disorders service, with only some patients having comorbid OCD (Cumella, Kally, & Wall, 2007; Olatunji, Tart, Shewmaker, Wall, & Smits, 2010); one for having a sample size of two patients (Carmin & Wiegartz, 2000); or nine patients (Drummond, Pillay, Kolb, & Rani, 2007); one for being a review rather than a research study (Winkelmann & Hohagen, 1995); two because they did not include CBT as part of the treatment (Haghighi et al., 2013; Shafti & Kaviani, 2015); one for not including data on post-treatment Y-BOCS scores (Brennan et al., 2014); and one as it was unpublished (Alosso, 2012).

Finally, two articles were excluded as they included data from the same cohorts reported by other papers (Stewart et al., 2009; Stewart, Yen, Stack, & Jenike, 2006). We included data from the last two years of McKenzie and Marks (2003) when the Y-BOCS was provided. The remaining 19 publications that met our criteria have been summarized in Table 1. Three studies were randomized controlled trials of CBT alone or with a SSRI within an inpatient setting (Hohagen et al., 1998; Kordon et al., 2005; Rufer et al., 2005). All other studies were non-randomized prospective before and after comparisons with no control group.

In addition, we wanted to investigate predictors of treatment outcome and dropout rates during treatment (see Table 2).

Therefore, 10 of the studies included in the meta-analysis which also included analysis of predictors of treatment outcome and dropout were combined with three studies that were excluded from the meta-analysis as they included only predictors of treatment outcome (Brennan et al., 2014; Stewart et al., 2009, 2006).

3.2. Study characteristics

Overall, the average length of stay was 10.4 weeks, with the amount of exposure and response prevention (ERP) provided in therapy by a clinician ranging from 1 h a week to 20 h a week. The locations of the programs were in Germany (11), USA (4), UK (3) and Italy (1). There were 15 studies describing an in-patient program and 4 studies describing a residential unit. One study included a day patient program but this was part of an in-patient service (Fricke et al., 2006). A variety of methods were used to account for missing data. Most specified an intention to treat analysis (ITT) (using Last Observation Carried Forward or Multiple Imputation). The studies were clinically representative according to key criteria (Shadish, Navarro, Matt, & Phillips, 2000): we specified a priori that study subjects had to have a diagnosis of OCD and have undergone treatment following clinical referral in an inpatient, day-patient or residential unit setting, with practicing therapists (rather than academics) using CBT.

3.3. Results of individual studies

Some studies specified their inclusion criteria for admission. For example Stewart, Stack, Farrell, Pauls, & Jenike (2005) describe admission criteria that include "the presence of OCD-related severe life impairment and inadequate prior treatment response" (page 604). Those with conditions precluding any significant engagement in intensive residential treatment, such as severe mental retardation or severe primary psychotic illness, were excluded. Some studies mention a mixed population of treatment refractoriness – for example Veale et al. (2015) have admissions both of those who fulfill severe treatment refractory criteria for a national funding stream and those who are severe without being treatment refractory.

3.4. Synthesis of results

The analysis of change scores included 19 studies with a total of 2306 participants at admission and 2202 participants at discharge. The analysis comparing Y-BOCS scores at baseline and discharge showed treatment reduced scores by 10.7 points (95% CI: 9.8–11.5, $z = 24.4$, $p < 0.001$).

Fig. 1 shows a Forest plot with the weighted individual contributions of each study to the overall estimate. This difference of 10.7 points on the Y-BOCS scale translated to an overall effect size of $g = 1.87$ (95% CI: 1.63–2.10). Based on Cohen's guidelines (Cohen, 1988) this is a large improvement between admission and discharge, being almost two standard deviations lower than the pre-test Y-BOCS score. The Q test statistic was significant ($Q(18) = 84.3$, $p < 0.001$) and $I^2 = 78.7\%$ which is considered to be a considerable amount of heterogeneity. However, this heterogeneity is consistent with the studies representing a wide variety of treatments and populations. However, moderator analysis for year of study and length of stay explained none of this heterogeneity. Neither showed an association with effect size (year of study: $p = 0.947$ and length of stay: $p = 0.519$).

In the analysis of Cook's Distance, two studies (Hohagen et al., 1998; Stewart et al., 2005) had a high degree of influence. However, excluding these study from them meta-analysis only lead to no difference in the estimate of the treatment effect, 10.7 (95% CI, 10.0–11.5) but did lead to a reduction in heterogeneity, $I^2 = 65.2\%$.

Table 1
Studies included in meta-analysis.

Study	Type of unit Location Period covered	Length of stay (weeks) Mean (SD)	Treatment program	Missing data	Y-BOCS admission mean (SD)	Y-BOCS discharge mean (SD)	Difference of means	t-Test	Y-BOCS follow up mean (SD)
1. Calvocoressi, McDougle, Wasylink, and Goodman (1993)	General inpatient ward (Yale University, Connecticut, USA) 1985-1992	14.5 (7.1)	ERP (number of hours weekly missing) with medication management	Case deletion (n=66 out of 77)	27.6 (8.8) n=66	18.3 (9.2) n=66	9.3	t(65)=9.1, p<.001, d=not informed	Not reported
2. Hohagen et al. (1998)	Inpatient (multi-center study in Mannheim, Hamburg and Freiburg, Germany)	9.0	Multimodal BT and placebo (9 hours therapist-aided ERP per week for first 2 weeks; self-directed for rest of treatment)	Case deletion (n=49/60) (n=2 dropped out and n=9 removed from both groups to equate baseline Y-BOCS scores)	28.4 (3.8) n=25	15.9 (7.9) n=25	12.5	ANOVA	Not reported
					27.9 (2.9) n=24	12.4 (6.8) n=24	15.5		
3. Muller-Svitak, Reinecker, Rief, and Fichter (2002)	Inpatient (Bavaria, Germany) 1997–1998	10.3	6 h therapist-aided ERP per week. 7 × 2 h manualized group therapy, art therapy, physiotherapy.	Case deletion (n=2 discontinued prematurely)	25.8 (5.4) n=23	13.9 (6.9) n=23	11.9	t-test not given p<.001, d=not informed	14.1 (7.2) N=20 (3 months)
4. McKenzie and Marks (2003)	Residential (Bethlem Royal Hospital, UK) 1996-1998	10.0	3 h Therapist-aided CBT weekly followed by self-directed ERP. Medication prescribed if essential. Family interventions. Home visits before discharge.	Not stated	27.0 (7.0) n=51	19.0 (7.0) n=30	8.0	Not stated	22.0 (7.0) N=16 (3 months)
5. Kordon et al. (2005)	Inpatient (Germany)	14.6	CBT alone: as inpatient continued as outpatient	LOCF	26.6 (5.5) n=37	11.6 (7.4) n=37	15.0	Not stated	1 Year 14.9 (10.4) 2 year 15.5 (10.9)
			CBT+SSRI: as inpatient then as outpatient		28.4 (4.7) n=20	15.7 (6.7) n=20	12.7		1 Year 15.6 (8.5) 2 year 15.6 (8.7)
			CBT+SSRI with SSRI discontinuation during follow-up period (number of hrs of CBT missing)		28.9 (7.4) n=17	14.2 (7.7) n=17	14.7		1Year 13.9 (9.5) 2 year 13.7 (9.9)
			Total		27.6 (5.8) n=74	13.3 (7.4) n=74	14.3		1 Year 14.9 (9.7) 2 years 15.1 (10.0)
6. Rufer, Hand, et al. (2005) (data taken from Rufer, Grothusen, Maß, Peter, and Hand (2005))	Inpatient (multi-center study) (University Hospital of Hamburg, Germany) 1993-1995	9.0 (All patients completed treatment)	Multimodal CBT (4 sessions weekly-number of hrs missing); began as therapist-aided then progressed to self-directed. Randomized to either fluvoxamine or placebo	Case deletion (n=7 lost)	27.6 (4.3) n=30	16.4 (7.4) n=30	11.2	t(29)=9.2, p<.001, d=not informed	14.9 (9.5) N=30 (7.2 years)
7. Stewart et al. (2005) (see Osgood-Hynes, Riemann, and Bjorgvinsson (2003) for description of program).	Residential (McLean Hospital, Boston, USA) 1997-2003	9.4 Range: 0.1–75 weeks	24 h Therapist-aided ERP in total per week. Weekly psycho-pharmacology assessments. Meetings with social worker. Weekly OCD group therapy	Case deletion (n=403/497) who stayed long enough for outcome data	26.6 (6.1), n=403	15.3 (5.6) n=403	8.0	t(402)=23.0, p<.001, d=not informed	Not reported
8. Kuelz et al. (2006)	Inpatient (Freiburg, Germany)	12.0	2 h Therapist-aided CBT per week in "first phase". Then progressed to "patient exposing himself". No psychotropic medication for 2 weeks prior to baseline measures. 7 patients received medication during the 12 weeks where indicated	Case deletion of 4 patients lost to follow up; 1 that was prescribed anti-psychotics during study	24.1 (6.0) n=30	13.7 (7.0) n=30	10.4	t(29)=8.0, p<.001), d=not informed	Not reported
9. Rufer et al. (2006)	Inpatient (University Hospital of Hamburg, Germany) 1993-1995	10.0 (range: 6.0–9.0 wks)	4x weekly individual therapist-aided CBT (followed by self-directed ERP). Group therapy. Medication (n=74 on SSRIs, n=15 on anti-psychotics)	Treatment completer (Case deletion)	26.8 (5.1) n=94	17 (7.1) n=94	9.8	t(93)=9.2, p<.001, d=not informed	14.9 (9.5)
10. Fricke et al. (2006)	Inpatient or day-clinic (Hamburg, Germany)	8.4 (4.1)	Several therapist-aided CBT sessions weekly plus self-directed ERP	Completer analysis	25.6 (5.4) n=55	15.3 (5.6) n=55	10.3	t(54)=14.2, p<.001,	15.5 (7.3) N=44 (6

			(number of hrs missing). Behavioral groups (e.g. social skills training). Almost all prescribed SSRI					d=not informed	months)
11. Langner et al. (2009)	Inpatient (Windach, Bavaria, Germany)	11.1 (3.9)	2x weekly individual therapist-aided CBT (number of hrs missing). Group CBT (2 h daily). Weekly patient-led therapeutic group. Supportive medication.	Not stated	24.2 (6.4) n=254	13.3 (7.6) n=254	10.9	Not stated	Not reported
12. Boschen et al. (2010)	Inpatient (Springfield Hospital, London, UK)	19.3 (8.5) Max=26	1 h weekly therapist-aided CBT incl. cognitive reattribution or D.I.R.T. Self-directed ERP (number of hrs missing). Occupational Therapy Medication review	LOCF	34.7 (4.2) n=52	24.4 (10.6) n=52	10.4	t(34)=11.3, p<.001, d=not informed	Not reported
13. Adams Jr., Riemann, Wetterneck, and Cisler (2012) (see Osgood-Hynes et al. (2003) for description of program).	Inpatient (Rogers Memorial Hospital, Wisconsin, USA)	8.3 (3.7)	12.5 h per week of therapist aided and self-directed ERP. Cognitive restructuring (1 h/day). Homework review group (½ hr/day). Daily recreational therapy (1 h/day) Group cognitive restructuring (1 hr/day). Weekend program. Most prescribed ≥ 1 psychotropic medications	ITT	27.4 (6.5) n=160	15.2 (6.9) n=160	12.2	Not provided	Not reported
14. Gonner et al. (2012)	Inpatient (Bad Dürkheim, Germany)	7.4	Average 1.5 h therapist-aided CBT per week. Disorder-specific grp. therapy. 2x week psychosomatic or problem-solving grp. 2x week relaxation grp. 2x week sports therapy Additional services, i.e.: couple/ family sessions, self-confidence training, body-oriented methods, or occupational therapy.	ITT analysis and Case deletion were run in parallel	ITT 25.6 (5.4) n=102	ITT 16.6 (7.9) n=102	9.0	ITT t(107)=12.0, p<.001, d=not informed	Not reported
15. Zurowski et al. (2012)	Inpatient Lübek, Germany	12.0 (all patients completed treatment)	2.5 h therapist-aided CBT per week. None received psychotropic medication	ITT	26.1 (3.7) n=20	13.2 (3.1) n=16	12.9 (3.6)	Not reported	Not reported
16. Björgvinsson et al. (2013)	Residential unit (The Menninger Clinic, Houston, Texas)	6.2 (7.5) (range: 2.0-12.0 weeks)	10.5 h per week therapist-aided ERP; 3 h self-directed ERP per week; psycho-educational CBT groups, individualized family interventions.	Case deletion (46/120 included in analyses)	26.5 (5.9) n=46	19.0 (7.6) n=46	7.5	t(45)=6.7, p<.006, d=not informed	Not reported
17. Dèttore et al. (2013)	Inpatient (Poggio Sereno Clinic, Florence, Italy)	5.0	1st week: 5 days × 4 h daily psycho-education; 4 weeks: 20 h ERP per week. Concomitant SRI pharmacotherapy (dose kept stable).	Non-completers 11 of 49.	Completers only: 28.7 (6.1) n=38	Completers only: 18.3 (7.9) n=38	Completers only: 10.3	t(37)=7.6, p<.000, d=1.5	Not reported
18. Voderholzer et al. (2013)	Inpatient OCD Unit (University Hospital in Freiburg and University Hospital in Lübeck, Germany)	13.0 (5.7)	2 h Therapist or self-guided ERP per week. 2 therapeutic sessions per week (50–60 min). Daily group Physiotherapy 1 h a week Ergo therapy.	Case deletion (6 of 66 dropped out before completion)	25.3 (4.6) n=60	14.1 (5.3) n=60	11.2	p=.000 ES=2.5	Not reported
19. Veale et al. (2015)	Residential unit (Bethlem Royal Hospital, UK) 2000-2013	12.0	4 h individual CBT per week; Assistant aided exposure; Group therapies; Occupational Therapy; Family interventions; Medication review	Multiple Imputation	30.8 (6.00) n=418	18.6 (7.8) n=418	12.2	t(63)=18.1, p<.001, d=not informed	22.6 (7.9) (6–12 months)
Total		Avg weeks: 10.4			n=2306	n=2202			

*Note: CBT, cognitive behavior therapy; BT, behavior therapy; ITT, intention to treat analysis; LOCF, last observation carried forward; ERP, exposure and response prevention.

Seven studies reported a follow-up period (range 3 months to 7 years). Because of the wide range and small number of studies, a change in mean Y-BOCS was not calculated. Nonetheless, all studies reported that only small losses at follow up to 2 years. However, there was inevitably a significant loss of follow up data in large service evaluations.

3.5. Risk of bias across studies

Fig. 2 shows a funnel plot in which the estimates of the mean versus standard error are distributed reasonably symmetrically about the mean. Although the scatter plot is not strictly a funnel shape, this is likely to be due to the relatively high heterogeneity rather than publication bias (Sterne et al., 2011). In support of this, Begg's Rank correlation test for asymmetry was not significant, $\tau=0.064$, $p=0.730$ and the trim and fill procedure removed no studies. Finally calculation of the failsafe N using the Rosenberg Method gave a very large N of 22792. In sum, these analyses suggest that although there is substantial heterogeneity associated with treatment, the estimate of the benefit here is unbiased and robust.

3.6. Predictors of dropout or outcome

It would be particularly helpful to know whether there were any predictors of dropout or outcome before admission to a costly intervention. Only one study was found to investigate predictors of dropout rates (Veale et al., 2015), while 13 focused on predictors of treatment outcome (see Table 2).

In terms of demographics, one predictor stood out as the strongest: five out of six studies found that those who are married or cohabiting have significantly better treatment outcomes than those who are not. One study (Rufer et al., 2005) found that this is only the case when patients have been married or cohabiting for longer than three years. Two studies (Langner et al., 2009; Stewart et al., 2009) also suggest that those who live alone have a higher risk of relapse and re-hospitalization post treatment. One study found that gender was a significant predictor of treatment outcomes, with females responding better to treatment than males, compared with four studies suggesting it was not.

One study found that depression at admission was a significant predictor of treatment outcome while another found it was a predictor of dropout (Veale et al., 2015), compared to four studies that concluded no significant effect of depression as a predictor of treatment outcome.

Five out of eight studies suggest OCD severity at admission is a significant predictor. Three studies that found higher Y-BOCS scores at admission are a highly significant predictor of good treatment outcomes (potentially because with higher Y-BOCS at admission there is greater room for improvement), but two studies (Stewart et al., 2005, 2006) found that lower OCD severity at initial assessment is associated with lower OCD symptoms at discharge, therefore suggesting that both low and high OCD severity at admission is indicative of good treatment outcomes. Five studies (see Table 2) found that illness duration was not a significant predictor of OCD treatment outcomes.

One study found that patients who have a history of alcohol abuse were found to have poorer treatment outcomes (Brennan et al., 2014) and one study found they had higher rates of dropout during treatment (Veale et al., 2015). Clients who exhibit fewer hoarding behaviors were found to have better treatment outcomes than those with more severe hoarding symptoms (Brennan et al., 2014; Rufer, Fricke, Moritz, Kloss, & Hand, 2006). One study found significantly higher instances of schizotypal or passive-aggressive traits (Fricke et al., 2006) and one a non-significant trend of co-morbid personality disorders (PDs) (Gonner, Limbacher, & Ecker,

2012) in non-responders than in responders to CBT. However, one study (Dèttore, Pozza, & Coradeschi, 2013) found no evidence of comorbid PDs or other disorders having an effect on treatment outcome-those with and without PDs or PTSD responded equally to treatment.

One study (Stewart et al., 2006) concluded an effect of psychosocial functioning on treatment outcomes, with those with higher psychosocial functioning having better treatment outcomes than those with lower psychosocial functioning. They found higher rates of unemployment and single marital status in those with poorer treatment outcomes, which they attribute partially to weaker support networks, compared to those with better social skills and better treatment outcomes.

A range of other predictors has also been found by single studies. One study (Langner et al., 2009) found that high motivation at admission predicted good outcome and a longer period of time spent as an inpatient without appropriate psychological treatment predicted poor outcome. One study found that those taking antipsychotic medication at admission were more likely to dropout, while those who were in employment were more likely to self-discharge or be discharged early (< 5 weeks) (Veale et al., 2015).

4. Discussion

The meta-analysis shows a substantial amount of heterogeneity in the estimate of treatment size. Nevertheless there was a robust and extremely large effect of treatment with Hedges g of 1.87 and mean improvement of 10.7 points on the Y-BOCS. The year of the study and length of stay did not moderate the effect size. Studies were published within a range of 22 years and there is no evidence that outcomes in OCD for outpatients have improved over this period. All clients received variations of CBT including exposure and response prevention for OCD ranging in intensity from 1 hour a week for up to 6 months (Boschen, Drummond, & Pillay, 2008) or 20 h a week for 5 weeks (Dèttore et al., 2013). Some did not report on the number of sessions of CBT per week. However, the reports may or may not include details of group or occupational therapy or supplementary sessions of accompanied exposure by an assistant. It is therefore difficult to compare the amount of treatment or exposure as a moderator.

The heterogeneity may therefore be partly explained by the nature of the participants included and the wide nature of the treatment programs offered. For example, some units specified admission criteria by the nature of participants' problems (e.g. risk to life or severe self-neglect) and the need to fulfill severe treatment refractory criteria to receive state funding (Drummond et al., 2008). The highest mean Y-BOCS at admission was 34.7 (Boschen, Drummond, Pillay, & Morton, 2010) which is in the severe range and the lowest mean at admission was at 24.1 (Kuelz et al., 2006), which is in the moderate range. Some studies had large numbers and were service evaluations (for example Stewart et al. (2005), whilst one was a randomized controlled trial or study that happened to be in an inpatient setting. There were a variety of methods for data loss that could not always be gleaned from the publication.
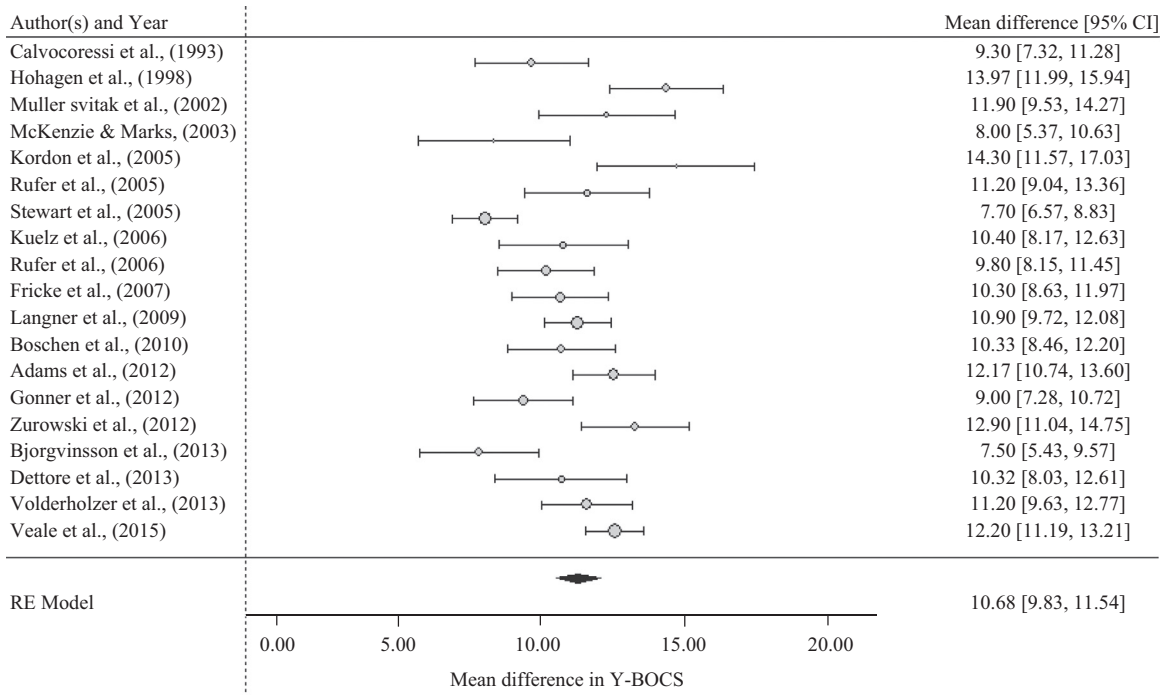
There were no consistent predictors of outcome in this review. Previous meta-analysis investigating predictors of OCD treatment outcome from 38 studies in outpatient settings (Knopp, Knowles, Bee, Lovell, & Bower, 2013) came to similar conclusions. Knopp et al. (2013) reported that consistent findings between predictors and outcomes were rare across the studies investigated. Findings about factors such as OCD severity, OCD symptom subtypes, illness duration, age, gender, marital/relationship status, employment status, past treatment, and severity of depression and anxiety symptoms, are contradictory-some studies suggesting these

Table 2
The effect of different factors on treatment outcome.

Study	Predictors of treatment outcome											
	Depression	Alcohol use	Marital status/ cohabiting	Hoarding behavior	Personality disorders	Illness duration	Severity of OCD	Motivation	Biological predictor	Gender	Psycho-social functioning	Comorbid illness
Rufer et al. (2005)	+	0	+	0	0	−	0	0	0	0	0	0
Stewart et al. (2005)	0	0	0	0	0	0	+	0	0	0	0	0
Fricke et al. (2006)	0	0	0	0	+	0	0	0	0	0	0	0
Rufer et al. (2006)	0	0	0	+	0	0	0	0	0	0	0	0
Stewart et al. (2006)	−	0	0	0	0	0	+	0	0	+	+	0
Langner et al. (2009)	0	0	+	0	0	−	+	+	0	−	+	0
Stewart et al. (2009)	0	0	+	0	0	0	−	0	0	−	0	+
Boschen et al. (2010)	−	0	+	0	0	−	−	0	0	−	0	0
Gonner et al. (2012)	−	0	0	0	−	−	−	0	0	0	0	−
Zurowski et al. (2012)	0	0	0	0	0	0	0	0	+	0	0	0
Dèttore et al. (2013)	0	0	0	0	−	0	0	0	0	0	0	0
Brennan et al. (2014)	−	+	−	+	0	−	+	0	0	−	−	−
Veale et al. (2015)	0	0	0	0	0	0	+	0	0	0	0	0

Note: + significant predictor of treatment outcome; − did not predict treatment outcome; 0 not investigated as having an effect of treatment outcome or otherwise.

Author(s) and Year	Mean difference [95% CI]
Calvocoressi et al., (1993)	9.30 [7.32, 11.28]
Hohagen et al., (1998)	13.97 [11.99, 15.94]
Muller svitak et al., (2002)	11.90 [9.53, 14.27]
McKenzie & Marks, (2003)	8.00 [5.37, 10.63]
Kordon et al., (2005)	14.30 [11.57, 17.03]
Rufer et al., (2005)	11.20 [9.04, 13.36]
Stewart et al., (2005)	7.70 [6.57, 8.83]
Kuelz et al., (2006)	10.40 [8.17, 12.63]
Rufer et al., (2006)	9.80 [8.15, 11.45]
Fricke et al., (2007)	10.30 [8.63, 11.97]
Langner et al., (2009)	10.90 [9.72, 12.08]
Boschen et al., (2010)	10.33 [8.46, 12.20]
Adams et al., (2012)	12.17 [10.74, 13.60]
Gonner et al., (2012)	9.00 [7.28, 10.72]
Zurowski et al., (2012)	12.90 [11.04, 14.75]
Bjorgvinsson et al., (2013)	7.50 [5.43, 9.57]
Dettore et al., (2013)	10.32 [8.03, 12.61]
Volderholzer et al., (2013)	11.20 [9.63, 12.77]
Veale et al., (2015)	12.20 [11.19, 13.21]
RE Model	10.68 [9.83, 11.54]

Mean difference in Y-BOCS

Fig. 1. Forest Plot displaying differences in YBOCS scores from admission to discharge for each study included in the meta-analysis and their weighted contributions to the overall estimate of change.
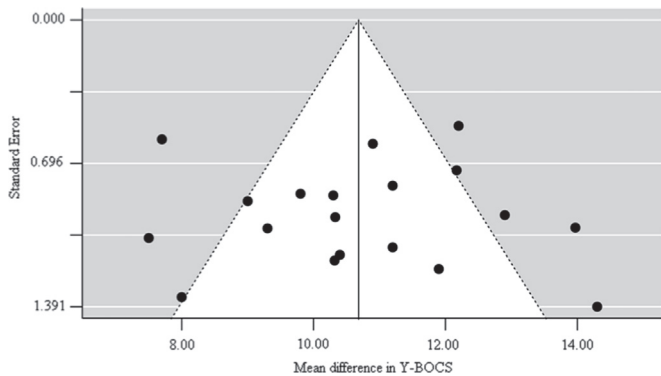
Fig. 2. A random effects model of inpatient treatment.

factors are predictors of treatment outcomes, and some not. Three out of four outpatient studies found hoarding to predict treatment outcomes, something that we found in two studies (Brennan et al., 2014; Rufer et al., 2006). Knopp et al. (2013) found a third of trials reported higher Y-BOCS severity to be predictors of worse treatment outcomes. In the present study, only two of five studies reported OCD severity as a predictor of outcome (Stewart et al., 2005; Stewart et al., 2006). Again, in Knopp et al. (2013) a third of all studies were found to associate employment and marital status with good outcomes, with unemployed, single patients having a worse prognosis post-treatment. This finding is replicated by the present study, with four out of five studies investigating these factors here reporting a significant relationship (Boschen et al., 2010; Langner et al., 2009; Rufer, et al., 2005; Stewart et al., 2009).

A previous meta-analysis of outpatients (Knopp et al., 2013) included 13 trials that investigated gender as a predictor of patient prognosis, with results however suggesting that gender was not a significant predictor of outcome. This is consistent with our conclusion of gender failing to predict treatment outcome.

In summary, the only consistent findings of predictors of good treatment outcome in inpatient or residential settings were

Y-BOCS scores at admission and marital status/ cohabitation, and the only consistent predictors of poorer outcome were symptoms of hoarding or the presence of comorbid alcohol misuse.

4.1. Limitations

We excluded some of the early studies, which did not report a change in Y-BOCS or used a self-report version of the Y-BOCS. There is a wide range of criteria for admission and treatment programs provided. Few studies reported on the changes in medication that occurred. What each setting shared was a specialized therapy program for severe OCD – thus it was not hospitalization that was being evaluated but a specialized intervention. Potential biases are likely to be greater for non-randomized studies compared with randomized trials, so results should always be interpreted with caution. Particular concerns arise with respect to differences between studies (selection bias). There may be a reporting bias as many programs may not audit their data. The details of the program, the protocol, or training of therapists were not always reported. None reported any adherence or competency measures of their therapists. None reported reliability ratings on the observer rated Y-BOCS and these might be biased as the treating therapist may have administered them. There were no consistent self-report symptoms of OCD such as the Obsessive Compulsive Inventory (Foa, Kozak, Salkovskis, Coles, & Amir, 1998) or quality of life outcome measures that might back up the results of the Y-BOCS. There were few long-term outcome studies and no cost effectiveness evaluations. This meta-analysis is mainly based on service evaluations for which inevitably the data is messy and there is enormous heterogeneity in the nature of patients and content programs. Some of the questions raised can really only be solved by large randomized controlled trials, which will be difficult and expensive to conduct. However, some specific questions could be answered with better collection of data and in the long term.

4.2. Further research

Future research will need to develop more sophisticated methods of evaluation collected prospectively that might predict outcome or dropout other than routinely collected data (e.g. demographics; severity of OCD; comorbidity). This may be helpful to determine which types of patients are not suited to inpatient or residential unit care or when they are not ready to change and should be discharged early. This meta-analysis suggests it may be helpful (1) for hoarding disorder to compare an exclusively home-based treatment against inpatient care with home visits and (2) to evaluate treating alcohol misuse and intolerance of emotion before admission for example by Dialectical Behavior Therapy (Linehan, Dimeff, & Koerner, 2007). For everyone, it may be important to evaluate a trial period of 2–4 weeks to determine level of engagement before deciding whether a patient is ready to change and continue with treatment. It may be helpful to determine whether clinicians can predict which patients should be discharged early but allow the patient to stay and observe their outcome at standard discharge (for example at 12 weeks).

For those who do not need to be admitted to an inpatient setting (for example no significant suicide risk or self-neglect), the need is to determine the long term clinical and cost effectiveness of residential treatment compared to home based or intensive or weekly outpatient CBT in patients with severe symptoms who can still travel to a service. It was not possible to evaluate the cost effectiveness of the interventions in this study but future trials should consider collecting not only the costs of an intervention, but also the total cost of other health and social care, including benefits, travel costs and lost employment in both a residential unit and outpatient care.

Much effort has been put into development of alternatives to psychiatric inpatient care for psychosis – for example intensive home based treatment. However, these programs are largely based on risk and medication management and some psycho-education for the family. The mainstay of inpatient or residential care consists of frequent CBT with a high level of expertize and support for doing exposure. If a person with OCD needs inpatient care (for example if there is a risk to life, severe self-neglect or extreme handicap) or if the patient lives a long way from a specialist service, it will be difficult to develop and evaluate a realistic alternative by a non-specialist team.

More research is needed to define the optimum components of a therapy program. Thus, although the evidence is for CBT with exposure and response prevention, little is known on how to optimize the frequency of individual or group therapy, assisted exposure, occupational therapy, family therapy and home visits. Other alternatives might include a combination of settings (for example to combine a shorter stay at a residential unit with outpatient or home based treatment). There are many inpatient and residential programs internationally (for example see OC Foundation website www.ocfoundation.org), but there are no agreed standards of care or outcomes – for example the nature and frequency of therapy; the nature of the therapeutic environment; the results of audit of outcomes; agreed outcome or quality of life measures; the reasons for admission; the percentage who dropout and average length of stay. We would therefore encourage units to publish their data, providing a flowchart of a large case series. They should try to agree on standardized methods of reporting their program. For example, the outcome data should include all clients who stay two weeks or more and an intention to treat analysis. Without this information, a patient will find it very difficult to make an informed choice and it would be helpful for units to collaborate in agreed standards of care and audit of outcomes.

Little is known about how to optimize the therapeutic milieu to enhance outcome in a residential setting with a cognitive behavioral approach. Veale, Gilbert, Wheatley, and Naismith (2014) argue for an environment where residents learn and practice compassion focused approaches to others so that the culture supports being motivated and attentive to each other's needs, being empathic, respectful, sympathetic, kind, accepting, non-judgmental and tolerant of each other's distress. In such an environment, members would positively reinforce acts of courage in one another for efforts at exposure. When residents and staff are aware of such acts, they might respond naturally and compassionately in the moment when another member makes an effort to change. In addition, some clients may have inter-personal difficulties and it is important to develop an environment in which residents can feel safe so that they can test out their fears. The culture needs to be very tolerant of OCD behavior so that others do not respond by punishing or shaming of the individual. It is possible to measure such a therapeutic environment (for example experience the experience of compassion, a sense of belongingness and the frequency of positive reinforcement) and for future research to determine whether such an environment enhances or moderates outcome (Veale, Miles, Naismith, & Gilbert, 2015).

5. Conclusions

Inpatient and residential treatment is an encouraging option for those with severe or treatment refractory OCD. Such clients can make significant improvements with intensive residential or inpatient therapy but little is known either about its long-term benefits or cost effectiveness compared with an alternative. However, this study highlights the diversity in the types of treatments offered (length of stay, treatment program content etc.). In addition, the study highlights that data available on predictors of drop out or treatment outcome is inconsistent, with studies concluding an array of different results.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.jocrd.2015.11.005.

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