How often are outcomes other than change in substance use measured? A systematic review of outcome measures in contemporary randomised controlled trials

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Abstract

Issues. Recovery is a theoretical construct and empirical object of inquiry. The aim was to review whether outcome measures used in randomised controlled trials of drug treatment reflect a comprehensive conceptualisation of recovery. Approach. Systematic review using the following databases: Cochrane Database of Systematic Reviews, Cochrane Controlled Register of Trials, Database of Abstracts of Reviews of Effect, Web of Science, MEDLINE, EMBASE and PsycINFO. Search returned 6556 original articles and 504 met the following inclusion criteria: randomised controlled trial in English-language peer-reviewed journal; sample meets criteria for drug dependence or drug use disorder; reports non-substance use treatment outcomes. Review protocol registration: PROSPERO (CRD42018090064). Key Findings. 3.8% of the included studies had a follow up of 2 years or more. Withdrawal/craving was present in 31.1% of short-term versus 0% of long-term studies. Social functioning in 8% of short-term versus 36.8% of long-term studies. Role functioning (0.9 vs. 26.3%), risk behaviour (15.6 vs. 36.8%) and criminality (3.8 vs. 21.1%) followed a similar pattern. Housing was not examined short-term and unregularly long-term (2.0%). ‘Use of health-care facilities’, clinical psychological, behavioural factors were frequently reported. Physiological or somatic health (15.2 vs. 10.5%), motivation (14.2 vs. 15.8%) and quality of life (7.1 vs. 0%) were less frequently reported. Conclusion. The short time interval of the follow up and lack of information on relevant factors in recovery prevents the development of evidence-based approaches to improve these factors. Particularly, measures of social and role functioning should be added to reflect an adequate conceptualisation of recovery. [Bjornestad J, McKay JR, Berg H, Moltu C, Nesvåg S. How often are outcomes other than change in substance use measured? A systematic review of outcome measures in contemporary randomised controlled trials. Drug Alcohol Rev 2020]
illness [2-4]. While specific factors, such as reduction in criminality, are more prominent in DUD recovery than in recovery from severe mental illness, general core factors, including an increase in community and social functioning, are common to these conditions [5-9]. The same applies for the reduction in core symptoms, for example substance use and severe psychiatric symptoms, as essential for achieving stable long-term recovery [10-12]. In this systematic review, we propose that conceptualisations of recovery from severe mental illness are applicable in DUD. Second, we systematically review to what extent substance use outcome measures used in randomised controlled trials (RCT) of drug treatment reflect a comprehensive understanding of recovery.

Clinical recovery traditionally refers to mental illness or DUD as distinct disorders displaying core symptoms. Clinical recovery is achieved when the core symptoms subside below diagnostic thresholds. Furthermore, the criteria for clinical recovery are based on researcher-derived thresholds and predefined objectives, including symptoms and functioning. Recovery also has a temporal criterion intended to indicate the stability of the recovery [4,13,14]. While subject to ongoing debate, a minimum duration of 2 years has been proposed. Two years allows for the possibility of new habits and behaviours to take hold, a relapse may have occurred or not, the maintenance of a drug-free social network has begun to consolidate, etc. [15-17]. There is more widespread agreement on symptom criteria for changes in drug use (i.e. use to abstinence or moderation) in the DUD literature [18,19]. However, consensus is lacking regarding criteria for functional and social recovery. Because of the extensive identity changes that are often considered necessary to handle a drug-free life, or even drug moderation, some have set a 5-year temporal criterion for DUD recovery [20-23].

The personal recovery tradition arose as a reaction to researcher-derived recovery criteria. Personal recovery is conceptualised beyond core symptom reduction as: ‘...a process of restoring a meaningful sense of belonging to one’s community and positive sense of identity apart from one’s condition while rebuilding a life despite or within the limitations imposed by that condition’ [24,25]. Synthesising the research on personal recovery into an empirically based concept, Leamy et al. [26] outlined the Connectedness, Hope & Optimism, Identity, Meaning and Empowerment framework, in which five main long-term processes characterise recovery: (i) connectedness; (ii) hope and optimism; (iii) identity; (iv) meaning in life; and (v) empowerment. Empirical research suggests that these processes are relevant for DUD recovery [6,12,21,22].

The relational recovery tradition critiques the clinical and personal recovery approaches for not incorporating the interpersonal embeddedness of recovery [27]. This framework sees interpersonal contexts as permeating individualistic or subjective concepts like connectedness and self-agency [28], and advocates against conceptualising recovery as separate from the social and relational reality that partly defines the potentialities for each individual. These issues are just as relevant for DUD as for serious mental illness [29,30].

Though there are differences between these three approaches, the perspectives of clinical, personal and relational recovery share common ground [30]. Consistent with empirical findings, symptom reduction is seen as a necessary but insufficient requirement to maintain recovery over time. Although clinical recovery is unique in its definition of a concrete temporal criterion [15,16], recovery is universally described as a non-linear and cumbersome long-term growth process, with the threat of relapse often present. It is also acknowledged that a good outcome sometimes requires a long-term care effort [11-13,31]. Empirical support for these findings is solid and consistent across different clinical disciplines and research traditions [10,17,22,32-35]. On this basis, it is proposed that treatment outcome research in DUD should reflect these findings when assessing recovery.

The aim of this review was to systematically review and identify non-substance use (non-SU) treatment outcome measures used in RCTs on illicit drug use over the last 10 years, and to assess the degree to which they reflect any of the above-mentioned perspectives of recovery. RCTs were chosen because this methodology is generally considered the most valuable for both evaluating treatment efficacy and effectiveness and developing treatment guidelines.

Methods

This review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [36] to ensure comprehensive and transparent reporting of procedures and results. The protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO) in March 2018 (registration number: CRD42018090064) (Appendix 1).

Search strategy

Two independent researchers (JB and SN) conducted a search of the literature using the following electronic databases: Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, Database of Abstracts of Reviews of Effect, Web of Science, MEDLINE, Embase and PsycINFO. Variations and
combinations of terms targeting five main concepts were used in the search: RCTs, substance abuse, substances, therapeutic approaches and recovery success. Subject headings belonging to the individual databases (e.g. MeSH subject terms) and free-text terms (see Appendix 2 for model search) were also used. The search queries were reviewed by an information scientist. In addition, a hand search was performed using reference lists from reviews and meta-analyses identified in the main search. In cases of doubt, the full-text paper was read to determine eligibility. Papers published between January 2008 and January 2019 were included. The last search was conducted on 11 January 2019.

**Eligibility criteria**

The included articles met the following criteria:

- Empirical study published in English-language peer-reviewed journal.
- Study sample meets the criteria for dependence syndrome (International Classification of Diseases, 10th revision) or moderate–severe DUD (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition).
- Randomised controlled trial.
- Reports non-SU treatment outcomes in addition to changes in substance use (e.g. social functioning, employment/school status, criminality, psychological symptoms).
- Empirical study from the past decade (2008–), as the recovery field has gained a more solid theoretical and empirical foundation during this time [1,4,11,26,27,35–37].

**Exclusion criteria**

Articles were excluded if the study sample was only or predominantly comprised of individuals with alcohol dependence, or if the study did not include non-substance use outcomes.

**Data collection**

All potential studies were exported into a reference citation manager (EndNote) before removing duplicates. Two independent reviewers (authors JB and SN) separately performed the screening of titles and abstracts, full-text analysis and selection of non-SU treatment outcome measures. Outcome categories (as presented in Tables 1–3) were developed during 13 consensus meetings (>60 min each, JB and SN) and existing taxonomies as given below. Disagreements were resolved through discussion until consensus was reached. A third reviewer (JRM) was available to resolve disagreements and provide critical evaluation.

**Analytic methods and data extraction procedure**

A narrative descriptive synthesis was performed for the included articles. The qualitative synthesis was used to determine the taxonomy of non-SU outcomes. We used the suggested taxonomies of Dodd et al. [71], Bray et al. [72] and Shorter et al [73] as our basis for the synthesis. Dodd et al. was chosen as their standardisation includes flexible categories, applicable for general dimensions that emerge across conditions, such as functioning [71]. Bray et al. [72] and Shorter et al. [73] were used to adapt the categorisation specifically to DUD. Where we could not find normative taxonomies covering outcomes satisfactory, or we assessed factors as particularly relevant and specific for DUD (e.g. criminality), we used the study authors’ outcome operationalisations as a compass for developing categories. In this context the following data extraction procedure was used: first, non-SU treatment outcome measures across different domains (e.g. work, community functioning, social functioning, health behaviour) were identified. Second, the properties of each outcome measure were analysed and categorised based on similarity (e.g. hepatitis C and HIV related to risky sexual behaviour were both organised under the ‘Risk behaviour’ tab in Table 1).

Contemporary recovery perspectives address issues of functioning (e.g. community and social), incorporate various perspectives on outcome (e.g. service user and researcher perspectives) and are explicit that a long-term perspective is crucial particularly with regards to functional recovery [11,12,29,30]. Since research on recovery has been growing over the past 10 years, this became a central rationale for the time limitation in our search—to test whether the DUD field had incorporated this shift in focus, from symptom relief (typically some measure of change in substance use), to more explicitly addressing function and social factors as important outcome measures.

For the same reasons, the second part of the synthesis was a pre-planned sub-analysis to identify long-term studies using non-substance use outcomes. Here, cut-off was set to studies with a follow up of at least 2 years, following Lieberman’s criteria of stable recovery [2]. Also, the temporal criterion was set to 2 years, as this is suggested as the temporal requirement for recovery in the clinical recovery literature [15,17]. Acknowledging the debate in this area, and some researchers advocating a temporal criterion up to 5 years [20–23], our 2-year criteria can primarily be viewed as a practical tool and
Table 1. Non-substance use outcomes used in the contemporary drug use disorder trial literature

| Outcomes | Follow up, weeks | Time period |
|----------|-----------------|-------------|
|          | <13  | 13–26 | 27–52 | 53–103 | Min. 2-years follow up | 2008–2013 | 2014–2018 |
| Total, n = 504 | | | | | | |
| No. studies | 42.1 (212) | 29.6 (149) | 21.8 (110) | 2.8 (14) | 3.8 (19) | 51 (257) | 49 (247) |
| Outcomes | | | | | | |
| Adverse effects | | | | | | |
| Sub-categories: withdrawal/cravings | 31.1 (66) | 13.4 (20) | 6.4 (7) | 0 | 0 | 21.0 (54) | 15.8 (39) |
| Psychological/behavioural factors | | | | | | |
| Clinical | 41.0 (87) | 38.3 (57) | 33.6 (37) | 64.3 (9) | 31.6 (6) | 35.0 (90) | 42.9 (106) |
| Sub-categories: Psychological symptoms, psychiatric diagnosis, adverse events, cognitive functioning | | | | | | |
| Motivation | 14.2 (30) | 10.7 (16) | 12.7 (14) | 21.4 (3) | 15.8 (3) | 15.2 (39) | 10.9 (27) |
| Sub-categories: Self-efficacy, coping, readiness to change, treatment satisfaction, satisfaction/reward | | | | | | |
| Physiological/clinical (somatic) | 19.8 (42) | 16.8 (25) | 19.1 (21) | 21.4 (3) | 10.5 (2) | 17.9 (46) | 23.1 (57) |
| Sub-categories: Physical health, seizure, pain experience, adverse effects, tolerability, insomnia, sleep | | | | | | |
| Housing | | | | | | |
| Functioning | | | | | | |
| Social functioning | 8.0 (17) | 12.1 (18) | 15.5 (17) | 14.3 (2) | 36.8 (7) | 11.7 (30) | 12.6 (31) |
| Sub-categories: Community functioning, social relations and support, friend relationships, parenting, psychosocial, personal finance, aggression | | | | | | |
| Use of health-care facilities | 26.9 (57) | 43.6 (65) | 37.3 (41) | 42.9 (6) | 52.6 (10) | 42.8 (110) | 27.9 (69) |
| Sub-categories: Hospital days, treatment adherence/compliance, medication adherence (including therapeutic naltrexone levels), use of community-based organisation, retention, attrition, days to readmission, drop out, alliance | | | | | | |
| Role functioning | 0.9 (2) | 6.7 (10) | 8.2 (9) | 14.3 (2) | 26.3 (5) | 7.0 (18) | 4.1 (10) |
| Sub-categories: Taxed job, school participation, disability days | | | | | | |
| Global functioning | 6.1 (13) | 12.8 (19) | 12.7 (14) | 21.4 (3) | 10.5 (2) | 9.7 (25) | 10.5 (26) |
| Sub-categories: Composite of several functioning domains; employment, medical, psychiatric, legal, family/social, drugs, alcohol, etc. (typically based on composite scores from ASI, GAF, GSI) | | | | | | |
| Quality of life | 7.1 (15) | 12.8 (19) | 12.7 (14) | 28.6 (4) | 0 | 9.4 (24) | 10.5 (26) |
| Sub-categories: Quality of life measures, health related quality of life | | | | | | |
| Criminality | 3.8 (8) | 7.4 (11) | 13.6 (15) | 14.3 (2) | 21.1 (4) | 7.4 (19) | 8.5 (21) |
| Risk behaviour | 15.6 (33) | 24.2 (36) | 22.7 (25) | 14.3 (2) | 36.8 (7) | 25.7 (66) | 15.4 (38) |
| Sub-categories: Risk behaviour (e.g. engaging in behaviours which increase the risk of hepatitis C, HIV or overdose) | | | | | | |
| Studies including only one non-substance use outcome in addition to change in substance use | | | | | | |

ASI, Addiction Severity Index; GAF, Global Assessment of Functioning; GSI, Global Severity Index.
as a minimum criterion to identify long-term studies. Finally, descriptive statistics were generated, aimed at summarising and quantifying significant treatment effects across studies.

Results

Search results

The electronic search returned 6556 articles. After duplicates were removed, 4545 articles remained. A hand search of reference lists from reviews and meta-analyses returned a further 21 articles. Full-text evaluation was conducted for 761 articles, of which 504 met the inclusion criteria and were included in the final synthesis. Details of the search results are summarised in Figure 1. Since the number of screened and included articles was extensive, it was necessary to develop superordinate categories (e.g. social functioning). Seven non-SU outcome categories and seven sub-categories were developed.

Non-SU outcome measures

Details of the included non-SU outcomes are summarised in Table 1 (see Appendix 3 for substance use measures used in the included articles). The five most frequently included outcomes were: clinical factors (from the category psychological/behavioural factors) \( n = 196 \); use of health-care facilities (from the category functioning) \( n = 179 \); risk behaviour \( n = 104 \); physiological/clinical (somatic) \( n = 103 \); and withdrawal/cravings (from the category adverse effects) \( n = 93 \). The five least frequently included outcomes were: housing \( n = 11 \); role functioning (from the category functioning) \( n = 28 \); criminality \( n = 40 \); global functioning—mostly community-related functioning (from the category functioning) \( n = 51 \); and quality of life (from the category functioning) \( n = 51 \). In comparison, all studies had at least one DUD measure, which was also almost always reported as an outcome. Substance use outcome measures were spread across 22 different sub-categories (e.g. days of drug use last month, substance use problems past 90 days, illicit opiate use).

Follow-up duration

From the included 504 research studies, 42.1% had less than 13 weeks of follow up, 29.6% had between 13 and 26 weeks, 21.8% had between 27 and 52 weeks, 2.8% had between 53 and 103 weeks and 3.8% had at least 2 years of follow up. The longest follow up was 416 weeks.

Relation between length of follow up and non-SU outcomes included

The most evident differences in non-SU outcome inclusions emerged between studies with less than 13 weeks of follow up and studies with at least 2 years of follow up (see Table 1). A measure of withdrawal/craving was present in 31.1% of the short-term versus 0% of the long-term studies. A reverse pattern was demonstrated with measures of social functioning, which were present in 8% of the short-term studies versus 36.8% of the long-term studies. Measures of role functioning \( (0.9 \text{ vs. } 26.3\%) \), risk behaviour \( (15.6 \text{ vs. } 36.8\%) \) and criminality \( (3.8 \text{ vs. } 21.1\%) \) followed a similar pattern. Housing was not examined in studies with short-term follow up, and only examined in one with long-term follow up \( (5.3\%) \). ‘Use of health-care facilities’ was frequently reported across follow-up duration categories. Here, however, the greatest difference was again between follow ups of less than 13 weeks and greater than 1 year \( (26.9 \text{ vs. } 52.6\%) \). Clinical psychological and behavioural factors were generally frequently reported \( (41.0 \text{ vs. } 31.6\%) \). Physiological or clinical (somatic) health \( (15.2 \text{ vs. } 10.5\%) \), motivation \( (14.2 \text{ vs. } 15.8\%) \) and quality of life \( (7.1 \text{ vs. } 0\%) \) showed similar patterns, but with substantially lower percentages. More studies with only one outcome in addition to change in substance use were found between 2014 and 2019 \( (55.1\%) \) than 2008 and 2013 \( (41.2\%) \).

Long-term interventions and reported effects on DUD and non-SU outcomes

Table 2 displays details on studies with follow ups of between 1 and 2 years, and Table 3 presents details on studies with at least 2 years of follow up. Reported treatment effects are also presented. Slightly over two-thirds \( (69.7\%) \) of the studies evaluated what may be termed complex interventions, which were primarily treatment programs with multiple components or several treatments/treatment elements merged together. Conversely, slightly less than one-third \( (30.3\%) \) of the studies evaluated more narrowly focused interventions, usually single treatments such as cognitive behavioural therapy or targeted HIV-prevention programs. Ten percent of the studies showed a positive effect on DUD outcomes but no effect on non-SU outcomes. Conversely, 6.7% had a positive effect on non-SU outcomes but no effect on DUD outcomes. In total, 57.6% of the studies showed a significant positive effect on at least one of the non-SU outcomes examined during the intervention period and/or during follow up. Slightly more than half of the studies \( (54.6\%) \) had at least one significant positive
| Author, publication year, country | Sample, substance type | Follow up (weeks) | Experiment condition | Control condition | Non-SU outcomes | DUD outcomes | Reported findings on non-SU outcomes | Reported findings on DUD outcomes |
|-----------------------------------|------------------------|------------------|----------------------|------------------|----------------|-------------|-------------------------------|-----------------------------|
| Litt et al. (2013), USA [38]      | Recruited through newspaper advertisement. Adults. n = 215. Marijuana | 61 | Three conditions: (i) Intended to enhance self-efficacy (motivational enhancement plus cognitive-behavioural treatment plus contingency management reinforcing); (ii) Same condition plus reinforcing drug abstinence completion of treatment homework; (iii) Case management control condition. COMPLEX | See experiment condition | (i) Psychological/ behavioural factors (motivation); (ii) Psychological/ behavioural factors (clinical); (iii) Functioning (composite scores); (iv) Functioning (use of health-care facilities) | Days abstinent during 90-days time period | No clear treatment condition main effects. A subsample of patients with significant increase in self-efficacy did very well over time. This subsample was more likely to have been treated in the 'case management abstinence' condition. This treatment effect appears to have been accounted for by days of continuous abstinence accrued during treatment, and by pre–post increases in self-efficacy. While in treatment, the experiment group reduced negative affect on the Positive and Negative Affect Scale. DHEA treatment | See non-SU findings |
| Ohana (2016), Israel [39]         | Detoxification program enriched with intensive psychosocial interventions and aftercare. Adults. n = 121. Poly use | 64 | Dehydroepiandrosterone (DHEA biochemical substance) group. SPECIFIC | Placebo group | (i) Psychological/ behavioural factors (clinical); (ii) Functioning (use of health-care facilities); (iii) Quality of life | Drug use during study period | At 16-month follow up, re-use rates in the experiment condition were about one-third, compared with placebo | |
Table 2. (Continued)

| Author, publication year, country | Sample, substance type | Follow up (weeks) | Experiment condition | Control condition | Non-SU outcomes | DUD outcomes | Reported findings on non-SU outcomes | Reported findings on DUD outcomes |
|----------------------------------|------------------------|-------------------|----------------------|------------------|-----------------|-------------|-------------------------------------|---------------------------------|
| **Eack (2016), USA** [40]        | Psychiatric Institute and Clinic. Individuals with schizophrenia who were receiving outpatient services and had moderate or higher addiction severity scores. Adults. n = 31. Poly use | 72 | Cognitive enhancement therapy (n = 22). SPECIFIC | Usual care (n = 9) | Psychological/behavioural factors (clinical) | Substance use problem severity past month | No significant between-group differences on non-SU outcomes | Substance use days were highly variable and followed nonlinear trajectories. Patients receiving cognitive enhancement therapy were significantly less likely to use alcohol but not cannabis. |
| **Slesnick (2016), USA** [41]    | Women’s Health Education. Office therapy or home-based family systems therapy (n = 123). COMPLEX | 72 | Women’s Health Education, mothers only (n = 60) | Functioning (social functioning) | Substance problems past 90 days | No treatment effects were found for parent–child interactions | Women assigned to family systems therapy showed more rapid decline in alcohol, marijuana and cocaine use |
| Author, publication year, country | Sample, substance type | Follow up (weeks) | Experiment condition | Control condition | Non-SU outcomes | DUD outcomes | Reported findings on non-SU outcomes | Reported findings on DUD outcomes |
|----------------------------------|------------------------|-------------------|----------------------|-------------------|----------------|-------------|--------------------------------------|------------------------------------|
| Zhang (2018), USA [42]           | Mothers who had at least one biological child in their care. Mothers were recruited from a community treatment centre for substance use in a large Midwestern city. Adults. n = 183. Poly use | 72                | Three conditions: (i) EBFT, home (n = 62); (ii) EBFT, office (n = 61); (iii) Women’s Health Education (n = 60). COMPLEX | See experiment condition | (i) Criminality; (ii) Functioning (use of health-care facilities) | Substance use problems past 90 days | Mothers in the family therapy conditions had better psychological control. Children with mothers who showed decreased substance use and psychological control exhibited lower levels of problem behaviours compared to children with mothers showing increased substance use and psychological control. | Mothers in the family therapy conditions were more likely to show reduced substance use. |
| Milby et al. (2008), USA [43]    | Birmingham Health Care. Agency serving homeless persons. Adults. n = 206. Cocaine | 76 | Full treatment model: contingency-managed housing, vocational training, and work therapy plus extensive behavioural day treatment. COMPLEX | Abbreviated treatment model: contingency-managed housing, vocational training, and work therapy | Functioning (use of health-care facilities) | (i) Prevalence of abstinence for the group at a point in time; (ii) Overall abstinence a period; (iii) Ability to initiate and sustain abstinence | No significant between-group differences on ‘use of health services compliance’ | Full treatment model produced better sustained abstinence outcomes. |
| Author, publication year, country | Sample, substance type | Follow up (weeks) | Experiment condition | Control condition | Non-SU outcomes | DUD outcomes | Reported findings on non-SU outcomes | Reported findings on DUD outcomes |
|---------------------------------|------------------------|------------------|----------------------|------------------|----------------|-------------|-----------------------------------|----------------------------------|
| Dakof et al. (2010), USA [44]   | Mothers recruited from the drug court. Adults. *n* = 62. Poly use | 78               | Engaging Moms drug court program. COMPLEX | Usual drug court care Functioning (use of health-care facilities) | Number of days of substance use | Significant time effects for both intervention groups on mental health, parenting practices and family functioning. There were no significant differences between the experiment group and controls on non-SU outcomes | Significant time effects for both intervention groups' substance use outcomes. No significant differences between the experiment group and controls on DUD outcomes |
| McKay et al. (2010), USA [45]   | Intensive outpatient programs at the time of entrance to treatment. Adults. *n* = 100. Cocaine | 78               | Three conditions: (i) Cognitive–behavioural RP; (ii) CM; (iii) Combination of RP and CM COMPLEX | See experiment condition | Abstinence from any cocaine use within each 3-month segment of follow up | No significant between-group differences on non-SU variables | Significant effect favouring CM, but not RP. Best outcome in the CM + RP condition |
| Milby et al. (2010), USA [46]   | Birmingham Health Care. Agency serving homeless persons. Adults. *n* = 103. Cocaine | 78               | Abstinence-contingent housing, vocational training, and work plus cognitive behavioural day treatment. COMPLEX | Abstinence-contingent housing, vocational training and work (i) Housing; (ii) Functioning (role) | Largest number of consecutive weeks abstinent over the first 52 weeks of study participation | No significant between-group effect differences on non-SU outcomes | Consecutive weeks of abstinence during treatment predicted long-term housing and employment stability |

Table 2. (Continued)
Table 2. (Continued)

| Author, publication year, country | Sample, substance type | Follow up (weeks) | Experiment condition | Control condition | Non-SU outcomes | DUD outcomes | Reported findings on non-SU outcomes | Reported findings on DUD outcomes |
|---------------------------------|------------------------|------------------|---------------------|------------------|----------------|-------------|-------------------------------------|----------------------------------|
| Tobin et al. (2011), USA [47]   | Self-reported injection drug users. Adults. n = 227. Poly use | 78               | Peer-based, personal risk network-focused HIV prevention intervention. SPECIFIC | Five group-based sessions addressing injection drug use-related topics | Risk behaviour | Frequency of use of these paraphernalia in the past 6 months. All injection use | Increase in condom use among females in the experiment group | Reduced injection risk in the experiment group |
| González-Menéndez (2014), Spain [48] | Female inmates from state prison. Adults. n = 37. Poly use | 78               | ACT. SPECIFIC       | CBT              | (i) Psychological/behavioural factors (motivation); (ii) Psychological/behavioural factors (clinical); (iii) Functioning (composite scores) | (i) Days to first heroin use; (ii) Days to heroin relapse; (iii) Maximum consecutive days of abstinence from heroin | HIV risk behaviours decreased significantly from baseline for all three groups, primarily driven by substantial reductions in injection drug use. HIV risk behaviours did not differ significantly between conditions | ACT was better than CBT in the maintaining of abstinence rates |
| Schottenfeld et al. (2008), Malaysia [49] | Outpatient research clinic and detoxification program. Adults. n = 126. Heroin | 95               | Three conditions: (i) Manual-guided drug counselling and maintenance treatment with naltrexone; (ii) Manual-guided drug counselling and maintenance treatment with buprenorphine; (iii) Manual-guided drug counselling and maintenance treatment with placebo. COMPLEX | See experiment condition | (i) Risk behaviour; (ii) Physiological/clinical (somatic) | | | |
| Messina et al. (2012), USA [50] | Female offenders participating in four drug | 96               | Gender-responsive programs using Helping Women Recover and Standard mixed-gender treatment | (i) Psychological/behavioural factors | Better in-treatment performance, more positive | Both groups reported non-significant reductions in drug use. Buprenorphine was associated with greater time to first heroin use than naltrexone | | |

(Continues)
| Author, publication year, country | Sample, substance type | Follow up (weeks) | Experiment condition | Control condition | Non-SU outcomes | DUD outcomes | Reported findings on non-SU outcomes | Reported findings on DUD outcomes |
|----------------------------------|-----------------------|------------------|----------------------|------------------|----------------|-------------|-------------------------------------|---------------------------------|
| Saal (2016), Germany [51]        | Four inpatient rehabilitation departments. Unemployed patients. Adults. \( n = 179 \). Poly use | 96                | Employment-focused case management. COMPLEX | Standard care (i) Housing; (ii) Functioning (role); (iii) Functioning (use of health-care facilities); (iv) Quality of life | Substance use past month | No significant between-group differences on return to work rates, satisfaction with life, housing and precarious financial situation. Experiment condition was more effective on linking SUD patients with federal employment agency or job centre services | No significant between-group differences on drug abstinence | |
| Non-SU outcomes                  | DUD outcomes          |                  |                      |                  |                 |             | perceptions related to their treatment experience, and trends indicating reductions in PTSD symptomology in the experiment condition. Both groups improved in their self-reported psychological well-being and arrest records | use. No between-group differences | |

**Table 2.** (Continued)

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COMPLEX refers to complex intervention program. SPECIFIC refers to specific intervention program. ACT, acceptance and commitment therapy; CBT, cognitive behavioural therapy; CM, contingency management; DUD, drug use disorder; EBFT, ecologically based family therapy; non-SU, non-substance use; PTSD, post-traumatic stress disorder; RP, relapse prevention; SUD, substance use disorder.
| Author, publication year, country | Sample, substance type | Follow-up (w) | Experiment condition | Control condition | Non-SU outcomes | DUD-outcomes | Reported findings on non-SU outcomes | Reported findings on DUD outcomes |
|----------------------------------|------------------------|--------------|----------------------|------------------|----------------|-------------|-------------------------------------|-------------------------------|
| Morgenstern et al. (2009), USA [52] | Women receiving temporary assistance for needy families. Adults, n = 302. Poly use | 104 | Intensive case management. COMPLEX | Screen-and-refer program | Functioning (role) | Monthly rates of absolute abstinence (daily screening) | Employment rate greater for the 'intensive case management' group | Abstinence rates were higher for the intensive case management group |
| Barrowclough et al. (2010), UK [53] | Secondary care. Persons with combined psychosis and SUD. Adults, n = 327. Poly use | 104 | Integrated motivational interviewing and CBT plus standard care. COMPLEX | Standard care | (i) Psychological/behavioural factors (motivation); (ii) Psychological/behavioural factors (clinical); (iii) Functioning (composite scores); (iv) Functioning (use of health-care facilities) | Number of days of substance use | Readiness to change use was higher in the experiment group at 12 months. This effect was not maintained at 24 months. No significant effects on any other non-SU outcomes | Amount of drugs used per substance use day was lower in the experiment group |
| Carpenedo et al. (2010), USA [54] | Large, urban, non-profit, free-standing methadone maintenance treatment centre. Adults, n = 130. Cocaine-abusing or dependent | 104 | Long-term voucher-based reinforcement therapy. SPECIFIC | Short-term voucher-based reinforcement therapy | Functioning (use of health-care facilities) | Number of days of cocaine use | No significant between-group differences in follow-up retention | Longer durations of self-reported continuous abstinence in the experiment group. This effect was not maintained during year 2 |
| Osiedo-Joekes et al. (2010), Spain [55] | Granada Penitentiary Centre. Chronic-opioid-dependent people with severe drug-related health problems. Adults, n = 62. Poly use | 104 | Injected diacetylmorphine (diacetylmorphine [pharmaceutical grade heroin]. Three subgroups in relation to their HAT history: (i) Currently on HAT; (ii) Discontinued HAT; (iii) Never received HAT. SPECIFIC | Oral methadone | (i) Physiological/clinical (somatic); (ii) Functioning (use of health-care facilities) | Number of days of substance use | Those currently in heroin-assisted treatment were the only group that had sustained at 2 years their marked improvement in physiological health after 9 months of treatment during the trial period | Illicit heroin use had a significant decrease in all three groups from baseline to 2 years post trial |
| Go (2015), Vietnam [56] | 455 HIV-infected injectors and 355 of their HIV-negative injecting network members living in 32 sub-districts in Thai Nguyen Province. Adults. Poly use | 104 | Enhanced individual level post-test counselling and group support sessions vs. standard care HIV testing and counselling. This resulted in four arms: (i) Standard of care; (ii) Community-level intervention; (iii) Individual-level intervention; (iv) Community plus individual intervention. COMPLEX | See experiment condition | (i) Risk behaviour; (ii) Functioning (social functioning) | No outcomes presented for DUD outcomes | Fewer participants reported sharing injecting equipment and unprotected sex from baseline to 24 months in all arms. No other significant effects on non-SU outcomes and no significant differences between arms | No outcome analyses on that variable presented |
| Cather et al. (2018), USA [57] | Co-ordinated specialty care service program (NAVIGATE) for people with comorbid psychosis and SUD. | 104 | Received NAVIGATE (n = 223). COMPLEX | Usual care (n = 181) | Functioning (use of health-care facilities) | Substance use past 30 days | See DUD outcomes | No treatment group by time interaction effect on days of self-reported substance use over the two-year follow up. Participant exposure to the substance use | No outcome analyses on that variable presented |
| Author, publication year, country | Sample, substance type | Follow-up (w) | Experiment condition | Control condition | Non-SU outcomes | DUD-outcomes | Reported findings on non-SU outcomes | Reported findings on DUD outcomes |
|---------------------------------|-----------------------|--------------|----------------------|------------------|----------------|-------------|-----------------------------------|----------------------------------|
| Hoffman et al. (2013), Russia [58] | Injection drugs users. Adults. n = 160. Poly use | 104 | Peer-educator network intervention as a strategy to reduce HIV acquisition and their drug and/or sexual networks. SPECIFIC | No peer-educator network intervention | Risk behaviour | No outcomes presented for DUD outcomes | No significant between-group differences on non-SU outcomes | No outcome analyses on that variable presented |
| Rotheram-Boris et al. (2009), USA [59] | HIV-infected marginally housed persons. Adults. n = 270. Poly use | 108 | Healthy Living Programme aimed at reducing risky sexual behaviour and substance use. COMPLEX | Passive control (did not receive intervention) | Risk behaviour | (i) Number of days marijuana used; (ii) Used hard drugs; (iii) Number of days hard drugs used | Reductions in unprotected risky sexual acts, number of sexual partners of HIV negative or unknown serostatus higher in the experiment group | Marijuana use and hard drug use lower in the experiment group |
| Schaeffer (2014), USA [60] | High-risk juvenile offenders. Adolescents (mean age = 15.8 years). n = 97. Poly use | 120 | Community Restitution Apprentice-Focused Training. COMPLEX | Education as usual | Substance problems past 30 days | Increased rate of youth employment and General Equivalency Diploma attendance in the experiment group. No effects for months employed, hours worked or hourly wage. Measures of mental health symptoms and criminal activity showed no favourable effects. | No between-group differences on substance use |
| DeFulio and Silverman (2011), USA [61] | Unemployed welfare recipients who persistently used cocaine while in methadone treatment. Adults. n = 51. Cocaine | 130 | Abstinence-contingent employment group that was required to provide cocaine and opiate-negative urine samples to work and maintain maximum rate of pay. COMPLEX | Work independently from drug use group | Drug urine samples. Testing became random and progressively less frequent as abstinence was sustained. Control group had less strict rules. | No significant between-group differences on either non-SU outcomes during the employment year or follow up | The experiment group had significantly more cocaine-negative samples during the employment year. Differences were not maintained during follow up |
| Scott (2017), USA [62] | Women released from the Cook County Jail’s Department of Women’s Justice Services. Adults. n = 480. Poly use | 144 | Recovery management check-ups for two years. SPECIFIC | One assessment only | Drug use during the study period | Higher rates of participation in substance use treatment, and recovery support services, when women were not on probation | The experiment condition effect favoured the control condition during the study period. These effects were strongest when participants were not on probation. No between-group differences when |

(Continues)
| Author, publication year, country | Sample, substance type | Follow-up (w) | Experiment condition | Control condition | Non-SU outcomes | DUD-outcomes | Reported findings on non-SU outcomes | Reported findings on DUD outcomes |
|----------------------------------|------------------------|--------------|----------------------|------------------|----------------|-------------|--------------------------------------|----------------------------------|
| Rawson et al. (2012), USA [63]   | Outpatient psychosocial treatment project. Adults. *n* = 871. Methamphetamine | 156 | 16-week Matrix model treatment. COMPLEX | Treatment as usual | (i) Psychological/behavioural factors (clinical); (ii) Functioning (use of health-care facilities) | Negative urinalysis results at 12 months and 36 months after treatment | More negative urine analyses in the experiment group at 16 weeks |
| O’Connell et al. (2012), USA [64] | Recruited from Health Care for Homeless Veterans program. Adults. *n* = 259. Poly use | 156 | Three conditions: (i) ICM plus rent subsidy vouchers; (ii) ICM only; (iii) Treatment as usual. COMPLEX | See experiment condition | (i) Psychological/behavioural factors (clinical); (ii) Functioning (social functioning); (iii) Housing; (iv) Functioning (role); (v) Functioning (use of health-care facilities); (vi) Quality of life | Composite scores and information about days of drug or alcohol use in past 30 days, including days of intoxication | Compared with ICM alone, condition 1 was associated with more positive housing outcomes for Caucasians, veterans with co-occurring mental disorders, and veterans who were active substance users. Condition 1 was associated with more positive socio-clinical outcomes for African Americans. No differences were observed in housing or socio-clinical outcomes as a function of age. No between-group differences |
| van der Pol et al. (2018), Netherlands [65] | Sample for this study was enrolled in a Dutch randomised controlled trial conducted as part of a transnational trial (Germany, France, Belgium, Switzerland, and the Netherlands). Adolescents (13–18 years). *n* = 109. Cannabis and comorbid problem behaviour | 156 | MDFT. COMPLEX | Treatment as usual | (i) Functioning (social functioning); (ii) Criminality | Substance use past 90 days | No between group differences between the treatment groups for time to first offence from start of the treatment or changes in frequency or severity of offending over time. Treatment effect trend favouring MDFT was found for property offending in the subgroup of adolescents with high baseline severity of cannabis use. No outcome analyses on that variable presented |
| Mueser et al. (2013), USA [66] | 3 community mental health centres. Co-occurring substance use and severe psychiatric disorders. Adults. *n* = 108. Poly use | 156 | Long-term (9–18 months) program combining education with teaching communication and problem-solving skills. COMPLEX | Brief (2–3 months) family education program | (i) Psychological/behavioural factors (motivation); (ii) Psychological/behavioural factors (clinical); (iii) Functioning (social functioning); (iv) Functioning (composite) | Days of drug use over the past 6 months | No consistent differences between the programs in substance use severity |

(Continues)
Table 3. (Continued)

| Author, publication year, country | Sample, substance type | Follow-up (w) | Experiment condition | Control condition | Non-SU outcomes | DUD-outcomes | Reported findings on non-SU outcomes | Reported findings on DUD outcomes |
|----------------------------------|------------------------|--------------|----------------------|------------------|----------------|-------------|-------------------------------------|----------------------------------|
| Suchman et al. (2011), USA [67]   | Mothers from outpatient substance-abuse treatment and caring for children between birth and 3 years of age. Adults. n = 47. Poly use | 162 | Mothers and Toddlers Program. COMPLEX | Parent education program (individual case management and developmental guidance) | (v) Functioning (use of health-care facilities) | (i) Psychological/behavioural factors (clinical); (ii) Functioning (social functioning) | Relapse to substance use | Between-group differences on family burden |
|                                  |                        |              |                      |                  |                |                          |                                     | Mothers in both groups showed reduction in relapse rates |
| Wechsberg et al. (2010), USA [68] | Out-of-treatment African American women. Adults. n = 455. Poly use | 208 | Three conditions: (i) Female-focused intervention; (ii) Modified NIDA (standard) intervention; (iii) Delayed treatment control condition. SPECIFIC | See experiment condition | (i) Risk behaviour; (ii) Physiological/clinical (somatic); (iii) Psychological/behavioural factors (clinical); (iv) Functioning (social functioning); (v) Functioning (use of health-care facilities) | Number of days of substance use | Non-significant between-group differences on any non-SU measures over time. Results suggest effects that might be considered durable, resistant and enduring and a sleeper effect from high to low risk |
|                                  |                        |              |                      |                  |                |                          |                                     | No significant between-group differences over time on DUD outcomes |
| Dennis and Scott (2012), USA [69] | Treatment agency in Illinois. Adults. n = 446. Poly use | 208 | Quarterly recovery management check-ups. SPECIFIC | Quarterly assessment only | Functioning (use of health-care facilities) | (i) Substance frequency scale; (ii) Substance problems past month; (iii) Days of abstinence | Experiment group participants were more likely to return to treatment sooner, to return at all, to return more times, and to receive more total days of treatment. Significantly fewer quarters in need of treatment. Effects were larger (general) for those with earlier onset and higher crime/violence scores. | Fewer substance-related problems per month, and more total days of abstinence in the experiment group |
| Aklin (2014), USA [70]           | Pregnant and postpartum women enrolled in methadone treatment. Adults. n = 40. Poly use | 416 | Therapeutic workplace. SPECIFIC | Usual care | (i) Risk behaviour; (ii) Functioning (role) | Substance use past 30 days | During year 4 when the business was open, therapeutic workplace participants reported more days employed, higher employment income, and less money spent on drugs. During | During year 4 therapeutic workplace participants provided significantly more cocaine- and opiate-negative urine samples than controls |

Outcome measures in substance use research

(Continues)
effect on DUD outcome, and 42.4% had a significant positive effect on at least one non-SU outcome and at least one DUD outcome, indicating a more general positive recovery effect.

**Discussion**

*New agendas for contemporary recovery research*

This review reveals that only a limited number of RCTs have been conducted using non-SU factors as treatment outcomes over time. Only 19 of the 504 included studies (3.8%) had follow ups of at least 2 years. Of these, 11 studies (2.2%) had follow ups of longer than 2 years. Given the suggested temporal criterion of a minimum of 2 years’ follow up for recovery, this finding alone suggests that the substance use RCT treatment literature from the past decade only reflects the above-mentioned perspectives of clinical, personal and relational recovery to a very limited degree [1,26,27,31]. Focus on functional and social recovery are prominent in all these perspectives. Functional and social recovery are non-linear and cumbersome processes that usually require more time than that required to achieve abstinence [11–13,31]. The threat of relapse may continue for years following the achievement of abstinence [5–9]. Hence, contemporary substance use RCT research may omit important social recovery factors and processes, including loneliness, social alienation and the pursuit for citizenship [2,8,29,30]. When poorly handled, these factors are related to poor course development and relapse. Conversely, when overcome, they facilitate personal growth, perceived agency and social inclusion, possibly making the hard work of recovery attractive and seen as a realistic life solution over time [12]. Further, the ways in which people strengthen and maintain functional outcomes over time, such as increased school participation or more frequent social meetings [20,21,26], are difficult to understand, given the current evidence base. This requires a longitudinal study design and focused mediation analyses, which are usually beyond the scope of most RCTs. These limitations make it challenging for clinicians to work from an evidence base in their attempts to tailor phase-specific DUD treatment strategies for long-term recovery efforts.

In line with contemporary recovery research, the 3.8% of studies with a follow up of at least 2 years are more likely to report general health and recovery effects than studies with shorter follow ups. However, one limitation of these 19 studies is that they typically report the non-SU outcomes of psychological health (typically reduction in depression) and use of health-care facilities (typically treatment retention), but do not report on other non-SU outcomes. Only seven studies (1.4%) reported
social functioning outcomes, five (1.0%) on role functioning, four (0.8%) on criminality, two (0.4%) on global functioning and zero studies on quality of life. The severely limited number of studies measuring these factors stands in contrast to the fact that they have consistently been associated with good and stable DUD outcomes in the recovery literature [10–12,31,74,75]. Moreover, conclusions that cut across different recovery traditions around what constitutes recovery—for example long-term increase in community and social functioning, along with reductions in or elimination of substance use [4,26,27]—are largely ignored. Likewise, the increasing trend of studies using only one non-SU outcome in addition to change in substance use (41.2% between 2008 and 2013 vs. 55.1% between 2014 and 2019) represents a step away from the longitudinal and multi-dimensional study approach required to investigate long-term recovery.

Limitations

The strengths of the study are evident in its protocol’s public availability before the review was conducted (via PROSPERO); this ensured transparency and that the review was conducted according to PRISMA guidelines [36].

One limitation concerns the fact that no advanced statistical tests were used to assess the reliability and validity of the reported findings of the included studies. The scope of the paper was to evaluate outcome measures and not treatment efficacy, per se. Another limitation is that each individual study was not assessed for key sources of biases (e.g. sample characteristics). In addition, and in line with previous research, some studies were based on small samples, and most instruments were constructed and tested within Anglo-American cultures. This typically increases the risk of reporting bias, suggesting that the included studies represent selective research dissemination. However, it should be emphasised that the aim was to identify outcomes with a high level of use within the field and that the search was conducted within several literature databases. The included studies did use samples with somewhat different characteristics (e.g. sex, age and level of symptomatology), which may violate the transitivity assumption and thus raises questions regarding the validity of direct comparisons across the included studies.
Suggested research directions

To improve the scientific knowledge base of treatment outcomes in DUD it will be advisable to incorporate functional and social outcomes into longitudinal research designs more consistently. These outcomes are already actively used by other initiatives, such as the Treatment Episode Dataset discharge data [76]. Empirical studies indicate that future research should focus on detailing the specific effects of social and community functioning in recovery. For example, we need to know more about which treatment interventions bring about sustained improvements in these areas, and which post-treatment factors mediate improvements in social and community functioning. In addition, a more valid temporal criterion that would enable professionals to more accurately identify vulnerable phases in recovery would be useful for tailoring treatment efforts towards expected fluctuations in relapse. A broad investigation should also aim to overcome specific limitations inherent in the RCT study designs, including sensitivity to contextual factors and comparison of single, common clinical metric across different study contexts. As suggested by Donovan et al. [77], applying within-study comparisons may be a more valid alternative to studying complex phenomena, such as recovery in DUD. Furthermore, systematic inclusion of service-user perspectives could prove a viable route to meet this aim [78]. By asking individuals with first-hand experience and those outside of the traditional scientific community for input in the research design, the risk of implementing measures with low ecological validity is considerably reduced [79]. In practical terms, the application of a mixed research design, combining exploration, hypothesis development and further large-scale testing (RCTs), could be a feasible solution.

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Conflict of Interest

The authors have no conflicts of interest.

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APPENDIX 1. DEVIATIONS FROM THE STUDY PROTOCOL

1. Change in research question: Our research question in the protocol registration (PROSPERO) was the following: To review the existing literature (RCTs) on treatment efficacy, and to determine the treatment factors important for long-term drug reduction and functional recovery after substance abuse. Our research question in the submitted review was the following: To systematically review non-SU treatment outcome measures used in longitudinal randomised controlled trials over the last 10 years, and to assess the degree to which they reflect any of the above-mentioned perspectives of recovery. RCTs were chosen because this methodology is generally considered the most valuable for both evaluating treatment efficacy and developing treatment guidelines. The reason for this change: Early in the review process (after PROSPERO registration) we did our first search, using our previous aim (broader criteria, including no time restriction etc.) as guidance. This search identified an insurmountable number of articles and needed to be narrowed. Also, we identified Tiffany et al. from 2012 (see reference list), explicitly addressing issues similar to the aim of our review. However, their findings were a result of an expert consensus meeting and not a systematic review of the literature. We knew that functioning and social functioning had previously been addressed more prominently in the earlier DUD literature (e.g. in the 1970s). At this point we discussed possible approaches that could provide meaningful and clinically relevant contextualisation for our review. Here, the idea of different recovery perspectives (personal, clinical, relational) emerged as a viable contextualisation, as modern recovery perspectives both address issues of functioning (e.g. community and social), incorporate various perspectives on outcome (e.g. service user and researcher perspectives) and are explicit that a long-term perspective is crucial particularly with regards to functional recovery. Since research on recovery has been in particular growth over the past 10 years, this became a central reason for the time limitation in our search—to test whether the DUD field had incorporated this shift in focus, from symptom relief (typically some measure of change in substance use), to more explicitly addressing function and social factors as important outcome measures.

2. Extended the study inclusion period to January 2019.

3. Some minor changes in search setup, including eligibility criteria, title search (see model search).

4. Removed the kappa coefficient to assess the level of agreement of the two independent reviewers for the selection of included and excluded measures. Due to the heterogeneity of the data material it was assessed that the best approach to reach valid outcome categories was a continuous collaboration (consensus meetings on a weekly basis).

5. Exclusion criteria: Studies that measured change in substance use only.

APPENDIX 2. MEDLINE SEARCH FOR REPLICATION

Database: Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>.

1. substance-related disorders/ or amphetamine-related disorders/ or cocaine-related disorders/ or heroin dependence/ or inhalant abuse/ or marijuana abuse/ or opioid-related disorders/ or morphine dependence/ or opium dependence/ or phencyclidine abuse/ or psychoses, substance-induced/ or substance abuse, intravenous/ or substance abuse, oral/ or narcotics/.

2. ((heroin or marijuana or marihuana or hashish or cannabis* or amphetamine* or opioiَd* or cocaine or o*piate* or opium* or morphine* or ecstasy or metaamphetamine or polydrug* or polysubstance* or multdrug* or solvent* or inhalant* or narcotic*) adj2 (abus* or misus* or addict* or dependen* or ‘use’ or usage or disorder*)).hw,kf,ti,ab.

3. ((drug* or substance*) adj2 (abus* or misus* or addict* or dependen* or disorder*)).kf,ti,ab.

4. (sniff* or designer drug* or narcotism).hw,kf,ti,ab.

5. addiction.hw,kf,ti.
6. 1 or 2 or 3 or 4 or 5
7. therapeutics/ or drug therapy/ or rehabilitation/ or psychotherapy/.
8. (treatment* or intervention* or rehabilitation or inpatient* or outpatient* or hospitali?ed. patient* or residential or day hospital or partial hospital or continuing care or ‘contin* of Care’ or CBT or community reinforcement or motivational interviewing or motivational enhancement therapy or incentives or family therapy or couples therapy or methadone or suboxone or buprenorphine or therapeutic community or medication* or mentalization* or dialectic* or emotion* focused or ‘action and commitment*’ or psychodynamic* or psychoanaly* or behavior* modification* or behavior* therapy or ‘drug adj2 therapy’ or pharmacotherapy).hw,kf,ti.
9. (‘12’ or twelve) adj (step facilitation or step program*)).hw,kf,ti.
10. 7 or 8 or 9.
11. (recovery or autorecovery or remission* or autoremission* or abstinen* or abstain* or drug free or sobriety or (life adj2 satisfaction) or wellbeing or well being or self-quit* or self-change* or self-agen* or self-restrain* or change strateg* or life* change* or ‘readiness to change’ or ‘stages of change’ or ‘quality of life’).hw,kf,ti.
12. ((increas* adj2 function*) or (improv* adj2 function*)).hw,kf,ti,ab.
13. ((reduce* or modif* or decreas*) adj2 (abus* or misus* or addict* or dependen*)).hw,kf,ti,ab.
14. ‘Quality of Life’.
15. (vocation* or occupation* or job or jobs or work or employee* or employment or education* or educating or school).hw,kf,ti.
16. (social adj2 interact*).kf,ti.
17. life change events/.
18. (life style* adj2 change*).hw,kf,ti.
19. Interpersonal Relations/.
20. 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19.
21. randomized controlled trial.pt.
22. rct*.ti,ab.
23. (randomized. and controlled and trial*).ti,ab.
24. 21 or 22 or 23 (585927).
25. exp. animals/ not humans.sh. (4474870).
26. 24 not 25 (573722).
27. 6 and 10 and 20 and 26 (1065).
28. limit 27 to english language (1052).
29. limit 28 to journal article (1050).
30. remove duplicates from 29 (1030).

Note: RCT filter based on Therapy, category specific/ narrow here: https://www.ncbi.nlm.nih.gov/books/NBK3827/#pubmedhelp.Clinical_Queries_Filters

APPENDIX 3. DRUG USE SUB-CATEGORIES

• Days of drug use last month
• Substance use problem severity
• Substance use problem severity past month
• Monthly frequency of cannabis use
• Monthly frequency of alcohol use
• Monthly frequency of other drug use
• Substance problems past month
• Substance use problems past 90 days
• Number of days of substance use
• Number of days cocaine use
• Drug use during study period
• One-month abstinence
• Days abstinent during 90-days time period
• Illicit opiate use
• Days of heroin use
• Maximum days of consecutive heroin abstinence
• Drug cessation
• Dependence
• Change in substance use context
• Relapse
• Days to first relapse