Changes in social functioning over the course of psychotic disorders—A meta-analysis

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ABSTRACT

In this meta-analysis we investigated changes in social functioning and its moderators in patients with a psychotic disorder but different durations of illness at baseline.

We included longitudinal studies assessing the course of five domains of social functioning in patients with a psychotic disorder. Effect sizes of change between baseline and follow-up within these domains were analyzed in four subgroups based on durations of psychotic disorder at baseline: less than 2 years, between 2 and 5 years, between 5 and 10 years, and more than 10 years. The influence of baseline confounders was analyzed using meta-regression and sensitivity analysis.

We included 84 studies analyzing 33,456 participants. We found a medium improvement (d = 0.60) in overall social functioning over time, with a greater improvement for studies investigating patients with a duration of illness of less than 5 years. We found minor improvement in specific domains of social functioning, such as vocational functioning (d = 0.31), prosocial behavior (d = 0.36), activities (d = 0.15), and independence (d = 0.25). Improvement in social functioning was associated with lower baseline levels of negative symptoms, higher baseline levels of quality of life, and, specifically, improved vocational functioning, with rehabilitation and combined treatment.

Social functioning in patients with psychotic disorders improves over time, especially for patients with shorter illness durations. Reduction of negative symptoms and improving quality of life might reinforce improvement of social functioning.

1. Introduction

Psychotic disorders often lead to functional limitations and substantially impact individuals, their loved ones and society (Linscott and Van Os, 2013; Van Os and Reininghaus, 2016; Sullivan et al., 2020). The majority of patients with psychotic disorders have difficulties maintaining their societal roles, such as being employed or maintaining relationships, also after symptomatic remission (Bellack et al., 2016; Madeira et al., 2016). This often leads to a more chronic course of psychotic disorders (Linscott and Van Os, 2013; Santesteban-Echarri et al., 2017). Therefore, improving social functioning, which is defined as regaining societal roles (Mueser and Tarrier, 1998), is a major aim in
Disagreements were resolved by consensus. The included studies meet the following criteria:

2.2. Eligibility criteria

First, we investigated the influence of study design (RCT versus cohort studies) and diagnosis (studies only including schizophrenia patients versus studies also including other psychotic disorders) on the outcomes.

Other potential moderators of social functioning were selected following a two-step procedure. First we identified 52 significant moderators in included studies and comparable meta-analyses (Santesteban-Echarri et al., 2017; Fusar-Poli et al., 2015; Swistaj et al., 2012). Second, we applied the following three criteria reported in the Cochrane Handbook 5.1 (Higgins and Green, 2011): 1) reported by at least 10 of the selected studies; 2) ability to be clustered in separate multivariate models; 3) Not closely related to each other to prevent multicollinearity. This resulted in 19 moderators, which we clustered in seven multivariate regression models: 1) treatment variables: implementation of rehabilitation, psychotherapy, antipsychotic use, and combined treatment to (a subsample of) the participants; 2) symptoms: positive symptoms,
negative symptoms, depression, and substance use at baseline; 3) demographic variables: years of education and gender; 4) study characteristics: publication year, and attrition rate; 5) overall neurocognition at baseline; 6) illness related variables: clinical stabilization at baseline, age at onset, DUP, and setting in which the study is executed (i.e., naturalistic or healthcare); 7) subjective quality of life and level of social functioning at baseline.

From continuous moderators that were evaluated by different assessment instruments (i.e., assessments of symptoms, neurocognition, subjective quality of life, and social functioning) we calculated percentile scores based on normative data to ensure that each moderator was assessed in the same scale range. Operationalizations of each moderator are reported in Supplementary Material E.

2.6. Quality assessment

Quality assessment was conducted using the Quality in Prognostic Studies (QUIPS) tool (Hayden et al., 2013) and was based on six criteria: participation, attrition, prognostic factor measurement, handling confounders, outcome measurement, and analysis and reporting. Based on these criteria a high, moderate or low risk of bias score was assigned for each study.

Two authors (LdW & MO) independently conducted quality assessment of 10% of the studies. The level of agreement was fair to good (κ = 0.56). Disagreements were resolved by consensus. We investigated the influence of study quality on outcomes by sensitivity analysis.

2.7. Statistical analysis

2.7.1. Meta-analytic procedure

Meta-analyses were conducted using RevMan 5.3 (The Nordic Cochrane Centre, 2014). Effect sizes were calculated by comparing study outcomes between baseline and follow-up assessment. For clinical trials the total study sample, clustering both treatment and control groups, was analyzed. Overall effect sizes of categorical outcomes were converted into Cohen’s d (Chinn, 2000) to show homogeneous and consistent patterns for both continuous and categorical outcomes. Magnitude of effect was considered marginal and clinically not relevant when d < 0.2, small when d ≥ 0.2 and < 0.5, medium when d ≥ 0.5 and < 0.8, and large when d ≥ 0.8 (Chinn, 2000). All outcomes were reported with 95% confidence intervals (CIs). We used random effects models, weighted by the method of inverse variance (Higgins, 2008). Statistical heterogeneity was assessed by calculating the $I^2$ statistic (including 95% CI), describing the percentage of observed heterogeneity not expected by chance (Higgins and Thompson, 2002).

2.7.2. Subgroup analyses

We analyzed differences in effect sizes of change between subgroups regarding the baseline duration of illness and duration of follow-up (Borenstein and Higgins, 2013). Because of the large number of subgroups, there is a high chance of finding type-I errors in one of our subgroup analyses. Therefore, we controlled for multiple testing effects through a Benjamini-Hochberg correction, with the false discovery rate set on 0.3 (Benjamini and Hochberg, 1995).

2.7.3. Calculation of moderating effects

We investigated the influence of potential moderators on the five outcome domains through a meta-regression analysis using Stata version 12 (StataCorp, 2011). We conducted meta-regression analyses for all study outcomes and further investigated the influence of significant moderators within different duration of illness subgroups using a sensitivity analysis, comparing study outcomes of studies with high levels or presence versus low levels or absence of the respective moderator. Because of the large number of moderators and subgroups, we controlled for multiple testing effects in all analyses through a Benjamini-Hochberg correction (Benjamini and Hochberg, 1995).

2.7.4. Handling outliers and publication bias

Potential influence of outliers (i.e. confidence interval [CI] of study outcomes exceeded overall CI) was handled by re-analyzing the meta-analysis after removing the outliers. Potential publication bias was detected by visual inspection of funnel plots.

3. Results

3.1. Study flow

Of the 6741 records retrieved through database search and reference tracking, 6159 records were excluded after title and abstract screening. Of the remaining 583 records, 480 records were excluded after full-text selection (see Fig. 1 for study flow and reasons of exclusion). The remaining 103 articles reported results of 84 studies.
3.2. Study characteristics

We selected 84 studies describing the course of social functioning of 33,456 participants. The mean age of participants was 33.4 years (SD = 11.5), and 39.3% were female (see Table 1).

Thirty-seven studies (44.0%) also included participants with other psychiatric conditions with psychotic features (see Table 1). Thirty-four studies (40.5%) were clinical trials, and 50 (59.6%) were cohort studies. In 38 studies (53.5%) at least 80% of the participants received antipsychotic medication, in 22 studies (31.0%) participants received any kind of rehabilitation intervention, in 33 studies (46.5%) participants received psychotherapy, and in 25 studies (35.2%) participants received combined treatment with at least two of the aforementioned treatment components.

The average drop-out rate was 27.7% (SD = 17.4%). The drop-out rate was low in 32 studies (38.6%) (i.e., <20%), moderate in 32 (38.6%) (i.e., 20–40%), and high in 19 studies (22.9%) (i.e., >40%). Differences in baseline study and patient characteristics between the baseline duration of illness subgroups are presented in Supplementary material C. The subgroups did not significantly differ in most characteristics. However, we found that study samples with a longer duration of illness were older, had more severe substance abuse, used antipsychotics more often and were more frequently diagnosed with schizophrenia than subgroups with a shorter duration of illness.

3.3. Meta-analysis of study outcomes with different durations of psychosis

A general overview of the outcomes, within each duration of illness and follow-up subgroup is presented in Fig. 2 and Table 2. We also added forest plots of study outcomes in Supplementary materials D.

3.3.1. Overall social functioning

In general, we found a medium improvement in overall social functioning (d = 0.60). For the studies with a shorter baseline duration of illness (i.e., <2 years and 2–5 years). Specifically for the subgroup with a baseline duration of illness <2 years, we found a large improvement in overall social functioning after a longer follow-up duration ($\chi^2 = 50.83; df = 2; p < 0.01$). For the subgroup with a baseline duration of illness between 5 and 10 years we found no improvement and for the subgroup with a baseline duration of illness >10 years we found a small improvement in overall social functioning. Both subgroups with <2 years and 2–5 years of illness at baseline showed larger improvement over time than the subgroup with a baseline duration of illness >10 years ($\chi^2 = 15.30; df = 1; p < 0.01$ and $\chi^2 = 7.71; df = 1; p < 0.01$).

3.3.2. Prosocial behavior

Overall, we found a small improvement in prosocial behavior (d = 0.36). We observed a large improvement in prosocial behavior for the subgroup with a baseline duration of illness 5–10 years after a short follow-up duration. For the subgroup with a duration of illness >10 years at baseline we found small improvement in prosocial behavior, with no differences between short and long follow-up outcomes. The subgroup with a baseline duration of illness between 5 and 10 years showed a greater improvement after short follow-up than the other subgroups ($\chi^2 = 13.28; df = 1; p < 0.01$; $\chi^2 = 11.61; df = 1; p < 0.01$; $\chi^2 = 13.28; df = 1; p < 0.01$).
### Table 1

Descriptive statistics of included studies.

| Study name | N (baseline-FU) | Age (SD) | % female | Primary diagnosis | Comorbidit y | Treatment | Baseline DOI | FU duration | Attrition rate | Outcome categories reported |
|------------|----------------|----------|----------|------------------|--------------|-----------|-------------|--------------|----------------|-----------------------------|
| Aas 201651 | 163–91         | 27.4 (8.3) | 43.8%    | Schizophrenia (31.3%); schizoaffective disorder (3.1%); bipolar disorder (3.3%); MDD with psychotic features (2.1%) | bipolar disorder | antipsychotics (76.0%); antidepressants (26.0%); mood stabilizers (22.9%) | 2.99        | 1            | 41.1%          | Overall social functioning |
| Addington 200052 | 80–65         | 33.2 (8.9) | 21.1%    | Schizophrenia (100%) | NA | Antipsychotics (100%); routine care (100%) | 11.2        | 2.5          | 18.8%          | Overall social functioning; Prosocial behavior |
| Baker 201553,54 | 235–139      | 41.6 (11.1) | 41.3%    | Schizophrenia spectrum disorder (58.7%); bipolar disorder (22.1%); Nonorganic psychotic syndrome (19.2%) | tobacco dependence | Health promotion intervention (51.9%); antipsychotics (100%) | 18.6        | 1            | 40.9%          | Overall social functioning |
| Bergé 201655 | 140–62        | 25.5 (5.3) | 42.1%    | Psychosis NOS (45.0%); schizoaffective disorder (27.1%); Brief psychotic disorder (10.7%); bipolar disorder with psychotic symptoms (3.6%); schizoaffective disorder (5.0%); Drug induced psychosis (2.9%); Delusional disorder (0.7%) | Cannabis abuse (11.0%); alcohol abuse (8.0%); cocaine abuse (5.0%); amphetamine abuse (6.0%) | antipsychotics (91.4%); ≤ 2 y | 1 2 59.3% Overall social functioning |
| Bjornestad 201756 | 363–168      | 26.9 (10.7) | 46.1%    | Schizophrenia (32.0%); Other psychotic disorder (68.0%) | Substance abuse (24.7%) | antipsychotic medication, supportive psychotherapy, and multifamily psychoeducation (100%) | 0           | 1-feb         | 51.0%          | Overall social functioning |
| Bodén 200957 | 124–76        | 28.5 (9.4) | 36.8%    | Schizophrenia (81.6%); schizoaffective disorder (7.9%); schizoaffective disorder (11.6%) | Schizophrenia (100%) | NR | 0.29        | 5            | 38.7%          | Independence; Vocational functioning |
| Calvocorelli 199858 | 17–aug      | 30.4 (9.3) | 47.1%    | Schizophrenia (100%) | NR | NR | 1 52.9% Overall social functioning | 0 13-2005 30.8% Overall social functioning |
| Carlsson 200659 | 253–175      | 28.2 (7.1) | 45.0%    | Schizophrenia syndromes (schizophrenia, schizoaffective psychosis and schizoaffective psychosis; 40.8%; non-schizophrenia syndromes (delusional disorder, brief psychosis and psychotic disorder not otherwise specified (NOS); 59.2%) | NR | Need adapted treatment (100%); antipsychotics (41.8%); benzodiazepines (70.6%); antidepressants or lithium (44.7%) | 0           | 1-3-2005       | 30.8%          | Overall social functioning |
| Cechnicki 201760 | 80–67         | 26.6 (5.8) | 56.7%    | Schizophrenia (100%) | NR | Community treatment program (50%); Individual treatment program (50%) | 0.79        | 3-dec         | 16.3%          | Overall social functioning |
| Chan 200361 | 25–21         | 40.4 (7.8) | 44.0%    | Schizophrenia (100%) | NR | NR | 15.4 0.33/0.67/1 16.0% | Independence; Overall social functioning Vocational functioning |
| Chang 201162 | 153–93        | 31.7 (9.2) | 54.8%    | Schizophrenia (80.7%); schizoaffective disorder (14.0%); schizoaffective disorder (5.4%) | Schizophrenia (100%) | antipsychotics (48.4%); antidepressants (12.9%); benzodiazepines (12.9%) | 1.5         | 1-2-2003       | 39.2%          | Overall social functioning Vocational functioning |
| Ciudad 200963 | 452–376       | 37.7 (10.5) | 35.6%    | Schizophrenia (100%) | Schizophrenia (100%) | substance/alcohol abuse (34.3%); substance use disorder (28.0%); personality disorder (14.5%); depressive disorder (39.4%) | 13.7        | 1            | 16.8%          | Overall social functioning Activities; Independence; Overall social functioning; Prosocial behavior; |
| Conley 200964 | 2327–2228     | 41.8 (11.2) | 38.5%    | Schizophrenia (57.2%); schizoaffective disorder (33.6%); other psychotic disorder (9.3%) | Schizophrenia (100%) | antidepressants (38.8%); Anti-anxiety agents (11.3%); Mood stabilizers (31.2%); Hypnotics (1.7%); Antiparkinsonian | 21.6        | 3            | 4.3%           | (continued on next page) |
Table 1 (continued)

| Study name   | N (baseline-FU) | Age (SD) | % female | Primary diagnosis* | Comorbidity* | Treatment* | Baseline DOI* | FU duration | Attrition rate | Outcome categories reported |
|--------------|-----------------|----------|----------|-------------------|--------------|------------|--------------|-------------|--------------------------|------------------------------|
| Coryell 1987566 | 144–98          | 37.3 (14.4) | 64.6% Psychotic major depressive disorder (72.2%); schizoaffective disorder (27.8%) | major depression (100%) | agents (44.8%); atypical antipsychotics (59.8%); typical antipsychotics (58.2%); ECT (23.6%); antipsychotics (64.3%); antidepressants (100%) | 10.3 | 1/2 5/10 | 31.9% | Vocational functioning  |
| DeLisi 199877 | 50–43           | 27.4 (7.0) | 36.0% Schizophrenia (66.0%); schizoaffective disorder (16.0%); psychosis NOS (4.0%); bipolar disorder (2.0%); major depressive disorder (4.0%); Schizophrenia (63.9%); schizoaffective disorder (36.1%) | Substance abuse (48.0%); | lithium (30%); antidepressants (35%); minor tranquilizers (50%) | 1.02 | 4/4.7/5 | 14.0% | Activities; Overall social functioning; Prosocial behavior; Vocational functioning  |
| Dickerson 199968 | 88–72           | 40.1 (9.6) | 30.6% Schizophrenia (66.2%); schizoaffective disorder (13.9%); schizophreniform disorder (6.2%); Psychosis NOS (4.6%); Brief psychotic disorder (1.5%); no diagnosis (3.1%); unknown (4.6%); Schizophrenia (63.9%); schizoaffective disorder (36.1%) | NR | | 19.2 | 2 | 18.2% | Overall social functioning |
| Dixon 20156970 | 65–20           | 22.2 (4.2) | 36.9% Schizophrenia (66.2%); schizoaffective disorder (13.9%); schizophreniform disorder (6.2%); Psychosis NOS (4.6%); Brief psychotic disorder (1.5%); no diagnosis (3.1%); unknown (4.6%); Schizophrenia (66.6%); schizoaffective disorder (13.9%); | Bipolar disorder NOS (3.1%); Depressive disorder NOS (23.1%); Panic disorder (4.6%); Social phobia (3.1%); obsessive compulsive disorder (1.5%); PTSD (7.7%); anxiety disorder NOS (4.6%); alcohol use disorder (18.5%); sedative-hypnotic-anxiolytic use disorder (1.5%); Cannabis use disorder (35.9%); Stimulant use disorder (1.5%); Opioid use disorder (3.1%); Cocaine use disorder (4.6%); Hallucinogen use disorder (4.6%); Treatment connection program (100%) | 3.39 | 1 | 17.0% | Overall social functioning |
| Eack 200871   | 59–49           | 25.9 (6.3) | 31.0% Schizophrenia (65.5%); Schizoaffective disorder (34.5%); Schizophrenia (78.3%); Schizoaffective disorder (21.7%); | NR | | 14.3 | 1/2/3/4 | 0.0% | Overall social functioning; Prosocial behavior; Vocational functioning |
| Economou 201172 | 60–60           | 35.4 (6.9) | 51.7% Schizophrenia (66.6%); schizoaffective disorder (13.9%); schizophreniform disorder (6.2%); Psychosis NOS (4.6%); Brief psychotic disorder (1.5%); no diagnosis (3.1%); unknown (4.6%); Schizophrenia (66.6%); schizoaffective disorder (13.9%); | NR | | 0.6 | 0.5/1 | 52.9% | Overall social functioning |
| Edwards 199873 | 227–107         | 23.7 (5.9) | 35.7% Schizophrenia (36.1%); schizophreniform disorder (22.5%); delusional disorder (2.2%); schizoaffective disorder (11.0%); bipolar disorder (12.8%); depression with psychotic features (8.4%); Bipolar disorder NOS (12.8%); depression with psychotic features (8.4%); | NR | | 17.6 | 4.6 | 49.3% | Overall social functioning |
| Ekerholm 201274 | 71–36           | 41.1 (7.9) | 13.9% Schizophrenia (100%); | NR | Antipsychotics (95.8%); | 1.2/4 | 59.7% | | Overall social functioning |
| Friedman 200275 | 308–124         | 72.4 (6.3) | 54.8% Schizophrenia (100%); | NR | Neuroleptics (74.1%); anticholinergics (13.0%); | 1/1.25 | 25.9% | | Overall social functioning |
| Gaughran 201776 | 406–301         | 44.2 (10.1) | 42.4% Psychotic disorder (100%); | NR | Health promotion intervention (52.5%); | 0 | 7/11/17 | 9.8% | Vocational functioning |
| Gmür 199177   | 92–83           | 22.9 (22.6) | 43.5% Schizophrenia (100%); | NR | | | | | |
| Study name                  | N (baseline-FU) | Age (SD) | % female | Primary diagnosis*                                        | Comorbidity*                                    | Treatment†                           | Baseline DOI† | FU duration | Attrition rate | Outcome categories reported |
|----------------------------|-----------------|----------|----------|----------------------------------------------------------|-------------------------------------------------|--------------------------------------|---------------|--------------|--------------------------|-----------------------------|
| González-Blanch 2010        | 141–131         | 26.6 (6.8) | 38.2%    | Schizophrenia (73.3%); schizoaffective disorder (26.0%)  | NR                                              | outpatients treatment (15.2%); inpatient treatment (45.7%) | 2.37          | 1            | 7.1%                     | Vocational functioning       |
| Hill 2012                  | 171–123         | 29.1 (12.0) | 42.1%    | Schizophrenia/ schizoaffective disorder (59.1%); other psychosis (40.9%) | Substance abuse (25.5%)                         | NR                                   | 1.94          | 12           | 28.1%                    | Overall social functioning   |
| Horan 2012                 | 81–55           | 22.3 (4.3)  | 23.6%    | Schizophrenia (56.8%); schizoaffective disorder (12.4%); schizoaffective disorder (30.9%) | NR                                              | Risperidone (100%)                   | 0.7           | 1            | 32.1%                    | Independence; Prosocial behavior; Vocational functioning |
| Harrow 1999                | 157–120         | 22.9 (NR)  | 56.0%    | Schizophrenia (40.8%); schizoaffective disorder (7.6%); Bipolar disorder (23.6%); Depressive disorder (17.8%); paranoid disorder (3.2%); other psychotic disorder (7.0%) | Bipolar disorder (23.6%); Depressive disorder (17.8%) | NR                                   | NR            | 2/4.5/ 7.5/10/ 15/20 | 23.4%                    | Overall social functioning; Prosocial behavior; Vocational functioning |
| Harvey 1999                | 57–55           | 77.8 (8.2)  | 56.1%    | Schizophrenia (100%)                                    | NR                                              | antipsychotics; anticholinergics (8.8%); Benzodiazepines (14.0%); Anticonvulsants (5.3%) second generation antipsychotics (100%) | 47.1          | 2.6          | 3.5%                     | Overall social functioning   |
| Harvey 2010                | 111–61          | 57.0 (9.0)  | 27.0%    | Schizophrenia (100%)                                    | NR                                              | Aripiprazole (33.7%); Olanzapine (32.7%); Risperidone (32.7%) second generation antipsychotics (100%) | 33.34         | 3.75         | 45.1%                    | Overall social functioning; Prosocial behavior; Prosocial behavior |
| Heeraman-Aubeeluck 2015    | 101–38          | 25.9 (7.3)  | 51.5%    | Schizophrenia (100%)                                    | NR                                              | Aripiprazole (33.7%); Olanzapine (32.7%); Risperidone (32.7%) second generation antipsychotics (100%) | NR            | 0.5/1       | 62.4%                    | Overall social functioning; Prosocial behavior; Prosocial behavior |
| Hodgkin 2015               | 1027–923        | 23.0 (5.0)  | 31.0%    | Unspecified psychosis (71.8%); Schizophrenia (14.3%); Bipolar disorder (5.2%); Schizoaffective disorder (1.7%); Substance induced psychosis (7.0%) | Bipolar disorder (5.2%); Substance use (67.0%) | Bipolar disorder (5.2%); Substance use (67.0%) | 1.7           | 0.5/1       | 10.1%                    | Activities; Overall social functioning |
| Hovington 2013             | 136–122         | 22.6 (4.0)  | 28.7%    | Schizophrenia spectrum disorder (62.5%); affective psychosis (27.2%); psychosis NOS (10.3%) | affective disorder (27.2%)                      | Risperidone (33.1%); Olanzapine (48.5%); Clozapine (5.2%); haloperidol (0.74%); paliperidone (1.47%); ziprasidone (1.47%) | 5.46          | 1           | 10.3%                    | Overall social functioning   |
| Ito 2015                   | 156–72          | 30.6 (10.1) | 53.2%    | Schizophrenia spectrum disorder (100%)                  | NR                                              | Antipsychotics (100%)                 | 1.99          | 0.5/1/1.5  | 53.9%                    | Overall social functioning; Prosocial functioning |
| Jäger 2014                 | 374–300         | 38.8 (12.4) | 41.8%    | Schizophrenia spectrum disorder (71.7%); Schizoaffective disorder (26.3%) | NR                                              | antipsychotics; antidepressants (16.3%); benzodiazepines (16.0%); mood stabilizers (11.5%) Early intervention program; antipsychotics (100%) | NR            | 0.5/1/1.5  | 19.8%                    | Overall social functioning; Prosocial functioning |
| Jordan 2014                | 318–208         | 22.9 (4.0)  | 29.6%    | Schizophrenia spectrum disorder (70.7%); affective disorder (23.3%) | affective disorder (23.3%); Substance dependence (53.5%) | Early intervention program; antipsychotics (100%) | 0.71          | 2           | 34.6%                    | Prosocial behavior           |
| Kalla 2011                 | 86–68           | 27.5 (6.6)  | 52.9%    | Schizophrenia (45.6%); Schizoaffective disorder (11.8%); Brief reactive psychosis (13.2%); Delusional disorder (2.9%); Psychotic disorder NOS (2.9%) | NR                                              | inpatient treatment; neuroleptics (64.7%); tranquilizers (67.7%); Individual therapy (32.4%); Family therapy (73.5%); Group therapy (51.5%); Occupational therapy (39.7%); Rehabilitation (29.4%) | 0.5           | 1           | 20.9%                    | Overall social functioning   |
| Kam 2015                   | 163–163         | 22.4 (NR)  | 25.8%    | Schizophrenia, schizotypal and delusional disorders (82.8%) | NR                                              | Early intervention services treatment (100%) | 3.8           | 3.6         | NR                       | Vocational functioning       |

(continued on next page)
Table 1 (continued)

| Study name | N (baseline-FU) | Age (SD) | % female | Primary diagnosis | Comorbidity | Treatment | Baseline DOI | FU duration | Attrition rate | Outcome categories reported |
|------------|----------------|----------|----------|------------------|-------------|-----------|-------------|-------------|-----------------|--------------------------------|
| Kavai 2003 | 51–26          | 24.3 (6.6) | 14.3%    | Schizophrenia (46.4%); bipolar disorder (46.4%); Major depressive disorder (7.1%) | bipolar disorder (46.4%); Major depressive disorder (7.1%) | Typical neuroleptics (64.3%); atypical neuroleptics (35.7%); lithium (21.4%); sodium valproate (28.6%); antipsychotics (69.4%); anti-anxiety drugs (7.5%); antidepressants (14.2%); Lithium (14.2%); antiparkinsonian agents (43.2%) | 0.56 | 1.5 | 49.0% | Overall social functioning |
| Katsanis 1992 | 134–107       | 23.9 (6.6) | 28.7%    | Schizophrenia (34.3%); schizophreniaform disorder (20.2%); major depressive disorder (17.9%); Bipolar disorder (27.6%) | Major depressive disorder (17.9%); Bipolar disorder (27.6%) | 0.25 | 0.75/1.5 | 20.2% | Overall social functioning; Vocational functioning |
| Kelly 2009 | 56–43          | 44.1 (8.3) | 27.9%    | Schizophrenia (100%) | NR | Haloperidol (58.1%); clozapine (41.9%); clobazapine (37%); family interventions (7%); CBT (13%) | 22.11 | 1 | 23.2% | Overall social functioning; Activities; Overall social functioning |
| Kurihara 2005 | 59–46          | 26.7 (7.8) | 41.3%    | Schizophrenia (100%) | NR | inpatient treatment; psychotropic medication (50%) | 2.4 | 1/3/5/11 | 22.0% | Prosocial behavior |
| Lake 2006 | 25–13          | 66.1 (11.0) | 61.5%    | Schizophrenia (75%); bipolar disorder (10%); frontotemporal dementia (15%) | bipolar disorder (10%); frontotemporal dementia (15%) | 6.69 | 1 | 48.0% | Activities |
| Lytard 2017 | 131–122        | 32.7 (7.9) | 29.8%    | Schizophrenia (88.6%); Schizoaffective disorder (7.6%); Psychosis NOS (1.5%); Delusional disorder (2.3%) | Schizophrenia (100%) | CBT (51.9%); Cognitive remediation (48.1%) | 6.94 | 0.83/2 | 6.9% | Vocational functioning |
| Mason 1995 | 67–58          | 29.0 (9.8) | 32.8%    | Schizophrenia (100%) | Schizophrenia (100%) | 22.0% | 1-2-2013 | 13.4% | Prosocial behavior; Vocational functioning; Overall social functioning |
| McGurk 2000 | 168–168        | 74.2 (6.6) | 51.8%    | Schizophrenia (100%) | Schizophrenia spectrum disorder (72.1%) | 1.25 | 0.0% | 33.2% | Activities; Independence; Prosocial functioning |
| Melle 2010 | 301–201        | 30.0 (10.0) | 44.3%    | Schizophrenia (100%) | Schizophrenia spectrum disorder (72.1%) | 0.25/1.2 | ≤2 y | ≤2 y | Vocational functioning |
| Mihaljevic-Peles 2016 | 362–258 | 37.0 (4.5) | 36.5%    | Schizophrenia (64.4%); Persistent delusional disorder (6.1%); Acute and transient psychotic disorder (14.9%); Schizoaffective disorder (9.8%); Other psychotic disorder (5.0%) | Schizophrenia (100%) | Risperidone (100%) | 7 | 1 | 28.7% | Prosocial behavior; Vocational functioning |
| Mojtafari 2005 | 674–479       | 30.4 (10.0) | 42.3%    | Schizophrenia (27.6%); bipolar disorder (20.1%); major depression (16.6%); psychotic disorder NOS (12.4%); other diagnosis (23.4%) | bipolar disorder (20.1%); major depression (16.6%); substance use disorder (52.2%) | inpatient treatment; antipsychotics (19.6%) | 1.84 | 4 | 28.9% | Overall social functioning |
| Montero 1998 | 70–60          | 26.8 (7.1) | 46.7%    | Schizophrenia (100%) | NR | antipsychotics (70.0%) | 4.7 | 0.75/2 | 14.3% | Prosocial behavior; Independence; Prosocial behavior; Vocational functioning |
| Morgan 2014 | 557–387        | 30.8 (10.7) | 45.9%    | Non-affective psychosis (72.4%); manic psychosis (13.4%); depressive psychosis (14.3%); Schizophrenia (30.2%); unspecified psychosis (18.9%); reactive psychosis (13.2%); alcoholism (2.8%); paranoid state (7.6%); personality disorder (11.3%); neurosis (1.9%); manic depression (1.9%); drug or substance abuse (9.4%); anorexia nervosa (1.9%) | Mania (13.4%); depression (14.3%) | Antipsychotics (100%) | 0.2 | 6.2/10/10.7 | 30.5% | Prosocial behavior; Vocational functioning |
| Munk-Jorgensen 1991 | 53–36        | 28.5 (13.6) | 37.7%    | Schizophrenia (30.2%); unspecified psychosis (18.9%); reactive psychosis (13.2%); alcoholism (2.8%); paranoid state (7.6%); personality disorder (11.3%); neurosis (1.9%); manic depression (1.9%); drug or substance abuse (9.4%); anorexia nervosa (1.9%) | alcoholism (3.8%); personality disorder (11.3%); neurosis (1.9%); manic depression (1.9%); drug or substance abuse (9.4%); anorexia nervosa (1.9%) | inpatient treatment (100%) | ≤2 y | 12 | 32.1% | Vocational functioning |

(continued on next page)
| Study name | N (baseline-FU) | Age (SD) | % female | Primary diagnosis | Comorbidity | Treatment | Baseline DOI | FU duration | Attrition rate | Outcome categories reported |
|------------|----------------|----------|----------|------------------|-------------|-----------|--------------|--------------|-----------------|--------------------------------|
| Na 2016\(^a\) | 25–24 | 28.2 (6.4) | 48.0% | Schizophrenia (60.0%); Schizoaffective disorder (12.0%); Psychotic disorder NOS (28.0%) | (9.4%); anorexia nervosa (1.9%) | Antipsychotics (100%); Mind flower program (100%) | NR | 0.5/1 | 4.0% | Overall social functioning; Prosocial behavior; Vocational functioning |
| Novick 2016\(^b\,\(^c\)\) | 16,380–10,698 | 38.5 (12.9) | 43.6% | Schizophrenia (100%) | alcohol or substance use (3.8%) | outpatient treatment; antipsychotics (100%); antidepressants (19.7%); Tranquilizers (19.1%) | 0.6\(^b\,\(^c\)\), 10.6\(^b\,\(^c\)\) | 1.5/2/3 | 34.7% | Overall social functioning; Prosocial behavior; Vocational functioning |
| O'Connor 2013\(^d\) | 152–127 | 29.8 (9.0) | 69.1% | Schizophrenia (23.6%); schizopreniform disorder (30.0%); schizoaffective-depressed (4.7%); schizoaffective-bipolar (6.3%); major depression with psychosis (10.2%); manic episode with psychosis (12.5%); psychosis NOS (12.6%) | | | | | | |
| Okin 1995\(^e\) \(\text{continued}\) | 37–37 | 37.6 (14.2) | 41.5% | Schizophrenia (100%) | | community residential treatment (100%) | 11.5 | 7.5 | 0.0% | Activities; Independence; Vocational functioning |
| Orite 2015\(^f\) | 18–18 | 21.7 (4.6) | 27.8% | Schizophrenia (100%) | | atypical antipsychotics (72.2%); mood stabilizers (5.6%); antidepressants (33.3%); anxiolytics (16.7%) | 1.15 | 1 | 0.0% | Overall social functioning |
| Petersen 2008\(^g\) | 547–369 | 26.8 (6.2) | 41.7% | Schizophrenia (66.2%); schizotypal disorder (13.0%); delusional disorder (2.0%); brief psychosis (6.0%); schizoaffective disorder (7.0%); unspecified nonorganic psychosis (1.0%); affective disorder (1.0%) | substance abuse (26.7%); affective disorder (1.0%) | OPUS treatment (100%) | NR | 2 | 32.5% | Independence; Overall social functioning; Vocational functioning |
| Richard 2013\(^h\) | 110–52 | 23.2 (7.9) | 27.4% | Schizophrenia (43.6%); schizoaffective disorder (13.6%); delusional disorder (2.8%); major depressive disorder (10.9%); psychotic disorder NOS (18.2%); schizopreniform disorder (1.8%); bipolar disorder (3.7%) | major depression (10.9%); bipolar disorder (3.6%) | | | | | Overall social functioning |
| Ritsner 2003\(^i\) \(\text{continued}\) | 339–220 | 38.9 (10.1) | 25.1% | Schizophrenia (74.4%); schizoaffective disorder (16.6%); major depressive disorder (4.5%); bipolar disorder (4.5%) | major depressive disorder (4.5%); bipolar disorder (4.5%) | antipsychotics (78.0%); benzodiazepines (32.0%); antidepressants (21.0%); mood stabilizers (30.0%); antipsychotics (83.4%); personalized medication management; family psychoeducation; resilience-focused individual therapy and supported employment (100%) | 14.1 | 1.37 | 35.1% | Activities; Prosocial behavior |
| Rosenheck2017\(^j\) | 404–227 | 23.1 (5.1) | 27.5% | Schizophrenia (53.0%); Schizoaffective disorder, bipolar (5.9%); Schizoaffective disorder, depressive (14.1%); schizopreniform disorder (16.6%); Brief psychotic disorder (0.5%); Psychotic disorder NOS (9.9%); schizoaffective disorder (25.1%) | alcohol abuse/dependence (36.4%); Cannabis abuse/dependence (35.6%) | | | | | 43.8% | Vocational functioning |
| Rossi 2009\(^k\) | 347–243 | 44.2 (11.4) | 38.0% | Schizophrenia (74.9%); schizoaffective disorder (25.1%) | | and education (55.2%); Community care (44.8%) | 17.3 | 1 | 30.0% | Overall social functioning |
| Ryu 2006\(^l\,\(^m\)\) | 78–56 | 54.6 (7.2) | 34.6% | Schizophrenia (100%) | | Optimal Treatment Project (100%); antipsychotics (100%) | 31.5 | 1/2/3/4/5 | 26.2% | Activities; Independence; Overall social functioning |
Table 1 (continued)

| Study name | N (baseline-FU) | Age (SD) | % female | Primary diagnosis | Comorbidity | Treatment | Baseline DOI | FU duration | Attrition rate | Outcome categories reported |
|------------|----------------|---------|----------|------------------|-------------|-----------|-------------|-------------|---------------|-----------------------------|
| Scanlon 2014 | 46–28 | 28.4 (8.8) | 30.4% | Schizophrenia (32.6%); schizoaffective disorder (8.7%); schizophreniaform disorder (10.9%); delusional disorder (6.5%); mania (19.6%); psychotic depression (13.0%); psychosis NOS (8.7%) | mania (19.6%); psychotic depression (13.0%) | antipsychotics (84.8%) | 3.5 | 3.5/4.65 | 39.1% | Overall social functioning |
| Schwartz 1997 | 23–23 | 40.1 (8.1) | 39.1% | Schizophrenia (100%) | NR | inpatient residential treatment program (100%); neuroleptics (100%) | 17.7 | 1 | 0.0% | Independence; Overall social functioning |
| Scottish Schizophrenia Research Group 1988 | 49–41 | 30.6 (NR) | 53.1% | Schizophrenia (100%) | NR | antipsychotics (100%) | 0.23 | 1-2-2005 | 16.3% | Independence; Prosocial behavior; Vocational functioning |
| She 2017 | 170–108 | 32.4 (8.3) | 37.1% | Schizophrenia (100%) | NR | Integrated group treatment (50.6%); antipsychotics (100%) | 7.24 | 0.25/1 | 36.5% | Independence; Prosocial behavior; Vocational functioning |
| Siegel 2006 | 208–98 | 28.6 (7.4) | 40.8% | Schizophrenia (100%) | NR | antipsychotics (85.9%) | 6.1 | 3 | 52.9% | Overall social functioning |
| Simonsen 2007 | 301–184 | 27.8 (9.6) | 41.5% | Schizophrenia (27.9%); schizoaffective disorder (21.6%); schizoaffective disorder (13.0%); affective disorder (13.5%); alcohol abuse (16.0%); drug abuse (23.6%) | depressive disorder (4.0%) | antipsychotic medication (97.3%); TIPS treatment program (98.6%) | 0.45 | 0.25/1/2/5/10 | 38.9% | Overall social functioning |
| Smith 2002 | 56–35 | 37.0 (9.0) | 41.3% | Schizophrenia (60.9%); schizoaffective disorder (39.1%) | depressive disorder (4.0%) | outpatient treatment program (100%); antipsychotics (100%) | 19 | 0.25/1 | 37.5% | Prosocial behavior |
| Stainby 2010 | 50–31 | 41.0 (13.2) | 28.0% | Schizophrenia (90.0%); schizoaffective disorder (6.0%); depression with psychosis (4.0%) | depression (4.0%) | depression (4.0%) | 16.8 | 2 | 38.0% | Overall social functioning |
| Stouten 2014 | 153–153 | 27.8 (NR) | 27.5% | Schizophrenia (51.92%); brief psychotic disorder (5.77%); delusional disorder (3.21%); shared psychotic disorder (1.28%); psychotic disorder NOS (36.60%); Schizophrenia (100%) | depressive disorder (4.0%) | antidepressants (12.8%); benzodiazepines (31.9%); psychosocial rehabilitation (19.2%) | 0.15 | 1 | 0.0% | Independence; Overall social functioning; Prosocial behavior; Vocational functioning |
| Tabares Seisdesos 2008 | 52–47 | 33.4 (8.2) | 21.3% | Schizophrenia (100%) | depression (4.0%) | antipsychotics; antidepressants (12.8%); benzodiazepines (31.9%); psychosocial rehabilitation (19.2%) | 8.7 | 1-mrt | 9.6% | Independence; Prosocial behavior |
| Test 1990 | 122–105 | 23.1 (3.6) | 32.8% | Schizophrenia (73.8%); schizoaffective disorder (23.0%); schizotypal personality disorder (3.3%) | bipolar disorder (72.6%); major depressive disorder (27.4%) | Training in community living (60%); usual psychiatric care (40%) | 4.07 | 0.5/1/2 | 13.9% | Independence; Prosocial behavior |
| Tohen 2000 | 219–199 | 34.1 (15.3) | 43.8% | Bipolar disorder (72.6%); major depressive disorder (27.4%) | bipolar disorder (72.6%); MDD (27.4%); substance use disorder (14.2%); medical disorder (33.8%) | psychotropic medication (89.5%) | 0.4 | 0.5/1/2 | 9.1% | Overall social functioning |
| Tsang 2016 | 90–70 | 36.1 (9.3) | 36.7% | Schizophrenia (57.8%); schizoaffective disorder (42.2%) | major depressive disorder (2.3%) | Supported employment (100%); cognitive remediation (50%) | 11.21 | 0.58/1 | 22.2% | Vocational functioning |
| Van Os 1999 | 706–608 | 38.3 (11.7) | 42.9% | Schizophrenia (38.1%); schizoaffective disorder | major depressive disorder (2.3%) | antipsychotics (96.3%); intensive case | 10 | 1-feb | 13.8% | Independence; Prosocial functioning (continued on next page) |
3.3.3. Independence

Overall, we found a small improvement in independence (d = 0.25). We found a large improvement of independence after a short follow-up duration in the subgroup with a baseline duration of illness 5–10 years and a small improvement of independence with greater improvement for study outcomes with shorter follow-up durations in the subgroup with a baseline duration of illness >10 years ($\chi^2 = 21.29; df = 3; p < 0.01$).

3.3.4. Activities

Overall, we found no improvement in activities (d = 0.15). We found a small improvement over time for studies with a baseline duration of illness of less than 2 years. We found no improvement over time for subgroups with a longer baseline duration of illness.

3.3.5. Vocational functioning

Overall, we found a small improvement in vocational functioning (d = 0.31). We found a medium improvement after a short follow-up and a large improvement after long follow-up for the subgroup with a baseline duration of illness >10 years. Differences in improvement between short and long follow-up were significant ($\chi^2 = 27.92; df = 3; p < 0.01$). We found no improvement in vocational functioning for the subgroup with a shorter baseline duration of illness (i.e. <2; 2–5 or 5–10 years).

3.4. Outliers and publication bias

We found 13 positive and 7 negative outliers for overall social functioning outcomes, 16 positive and 4 negative outliers for prosocial behavior, 1 positive outlier for independence, and 3 negative outliers for vocational functioning. Excluding outliers did not significantly influence any study outcome.

We found asymmetrical funnel plots, indicating publication bias, for overall social functioning and prosocial behavior (see Supplementary Material H). For overall social functioning mainly study outcomes with a baseline duration of illness <2 years and 2–5 years and for prosocial behavior larger studies with a duration of illness between 5 and 10 years at baseline positively influenced the outcomes.

3.5. Analysis of potential moderators of outcome at baseline

Meta-regression outcomes and sensitivity analyses are presented in Supplementary Material E and Table 3. For some outcome domains moderators were excluded, because data were available for less than 10 studies.

3.5.1. Overall social functioning

Meta-regression showed that baseline levels of depression, positive symptoms, negative symptoms, subjective quality of life, and overall social functioning were significant moderators for changes in overall social functioning. Subsequently, sensitivity analyses indicated that higher baseline levels of positive symptoms, subjective quality of life, and overall social functioning, and lower baseline levels of negative symptoms was associated with greater improvement in overall social functioning ($\chi^2 = 16.24; df = 1; p < 0.01$; $\chi^2 = 8.64; df = 1; p < 0.01$; $\chi^2 = 24.76; df = 1; p < 0.01$; $\chi^2 = 8.48; df = 1; p < 0.01$). The influence of baseline positive and negative symptoms and baseline subjective quality of life applied to the subgroup with a duration of illness <2 years. For both baseline negative symptoms and overall social functioning the influence also applied to the subgroup with a duration of illness between 5 and 10 years.

3.5.2. Prosocial behavior

Meta-regression outcomes showed that baseline levels of positive symptoms and substance use, and a health care setting were moderators for changes in prosocial behavior. Sensitivity analyses indicated that higher baseline levels of positive symptoms, and studies executed in a

Table 1 (continued)

| Study name | N (baseline-FU) | Age (SD) | % female | Primary diagnosis | Comorbidity | Treatment | Baseline DOI | FU duration | Attrition rate | Outcome categories reported |
|------------|----------------|----------|---------|------------------|-------------|-----------|-------------|-------------|-----------------|-----------------------------------|
| Veijola 2014 | 61–33 | 34.0 (1.6) | 42.4% | Schizophrenia (50%); unspecified or functional psychosis (5%); major depressive disorder (2%); bipolar disorder (4.8%) | schizophrenia (100%) | management (49.9%); standard case management (50.2%) | 0.25 | 1.5 | 67.1% | Overall social functioning |
| Whitehorn 2002 | 103–49 | 21.9 (5.7) | 33.1% | Schizophrenia spectrum disorder (100%) | personality disorder (33.3%) | Antipsychotics (100%); cognitive behaviorally oriented service (51.0%); treatment as usual (49.0%) | 0.01 | 2 | 52.4% | Overall social functioning |
| Wittorf 2008 | 151–96 | 33.9 (9.7) | 49.0% | Schizophrenia (85.5%); schizoaffective disorder (11.5%) | personality disorder (33.3%) | Antipsychotics (100%); cognitive behaviorally oriented service (51.0%); treatment as usual (49.0%) | 0.25 | 2 | 52.4% | Overall social functioning |
| Wunderink 2009 | 125–107 | 26.4 (6.4) | 31.2% | Schizophrenia (45.6%); other nonaffective psychosis (54.4%) | cannabis dependence (24.0%) | Antipsychotics (100%); 0.7 | 1.5 | 2 | 14.4% | Prosocial behavior |
| Xie 2005 | 169–130 | 32.4 (7.2) | 22.4% | Schizophrenia (70.4%); schizoaffective disorder (29.6%) | substance use disorder (100%); alcohol use disorder (81.6%); cannabis use disorder (44.7%); cocaine use disorder (15.1%); bipolar disorder (100%) | Dual disorder treatment (100%); | 1.5/2 | 2 | 23.1% | Activities; Independence; Prosocial behavior; Vocational functioning |

a NA = Not Applicable; NR = Not Reported; y = years.
b The reference list of the included studies are presented in Supplementary materials H.
Fig. 2. Effect sizes of improvement and/or deterioration of the five social functioning outcome categories.

* In this figure a positive trendline indicates improvement over time and a negative trendline indicates deterioration over time. The upper and lower whiskers show the 95% confidence interval. Thicker lines represent subgroup outcomes based on a higher number of patients.
health care setting were associated with greater improvement in prosocial behavior ($\chi^2 = 9.71; df = 1; p < 0.01; \chi^2 = 4.31; df = 1; p < 0.05$). Influence of positive symptoms and a health care setting applied to the subgroup with a duration of illness between 5 and 10 years ($\chi^2 = 38.15; df = 1; p < 0.01; \chi^2 = 9.52; df = 1; p < 0.01$).

3.5.3. Independence

Meta-regression outcomes showed that study samples with a schizophrenia diagnosis, and baseline levels of independence were significant moderators for changes in independence. Studies evaluating patients with high levels of baseline independence ($\chi^2 = 9.72; df = 1; p < 0.01$) and studies in which not the whole sample had schizophrenia ($\chi^2 = 13.03; df = 1; p < 0.01$) reported greater improvement in independence. The influence of baseline independence also applied to the subgroup with a duration of illness $>10$ years at baseline ($\chi^2 = 13.79; df = 1; p < 0.01$).

3.5.4. Activities

Meta-regression outcomes showed that publication year was a moderator for changes in activities. Sensitivity analyses indicated that studies that were published less than 10 years ago reported stronger improvement in activities than older studies ($\chi^2 = 16.24; df = 1; p < 0.01$), especially in the subgroup with a duration of illness between 5 and 10 years after baseline ($\chi^2 = 64.24; df = 1; p < 0.01$).

3.5.5. Vocational functioning

Meta-regression showed that rehabilitation, combined treatment, psychotherapy, depression, negative symptoms, positive symptoms, health care setting, publication year, and baseline vocational functioning are significant moderators for changes in vocational functioning.

Sensitivity analyses indicated that studies applying rehabilitation interventions ($\chi^2 = 41.30; df = 1; p < 0.01$), or combined treatment ($\chi^2 = 38.50; df = 1; p < 0.01$) to the (sub)sample describe greater improvement in vocational functioning. In contrast, studies applying psychotherapy reported weaker improvement in vocational functioning ($\chi^2 = 21.31; df = 1; p < 0.01$). These moderating effects of treatment applied to subgroups with a baseline duration of illness $<2$ years and 2–5 years.

Furthermore, studies evaluating patients with high levels of baseline positive symptoms ($\chi^2 = 15.77; df = 1; p < 0.01$), or low levels of baseline negative symptoms ($\chi^2 = 41.55; df = 1; p < 0.01$) reported greater improvement in vocational functioning. Moderating effects of negative symptoms applied to the subgroup with a baseline duration of illness $>10$ years ($\chi^2 = 98.31; df = 1; p < 0.01$).

Finally, studies conducted in a health care setting ($\chi^2 = 54.29; df = 1; p < 0.01$), published less than 10 years ago ($\chi^2 = 4.04; df = 1; p < 0.05$) and studies evaluating patients with high baseline vocational functioning ($\chi^2 = 31.64; df = 1; p < 0.01$) show greater improvement in vocational functioning than studies without these features. These differences applied to subgroups with both a baseline duration of illness $<2$ years and a baseline duration of illness 5–10 years.

3.6. Quality assessment

The quality assessment and its sensitivity analysis are presented in Supplementary Material F and G. High risk of bias, and lower study quality, was specifically indicated on a substantial number of studies for study attrition (26.2%) and prognostic factor measurement (36.9%).

Although the QUIPS items study attrition and prognostic factor measurement significantly influenced all outcome domains, the direction of the influence of these QUIPS items varied. Therefore, we did not find a consistent trend of influence of study quality of any of the QUIPS items.

4. Discussion

This meta-analysis investigated changes in social functioning and moderators of change in patients with psychotic disorders, with different durations of illness and duration of follow-up.

We observed medium improvement in overall social functioning, with greater improvement in those within the first 5 years of illness after a longer duration of follow-up. We found small improvement in vocational functioning, prosocial behavior and independence, specifically in subgroups with a baseline duration of illness of more than 5 years. We found no overall improvement of activities.

The results we found are in line with previous landmark longitudinal cohort studies, such as IPSS (Leff et al., 1992) that also found long-term improvement of social functioning for patients with psychotic disorders. Results are also in line with earlier studies indicating that patients with shorter illness duration at baseline showed more substantial improvement in social functioning than patients with longstanding psychosis (Frascarelli et al., 2015; Preston, 2000). Our findings also support the idea that the first 5 years after onset of a psychotic disorder could be labeled as a “critical period of recovery” (Birchwood et al., 1998), in which patients can achieve more improvement in social functioning (Luther et al., 2020). However, we observed small or no improvement in the other outcome domains of social functioning during the first five years of illness, though these results were based on a limited number of study outcomes. This emphasizes the need for more studies investigating specific domains of social functioning during early psychosis. The improvement in vocational functioning, prosocial behavior and independence in patients with a longer baseline duration of illness shows hopeful patterns of improvement for chronic patient populations, but also stresses the need for a focus on improvement in these domains for patients with early psychosis.

After controlling for multiple testing effects, we found indications...
### Table 2

**Meta-analysis of social functioning outcomes.**

| Overall social functioning | K (studies (outcomes)) | N (baseline-FU) | Effect size (95% CI) and magnitude of effect** | K (%) large effect** [+/-]** | Heterogeneity (I² (95%CI))** |
|----------------------------|------------------------|-----------------|-----------------------------------------------|-----------------------------|-----------------------------|
| All studies and outcomes   | 54 (99)                | 25,867–24,086   | d = 0.60 [M] (0.52–0.69)                     | + = 28 (28.57%)/– = 1 (1.02%) | I² = 97% (96–97%)           |

#### Baseline subgroup

**Follow-up cohort**

| Duration of illness < 2 years | 14 (25) | 2720–2506 | d = 0.92 [L] (0.60–1.24)** | + = 11 (45.83%)/– = 0 (0.00%) | I² = 97% (97–98%) |

**Subgroups**

| Duration of illness < 2 years | 2 (2) | 154–145 | d = 0.89 [L] (0.46–1.31)** | + = 1 (50.00%)/– = 0 (0.00%) | I² = 66% (NA) |

| Duration of illness 2–5 years | 2 (2) | 531–460 | d = 0.99 [L] (1.01–2.99) | + = 1 (50.00%)/– = 0 (0.00%) | I² = 98% (NA) |

| Duration of illness 5-10 years | 1 (1) | 67–67 | d = 0.00 [N] (–0.37–0.37)** | + = 0 (0.00%)/– = 0 (0.00%) | Not Applicable |

| Duration of illness >10 years | 10 (18) | 17,824–17,791 | d = 0.27 [S] (0.19–0.34)** | + = 3 (16.67%)/– = 0 (0.00%) | I² = 88% (83–91%) |

| Duration of illness unclear | 7 (14) | 996–768 | d = 0.64 [M] (0.23–1.04) | + = 6 (42.86%)/– = 1 (7.14%) | I² = 97% (96–97%) |

| Duration of illness < 2 years | 3 (3) | 876–824 | d = 0.52 [M] (0.15–0.90) | + = 1 (33.33%)/– = 0 (0.00%) | I² = 95% (99–97%) |

| Duration of illness 5-10 years | 2 (2) | 289–289 | d = 0.81 [L] (0.35–1.98) | + = 1 (50.00%)/– = 0 (0.00%) | I² = 58% (NA) |

| Duration of illness >10 years | 1 (1) | 33–33 | d = 0.19 [N] (–0.29–0.67)** | + = 0 (0.00%)/– = 0 (0.00%) | Not Applicable |

#### Subgroups Baseline subgroup

**Follow-up cohort**

| Duration of illness < 2 years | 6 (6) | 737–659 | d = 0.21 [S] (–0.08–0.50)** | + = 0 (0.00%)/– = 0 (0.00%) | I² = 80% (59–90%) |

| Duration of illness 2–5 years | 2 (2) | 190–190 | d = 0.69 [M] (0.49–0.90)** | + = 0 (0.00%)/– = 0 (0.00%) | I² = 0% (NA) |

| Duration of illness 5-10 years | 1 (1) | 307–300 | d = 0.07 [N] (–0.12–0.26)** | + = 0 (0.00%)/– = 0 (0.00%) | Not Applicable |

| Duration of illness clear | 1 (6) | 122–117 | d = 0.24 [S] (0.14–0.55)** | + = 0 (0.00%)/– = 0 (0.00%) | I² = 29% (0.51%) |

| Duration of illness unclear | 2 (2) | 122–105 | d = 0.20 [S] (–0.30–0.70) | + = 0 (0.00%)/– = 0 (0.00%) | I² = 63% (NA) |

#### Subgroups Baseline subgroup

**Follow-up cohort**

| Duration of illness < 2 years | 4 (13) | 320–319 | d = 1.08 [L] (0.71–1.45)** | + = 8 (61.54%)/– = 0 (0.00%) | I² = 94% (91–95%) |

| Duration of illness 5-10 years | 1 (2) | 46–46 | d = −0.17 [N] (–0.85–0.51) | + = 0 (0.00%)/– = 0 (0.00%) | Not Applicable |

| Duration of illness >10 years | 6 (19) | 1121–1120 | d = 0.34 [S] (0.19–0.49)** | + = 24 (20.69%)/– = 0 (0.00%) | I² = 94% (93–94%) |

(continued on next page)
### Table 2 (continued)

#### Prosocial behavior

| (Sub)analysis | K (studies (outcomes)) | N (baseline-FU) | Effect size (95% CI)\(^2\) and magnitude of effect\(^**\) | K (%) large effect\(^**\) \([-/–/+]\*) | Heterogeneity \((I^2 (95\% CI))\) |
|---------------|------------------------|-----------------|-------------------------------------------------|---------------------------------|-----------------|
| All studies and outcomes | 30 (113) | 5813–4615 | \(d = 0.36 [S (0.27–0.46)]\) | \(+ = 24 (20.69\%)/+ = 0 (0.00)%\) | \(I^2 = 94\% (93–94\%)\) |
| Duration of illness \(>\)10 years | | | | | |
| \(\geq\)2–<5 years | 7 (26) | 3300–2221 | \(d = 0.17 [N (0.01–0.33)]^2\) | \(+ = 5 (19.23\%)/+ = 0 (0.00)%\) | \(I^2 = 94\% (92–96\%)\) |
| \(\geq\)5–<8 years | 4 (14) | 351–315 | \(d = 0.27 [S (0.04–0.51)]^2\) | \(+ = 3 (21.43\%)/+ = 0 (0.00)%\) | \(I^2 = 88\% (53–92\%)\) |
| \(\geq\)8 years | 1 (8) | 130–125 | \(d = 0.37 [S (–0.01–0.76)]^2\) | \(+ = 3 (37.50\%)/+ = 0 (0.00)%\) | \(I^2 = 94\% (90–96\%)\) |
| Subgroup differences between follow-up cohorts | | | | | |
| Duration of illness unclear | | | | | |
| \(\leq\)2 years | 3 (4) | 107–107 | \(d = 0.94 [L (0.41–1.48)]^2\) | \(+ = 2 (50.00\%)/+ = 0 (0.00)%\) | \(I^2 = 87\% (70–94\%)\) |
| \(\geq\)2–<5 years | 3 (4) | 453–453 | \(d = 0.04 [N (–0.20–0.27)]^2\) | \(+ = 0 (0.00)%/+ = 0 (0.00)%\) | \(I^2 = 75\% (30–91\%)\) |
| \(\geq\)5–<8 years | 1 (2) | 157–148 | \(d = –0.16 [N (–0.37–0.05)]^2\) | \(+ = 0 (0.00)%/+ = 0 (0.00)%\) | \(I^2 = 0\% (NA)\) |
| \(\geq\)8 years | 3 (4) | 236–159 | \(d = –0.11 [N (–0.42–0.20)]^2\) | \(+ = 0 (0.00)%/+ = 0 (0.00)%\) | \(I^2 = 56\% (0–87\%)\) |

#### Independence

| (Sub)analysis | K (studies (outcomes)) | N (baseline-FU) | Effect size (95% CI)\(^2\) and magnitude of effect\(^**\) | K (%) large effect\(^**\) \([-/–/+]\*) | Heterogeneity \((I^2 (95\% CI))\) |
|---------------|------------------------|-----------------|-------------------------------------------------|---------------------------------|-----------------|
| All studies and outcomes | 18 (40) | 4734–3669 | \(d = 0.25 [S (0.13–0.37)]^2\) | \(+ = 6 (15.00\%)/+ = 0 (0.00)%\) | \(I^2 = 90\% (88–92\%)\) |
| Subgroups | | | | | |
| Baseline subgroup | Follow-up cohort | | | | |
| Duration of illness \(<\)2 years | | | | | |
| \(\leq\)2 years | 3 (3) | 257–257 | \(d = 0.07 [N (–0.18–0.33)]^2\) | \(+ = 0 (0.00)%/+ = 0 (0.00)%\) | \(I^2 = 32\% (0–98\%)\) |
| Duration of illness 2–5 years | | | | | |
| \(\leq\)2–<5 years | 1 (1) | 122–122 | \(d = 0.07 [N (–0.18–0.32)]^2\) | \(+ = 0 (0.00)%/+ = 0 (0.00)%\) | Not applicable |
| \(\geq\)5–8 years | 1 (1) | 122–122 | \(d = 0.20 [S (–0.05–0.45)]^2\) | \(+ = 0 (0.00)%/+ = 0 (0.00)%\) | Not applicable |
| Duration of illness 5–10 years | | | | | |
| \(\leq\)2 years | 3 (5) | 277–276 | \(d = 0.92 [L (0.60–1.24)]^2\) | \(+ = 3 (60.00\%)/+ = 0 (0.00)%\) | \(I^2 = 82\% (60–92\%)\) |
| Duration of illness \(>\)10 years | | | | | |
| \(\leq\)2 years | 3 (9) | 200–200 | \(d = 0.42 [S (0.09–0.75)]^2\) | \(+ = 3 (33.33\%)/+ = 0 (0.00)%\) | \(I^2 = 81\% (65–90\%)\) |
| \(\geq\)2–<5 years | 4 (8) | 3156–2092 | \(d = –0.05 [N (–0.11–0.02)]^2\) | \(+ = 0 (0.00)%/+ = 0 (0.00)%\) | \(I^2 = 16\% (1–28\%)\) |
| \(\geq\)5–8 years | 2 (4) | 186–181 | \(d = 0.20 [S (0.02–0.37)]^2\) | \(+ = 0 (0.00)%/+ = 0 (0.00)%\) | \(I^2 = 51\% (9–84\%)\) |
| \(\geq\)8 years | 2 (4) | 183–173 | \(d = 0.22 [S (0.08–0.35)]^2\) | \(+ = 0 (0.00)%/+ = 0 (0.00)%\) | \(I^2 = 0\% (0–85\%)\) |
| Duration of illness unclear | | | | | |
| \(\leq\)2 years | 1 (1) | 124–124 | \(d = 0.12 [N (0.01–0.23)]^2\) | \(+ = 0 (0.00)%/+ = 0 (0.00)%\) | Not applicable |
| \(\geq\)2–<5 years | 3 (3) | 745–745 | \(d = 0.02 [N (–0.55–0.58)]^2\) | \(+ = 0 (0.00)%/+ = 0 (0.00)%\) | \(I^2 = 96\% (90–98\%)\) |
| \(\geq\)5–8 years | 1 (1) | 76–76 | \(d = –0.20 [S (–0.86–0.45)]^2\) | \(+ = 0 (0.00)%/+ = 0 (0.00)%\) | Not applicable |

#### Activities

| (Sub)analysis | K (studies (outcomes)) | N (baseline-FU) | Effect size (95% CI)\(^2\) and magnitude of effect\(^**\) | K (%) large effect\(^**\) \([-/–/+]\*) | Heterogeneity \((I^2 (95\% CI))\) |
|---------------|------------------------|-----------------|-------------------------------------------------|---------------------------------|-----------------|
| All studies and outcomes | 13 (32) | 4489–3273 | \(d = 0.15 [N (–0.02–0.32)]^2\) | \(+ = 3 (9.38\%)/+ = 0 (0.00)%\) | \(I^2 = 95\% (94–96\%)\) |
| Subgroups | Baseline subgroup | Follow-up cohort | | | |
| Duration of illness \(<\)2 years | | | | | |
| \(\leq\)2 years | 1 (2) | 764–623 | \(d = 0.25 [S (0.17–0.32)]^4\) | \(+ = 0 (0.00)%/+ = 0 (0.00)%\) | \(I^2 = 0\% (NA)\) |

(continued on next page)
Table 2 (continued)

### Activities

| (Sub)analysis | K (studies (outcomes)) | N (baseline-FU) | Effect size (95% CI) and magnitude of effect** | K (%) large effect** | Heterogeneity (I² (95%CI))** |
|---------------|------------------------|-----------------|-----------------------------------------------|----------------------|-------------------------------|
| All studies and outcomes | 13 (32) | 4489-3273 | $d = 0.15 \left[N: (-0.02-0.32)\right]$ | $+ = 3 (9.38\%)/- = 0 (0.00\%)$ | $I^2 = 95\% (94-96\%)$ |
| Duration of illness 2-5 years | 6 (3) | 327 | $d = -0.40 \left[N: (-0.83-0.02)\right]$ | $+ = 0 (0.00\%)/- = 0 (0.00\%)$ | Not Applicable |
| Duration of illness 5-10 years | 7 (5) | 351-351 | $d = -0.01 \left[N: (-0.11-0.09)\right]$ | $+ = 0 (0.00\%)/- = 0 (0.00\%)$ | $I^2 = 0\% (0.79\%)$ |
| Duration of illness > 10 years | 7 (6) | 394-364 | $d = -0.01 \left[N: (-0.12-0.10)\right]$ | $+ = 0 (0.00\%)/- = 0 (0.00\%)$ | $I^2 = 0\% (0.75\%)$ |
| Duration of illness unclear | 1 (1) | 152-152 | $d = -0.19 \left[N: (-0.33 to -0.04)\right]$ | $+ = 0 (0.00\%)/- = 0 (0.00\%)$ | $I^2 = 0\% (0.90\%)$ |

### Vocational functioning

| (Sub)analysis | K (studies (outcomes)) | N (baseline-FU) | Effect size (95% CI) and magnitude of effect** | K (%) large effect** | Heterogeneity (I² (95%CI))** |
|---------------|------------------------|-----------------|-----------------------------------------------|----------------------|-------------------------------|
| All studies and outcomes | 27 (61) | 6396-4896 | $d = 0.31 \left[S: (0.20-0.42)\right]$ | $+ = 12 (19.67\%)/- = 1 (1.64\%)$ | $I^2 = 89\% (87-90\%)$ |

### Subgroups

#### Baseline subgroup

| Follow-up cohort | K (studies (outcomes)) | N (baseline-FU) | Effect size (95% CI) and magnitude of effect** | K (%) large effect** | Heterogeneity (I² (95%CI))** |
|------------------|------------------------|-----------------|-----------------------------------------------|----------------------|-------------------------------|
| Duration of illness <2 years | 5 (7) | 557-507 | $d = 0.06 \left[N: (-0.37-0.48)\right]$ | $+ = 0 (0.00\%)/- = 0 (0.00\%)$ | $I^2 = 94\% (89-96\%)$ |
| Duration of illness 2-5 years | 2 (2) | 158-158 | $d = 0.66 \left[M: (0.46-1.78)\right]$ | $+ = 1 (50.00\%)/- = 0 (0.00\%)$ | $I^2 = 75\% (NA)$ |
| Duration of illness > 10 years | 2 (2) | 434-337 | $d = -0.51 \left[M: (-1.52-0.51)\right]$ | $+ = 0 (0.00\%)/- = 1 (50.00\%)$ | $I^2 = 87\% (NA)$ |
| Duration of illness unclear | 2 (2) | 223-214 | $d = 0.34 \left[S: (-0.95-1.62)\right]$ | $+ = 1 (50.00\%)/- = 0 (0.00\%)$ | $I^2 = 98\% (NA)$ |

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Outcomes in **bold** are significant (p < 0.05) after Benjamini-Hochberg correction; Outcomes underlined are no longer significant after Benjamini-Hochberg correction for multiple testing.

1Significant subgroup differences with the duration of illness <2 years subgroup outcome within the same follow-up cohort.

70
that high levels of baseline positive symptoms and social functioning, low levels of baseline negative symptoms and studies published in more recent publications were associated with more improvement in multiple domains of social functioning. Furthermore, we found that a high level of baseline subjective quality of life was associated with improvement in overall social functioning and that the presence of specific rehabilita-
tion, or combined treatment, and the absence of psychotherapy were associated with improvement in vocational functioning.

The positive influence of high baseline levels of positive symptoms on improvement in social functioning contradicts previous studies indicating that lower severity of psychotic symptoms is an important predictor for social recovery (Alvarez-Jimenez et al., 2012; Bottledor et al., 2010). The results might be explained by the fact that patients with more severe symptoms have a higher level of functional impairment (Rymaszewska et al., 2007) and thereby greater potential for improvement in social functioning. The negative association between baseline levels of positive symptoms and functioning at baseline (r = -0.48; p < 0.01) in our included studies corroborates this explanation.

Furthermore, the positive association between low levels of baseline negative symptoms and improvement in social functioning is in accordance with previous findings (Albert et al., 2011; Bottledor et al., 2010; Gee et al., 2016; Moller et al., 2000). This might be explained by the conceptual overlap between features of negative symptoms (e.g. apathy and speech problems) and social functioning and the negative association between negative symptoms and neurocognition, social cognition and adherence to treatment (Bliksted et al., 2017; Ventura et al., 2015), which may hamper social recovery. In our report we could not replicate these negative associations, due to lack of study outcomes and lack of heterogeneity of neurocognition assessments. Therefore, we recommend further investigation of the etiology and pathobiology of negative symptoms and possibilities for integrating interventions targeting negative symptoms within functional rehabilitation (Gee et al., 2016; Stiekema et al., 2018; Fervaha et al., 2014).

The positive influence of baseline subjective quality of life on the improvement in overall social functioning confirms previous findings (Burns-Lynch and Musa, 2016; Lambert et al., 2009). This might be explained by the fact that better subjective quality of life might lead to increased engagement in social roles due to increased hope and optimism and a reduced “why try?” effect (Corrigan et al., 2009).

The positive association between recent publications and improvement in activities and vocational functioning might give some first indications for a shift towards greater emphasis on social functioning in standard care for psychosis. We recommend further elaboration of this trend in future research.

Furthermore, studies delivering rehabilitation and combined treatment to the study (sub)sample are associated with improvement in vocational functioning especially for patients with a short illness duration at baseline. This is in line with previous studies indicating beneficial vocational outcomes for vocational rehabilitation programs, such as individual placement and support (IPS), in early intervention services (Bond et al., 2015; Rinaldi et al., 2004). The negative influence of psychotherapy on vocational outcomes might be explained by the fact that most of the psychotherapy studies were not focused on rehabilitation or combined treatment and thereby less focused on vocational rehabilitation.

It is important to consider that we analyzed the whole study sample of each study, so we analyzed both the intervention and the control condition. Therefore, intervention effects do not exclusively explain changes in vocational functioning. The results could be explained by the ‘Hawthorne effect’ which indicates that being a subject of social investiga-
tion might explain the behavior-modifying effect (Wickström and Bendix, 2000). We recommend future research investigating long-term effects of different types of treatment and treatment adherence on different levels of social functioning to put current results into perspective.

Finally, we found a negative association between a diagnosis of schizophrenia and improvement in independence. This indicates that a more severe and chronic pattern of psychotic disorders might affect improvement in this outcome domain. However, both study design and study sample did not influence the other outcome domains in this meta-
analysis. Therefore, the broad inclusion norms increase the generaliz-
ability of our findings with limited influence on the heterogeneity of study outcomes.

A possible important explanation for the results we found might be explained by the fact that the duration of illness subgroups might be biased and censored because sample characteristics between these subgroups differed at baseline. However, in our meta-analysis we found no indications of such a sampling effect, except for the fact that studies with a longer duration of illness were more often diagnosed with schizophrenia than studies with a shorter duration of illness. This might have influenced outcomes as a schizophrenia diagnosis is negatively associated with improvement in independence. Nevertheless, the influence of this moderator is very limited, so the results could not be explained by sampling effects.

There are several limitations to address. First, the subgroup and sensitivity analyses were often based on a limited number of studies with heterogeneous outcomes, making the outcomes less reliable (Bühning et al., 2017). The high heterogeneity might be explained by the fact that social functioning remains a complex and disputed construct with low psychometric quality (Bellack et al., 2006). Although heterogeneity of study outcomes in complex meta-analyses are often inevitable and could not be directly translated to clinical implications of study outcomes (Ioannidis, 2008), we partly explained heterogeneity by executing meta-
regression analyses on potential moderators of outcomes. Quality assessment also revealed lower quality of a few included studies. How-
ever, the sensitivity analysis did not indicate a significant influence of study quality on outcomes. Furthermore, although subgroup and sensi-
tivity analyses were necessary to answer our research questions, the relatively high number of analyses might have caused alpha inflation. Therefore, we executed a Benjamini-Hochberg correction on all signific-
ant outcomes to test for potential type-I errors. Furthermore, we could not analyze the influence of potentially relevant moderators, such as stigma, social cognition, premorbid functioning, regional differences or ethnic groups due to limited studies reporting on these factors. These moderators would be valuable to investigate in future research. Finally, indications of publication bias and high numbers of positive outliers might have inflated study outcomes, though analyses of positive outliers does not support this possibility.

Our findings show hopeful patterns of improvement in social func-
tioning in the first 5 years of illness. However, even patients with a longer duration of illness improve in distinct outcome domains of social functioning. This stresses the needs for extensive intervention services. Reduction of negative symptoms and improvement in subjective quality of life might amplify improvement in social functioning. Further research into specific interventions might help to further unlock the social potential of patients with psychotic disorders.
### Table 3
Sensitivity analysis of significant moderators.

| (Sub)analysis | Overall social functioning |
|---------------|-----------------------------|
|               | K (studies (outcomes)) | N (baseline-FU) | Effect size (95% CI) and magnitude of effect ** | K (%) large effect *** | Heterogeneity (I² (95% CI)) |
| **Confounder** | **Rating** | **Depression** | **High** (14 (17)) | 3490–2297 | d = 0.82 [L] (0.41–1.23) | + = 6 (35.29%)/– 1 (5.88%) | I² = 98% (97–98%) |
| **Low** (12 (18)) | 2066–1832 | d = 0.58 [M] (0.15–1.02) | + = 6 (33.33%)/– 0 (0.00%) | I² = 98% (98–99%) |
| **Positive symptoms** | **High** (14 (25)) | 1959–1793 | $\chi^2 = 0.61; df = 1; p = 0.44$ | $d = 1.16 [L] (0.83–1.50)$ | + = 14 (56.00%)/– 0 (0.00%) | I² = 96% (96–97%) |
| **Low** (17 (33)) | 2869–2712 | d = 0.42 [S] (0.29–0.56) | + = 6 (18.75%)/– 0 (0.00%) | I² = 90% (87–92%) |
| **Negative symptoms** | **High** (17 (37)) | 3934–2817 | $\chi^2 = 16.24; df = 1; p < 0.01$ | d = 0.59 [M] (0.43–0.75) | + = 13 (35.14%)/– 0 (0.00%) | I² = 94% (93–95%) |
| **Low** (15 (19)) | 3010–2697 | d = 1.33 [L] (0.85–1.80) | + = 10 (52.63%)/– 0 (0.00%) | I² = 98% (98–99%) |
| **Subjective quality of life** | **High** (4 (18)) | 436–377 | d = 0.63 [M] (0.27–0.98) | + = 4 (22.22%)/– 0 (0.00%) | I² = 95% (94–96%) |
| **Low** (9 (19)) | 20,636–19,272 | d = 0.09 [N] (0.03–0.15) | + = 2 (10.53%)/– 0 (0.00%) | I² = 89% (85–92%) |
| **Baseline functioning** | **High** (27 (44)) | 22,236–20,881 | $\chi^2 = 6.84; df = 1; p < 0.01$ | d = 0.85 [L] (0.73–0.98) | + = 19 (43.18%)/– 1 (2.27%) | I² = 98% (97–98%) |
| **Low** (27 (56)) | 3998–3562 | d = 0.41 [S] (0.30–0.53) | + = 10 (17.86%)/– 0 (0.00%) | I² = 92% (91–93%) |

*Subgroup differences between follow-up cohorts $\chi^2 = 24.76; df = 1; p < 0.01$

*Duration of illness at baseline < 2 years study outcomes

| (Sub)analysis | K (studies (outcomes)) | N (baseline-FU) | Effect size (95% CI) and magnitude of effect ** | K (%) large effect *** | Heterogeneity (I² (95% CI)) |
|---------------|-----------------------------|
| **Confounder** | **Rating** | **Depression** | **High** (5 (7)) | 497–389 | d = 1.17 [L] (0.21–2.14) | + = 3 (42.86%)/– 0 (0.00%) | I² = 98% (98-99%) |
| **Low** (6 (9)) | 1042–973 | d = 0.99 [L] (0.35–1.64) | + = 5 (55.56%)/– 0 (0.00%) | I² = 98% (98–99%) |
| **Positive symptoms** | **High** (6 (15)) | 1096–889 | $\chi^2 = 0.09; df = 1; p = 0.76$ | d = 1.22 [L] (0.79–1.64) | + = 8 (53.33%)/– 0 (0.00%) | I² = 96% (95–97%) |
| **Low** (5 (5)) | 1201–1059 | d = 0.48 [S] (0.09–0.87) | + = 2 (50.00%)/– 0 (0.00%) | I² = 88% (74–94%) |
| **Negative symptoms** | **High** (4 (11)) | 339–288 | d = 0.79 [M] (0.40–1.17) | + = 5 (45.45%)/– 0 (0.00%) | I² = 92% (87–95%) |
| **Low** (9 (11)) | 2292–2012 | d = 1.68 [L] (1.04–2.33) | + = 7 (63.64%)/– 0 (0.00%) | I² = 98% (98–99%) |
| **Subjective quality of life** | **High** (2 (7)) | 278–234 | d = 1.23 [L] (0.61–1.84) | + = 4 (57.14%)/– 0 (0.00%) | I² = 96% (93–97%) |
| **Low** (1 (2)) | 1290–1159 | d = 0.21 [S] (0.01–0.43) | + = 0 (0.00%)/– 0 (0.00%) | I² = 72% (NA) |
| **Baseline functioning** | **High** (12 (18)) | 17,907–17,744 | $\chi^2 = 9.32; df = 1; p < 0.01$ | d = 1.15 [L] (0.71–1.59) | + = 9 (50.00%)/– 0 (0.00%) | I² = 98% (97–98%) |
| **Low** (5 (11)) | 1273–1094 | d = 0.67 [M] (0.30–1.04) | + = 4 (36.36%)/– 0 (0.00%) | I² = 95% (92–96%) |

*Subgroup differences between follow-up cohorts $\chi^2 = 2.69; df = 1; p < 0.01$

*Duration of illness at baseline 2–5 years study outcomes

| (Sub)analysis | K (studies (outcomes)) | N (baseline-FU) | Effect size (95% CI) and magnitude of effect ** | K (%) large effect *** | Heterogeneity (I² (95% CI)) |
|---------------|-----------------------------|
| **Confounder** | **Rating** | **Depression** | **High** (2 (2)) | 142–124 | d = 1.34 [L] (0.02–2.65) | + = 1 (50.00%)/– 0 (0.00%) | I² = 94% (NA) |
| **Low** | X | X | X | X | X |
| **Positive symptoms** | **High** | X | X | X | X | X |
| **Low** (3 (3)) | 209–191 | d = 0.88 [L] (−0.06–1.82) | + = 1 (33.33%)/– 0 (0.00%) | I² = 94% (83–98%) |
| **Negative symptoms** | **High** (1 (1)) | 67–67 | d = 0.00 [N] (−0.37–0.37) | + = 0 (0.00%)/– Not Applicable |
| **Low** (2 (2)) | 142–124 | d = 1.34 [L] (0.02–2.65) | + = 1 (50.00%)/– 0 (0.00%) | I² = 94% (NA) |

*Subgroup differences between follow-up cohorts $\chi^2 = 3.68; df = 1; p < 0.05$

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| (Sub)analysis | Overall social functioning | All studies and outcomes | Heterogeneity (I² (95% CI)) |
|---------------|---------------------------|--------------------------|---------------------------|
|               | K (studies (outcomes)) | N (baseline-FU) | Effect size (95% CI)* and magnitude of effect ** | K (%) large effect [ +/− ] *** | |
| Subjective quality of life | High | X | X | X | X |
|               | Low | X | X | X | X |
| Baseline functioning | High | 2 (2) | 543–481 | $d = 0.54$ [M] (−0.58–1.82) | $+ = 1$ (50.00%)/− 0 (0.00%) | $I^2 = 96\%$ (NA) |
|               | Low | 3 (3) | 209–191 | $d = 0.88$ [I] (−0.06–1.82) | $+ = 1$ (33.33%)/− 0 (0.00%) | $I^2 = 94\%$ (83–98%) |
| Subgroup differences between follow-up cohorts | $\chi^2 = 0.20$; $df = 1$; $p = 0.65$ |
| Subjective quality of life | High | X | X | X | X |
|               | Low | X | X | X | X |
| Baseline functioning | High | 1 (1) | 96–96 | $d = 2.37$ [I] (2.00–2.74) | $+ = 1$ (100.00%)/− 0 (0.00%) | Not applicable |
|               | Low | 4 (5) | 324–318 | $d = 0.36$ [S] (−0.14–0.86) | $+ = 1$ (20.00%)/− 0 (0.00%) | $I^2 = 91\%$ (81–95%) |
| Subgroup differences between follow-up cohorts | $\chi^2 = 40.27$; $df = 1$; $p < 0.01$ |
| Quality of life | High | X | X | X | X |
|               | Low | X | X | X | X |
| Baseline functioning | High | 2 (11) | 158–143 | $d = 0.24$ [S] (0.04–0.44) | $+ = 0$ (0.00%)/− 0 (0.00%) | $I^2 = 78\%$ (61–88%) |
|               | Low | 7 (14) | 19,336–18,256 | $d = 0.12$ [N] (0.07–0.17) | $+ = 2$ (14.29%)/− 0 (0.00%) | $I^2 = 81\%$ (72–87%) |
| Subgroup differences between follow-up cohorts | $\chi^2 = 1.28$; $df = 1$; $p = 0.26$ |

### Prosocial behavior

| (Sub)analysis | All studies and outcomes | Heterogeneity (I² (95% CI)) |
|---------------|--------------------------|---------------------------|
|               | K (studies (outcomes)) | N (baseline-FU) | Effect size (95% CI)* and magnitude of effect ** | K (%) large effect [ +/− ] *** |
| Substance use | High | 5 (13) | 827–766 | $d = 0.34$ [S] (0.18–0.50) | $+ = 0$ (0.00%)/− 0 (0.00%) | $I^2 = 67\%$ (52.77%) |

(continued on next page)
Table 3 (continued)

| (Sub)analysis | All studies and outcomes | Prosocial behavior |
|---------------|--------------------------|--------------------|
|               | K (studies (outcome)) | N (baseline-FU) | Effect size (95% CI)* and magnitude of effect** | K (%) large effect* | Heterogeneity (I^2 (95% CI)) |
| Low           | 5 (54) | 2842–1778 | d = 0.30 [S] (0.18–0.43) | + = 0 (0.00%)/-- | I^2 = 93% (92-94%) |
| Positive symptoms | Subgroup differences between follow-up cohorts | | | | |
| High         | 6 (54) | 743–734 | d = 0.50 [M] (0.33–0.67) | + = 0 (0.00%)/-- | I^2 = 96% (95-96%) |
| Low          | 10 (24) | 1057–1020 | d = 0.15 [N] (0.01–0.29) | + = 0 (0.00%)/-- | I^2 = 81% (75-86%) |
| Health care setting | Subgroup differences between follow-up cohorts | | | | |
| Health care | 16 (81) | 1964–1894 | d = 0.43 [S] (0.28–0.58) | + = 0 (0.00%)/-- | I^2 = 95% (94-95%) |
| Naturalistic | 14 (32) | 3836–2707 | d = 0.20 [S] (0.02–0.29) | + = 0 (0.00%)/-- | I^2 = 91% (89-93%) |
|               | Subgroup differences between follow-up cohorts | | | | |
|               | Duration of illness at baseline < 2 years study outcomes | | | | |
| Substance use | Rating | K (studies (outcome)) | N (baseline-FU) | Effect size (95% CI)* and magnitude of effect** | K (%) large effect* | Heterogeneity (I^2 (95% CI)) |
| Positive symptoms | | | | | |
| High         | 5 (6) | 760–704 | d = 0.39 [S] (0.10–0.67) | + = 0 (0.00%)/-- | I^2 = 82% (64-91%) |
| Low          | X X X X | | | | |
| Health care setting | Subgroup differences between follow-up cohorts | | | | |
| Health care | 4 (5) | 453–404 | d = 0.46 [S] (0.19–0.74) | + = 0 (0.00%)/-- | I^2 = 72% (37-88%) |
| Naturalistic | 4 (4) | 656–620 | d = 0.11 [N] (-0.15–0.36) | + = 0 (0.00%)/-- | I^2 = 73% (26-90%) |
|               | Subgroup differences between follow-up cohorts | | | | |
|               | Duration of illness at baseline 2–5 years study outcomes | | | | |
| Substance use | Rating | K (studies (outcome)) | N (baseline-FU) | Effect size (95% CI)* and magnitude of effect** | K (%) large effect* | Heterogeneity (I^2 (95% CI)) |
| Positive symptoms | | | | | |
| High         | 1 (8) | 122–117 | d = 0.32 [S] (0.14–0.49) | + = 0 (0.00%)/-- | I^2 = 32% (0-70%) |
| Low          | X X X X | | | | |
| Health care setting | Subgroup differences between follow-up cohorts | | | | |
| Health care | 1 (8) | 122–117 | d = 0.32 [S] (0.14–0.49) | + = 0 (0.00%)/-- | I^2 = 32% (0-70%) |
| Naturalistic | X X X X | | | | |
| (Sub)analysis | All studies and outcomes | Prosocial behavior |
|               | K (studies (outcome)) | N (baseline-FU) | Effect size (95% CI)* and magnitude of effect** | K (%) large effect* | Heterogeneity (I^2 (95% CI)) |
|               | Duration of illness at baseline 5–10 years study outcomes | | | | |
| Substance use | Rating | K (studies (outcome)) | N (baseline-FU) | Effect size (95% CI)* and magnitude of effect** | K (%) large effect* | Heterogeneity (I^2 (95% CI)) |
| Positive symptoms | | | | | |
| High         | 1 (6) | 170–169 | d = 1.68 [L] (1.32–2.03) | + = 0 (100.00%)/-- | I^2 = 91% (83-95%) |
| Low          | 1 (2) | 47–47 | d = 0.24 [S] (-0.06–0.53) | + = 0 (0.00%)/-- | I^2 = 0% (NA) |
| Health care setting | Subgroup differences between follow-up cohorts | | | | |
| Health care | 2 (8) | 216–215 | d = 1.24 [L] (0.77–1.72) | + = 6 (75.00%)/-- | I^2 = 95% (93-97%) |
| Naturalistic | 3 (7) | 216–188 | d = 0.43 [S] (0.24–0.63) | + = 2 (28.57%)/-- | I^2 = 13% (0-75%) |
| (Sub)analysis | Duration of illness at baseline > 10 years study outcomes | | | | |
| Substance use | Rating | K (studies (outcome)) | N (baseline-FU) | Effect size (95% CI)* and magnitude of effect** | K (%) large effect* | Heterogeneity (I^2 (95% CI)) |
| Positive symptoms | | | | | |
| High         | X X X X | | | | |
| Low          | 3 (47) | 2433–1369 | d = 0.32 [S] (0.19–0.45) | + = 0 (0.00%)/-- | I^2 = 93% (92-94%) | (continued on next page)
### Table 3 (continued)

#### Subanalysis

| Subgroup differences between follow-up cohorts | K (studies outcomes) | N (baseline-FU) | Effect size (95% CI) and magnitude of effect ** | K (%) large effect** | Heterogeneity (I² (95% CI)) |
|-----------------------------------------------|----------------------|-----------------|-------------------------------------------------|----------------------|-----------------------------|
| Positive symptoms                             |                      |                 |                                                 |                      |                             |
| High                                          | 1 (43)               | 152–152         | $d = -0.34$ [S] (0.21–0.48)                     | + 3 (14.29%)/− 0 (0.00%)/− | I² = 91% (89–92%)/− 0 (0.00%)/− |
| Low                                           | 4 (11)               | 403–387         | $d = -0.16$ [N] (−0.02–0.34)                    | + 0 (0.00%)/− 0 (0.00%)/− | I² = 71% (46–84%)/− 0 (0.00%)/− |
| Schizophrenia diagnosis                       |                      |                 |                                                 |                      |                             |
| Yes                                           | 6 (7)                | 812–517         | $d = -0.03$ [N] (−0.22–0.16)                    | + 0 (0.00%)/− 0 (0.00%)/− | I² = 71% (46–84%)/− 0 (0.00%)/− |
| No                                            | 9 (18)               | 4530–3985       | $d = 0.56$ [M] (0.30–0.81)                      | + 6 (33.33%)/− 0 (0.00%)/− | I² = 91% (88–93%)/− 0 (0.00%)/− |
| Baseline dependence                           |                      |                 |                                                 |                      |                             |
| High                                          | 9 (26)               | 932–931         | $d = 0.37$ [S] (0.20–0.54)                      | + 0 (0.00%)/− 0 (0.00%)/− | I² = 90% (87–92%)/− 0 (0.00%)/− |
| Low                                           | 9 (14)               | 3802–2738       | $d = -0.02$ [N] (−0.13–0.16)                   | + 0 (0.00%)/− 0 (0.00%)/− | I² = 81% (72–87%)/− 0 (0.00%)/− |

#### Confidence

| Subgroup differences between follow-up cohorts | K (studies outcomes) | N (baseline-FU) | Effect size (95% CI) and magnitude of effect ** | K (%) large effect** | Heterogeneity (I² (95% CI)) |
|-----------------------------------------------|----------------------|-----------------|-------------------------------------------------|----------------------|-----------------------------|
| Duration of illness at baseline < 2 years study outcomes |                      |                 |                                                 |                      |                             |
| Positive symptoms                             |                      |                 |                                                 |                      |                             |
| High                                          | 2 (2)                | 104–104         | $d = 0.26$ [S] (0.06–0.59)                      | + 0 (0.00%)/− 0 (0.00%)/− | I² = 0% (NA)/− 0 (0.00%)/− |
| Low                                           | 1 (1)                | 153–153         | $d = -0.08$ [N] (−0.30–0.14)                    | + 0 (0.00%)/− 0 (0.00%)/− | Not Applicable               |
| Schizophrenia diagnosis                       |                      |                 |                                                 |                      |                             |
| Yes                                           | 2 (2)                | 234–208         | $d = 0.07$ [N] (−0.28–0.41)                    | + 0 (0.00%)/− 0 (0.00%)/− | I² = 62% (NA)/− 0 (0.00%)/− |
| No                                            | 1 (1)                | 49–41           | $d = -0.08$ [N] (−0.30–0.14)                    | + 0 (0.00%)/− 0 (0.00%)/− | Not Applicable               |
| Baseline                                     |                      |                 |                                                 |                      |                             |
| High                                          | 2 (2)                | 104–104         | $d = 0.26$ [S] (0.06–0.59)                      | + 0 (0.00%)/− 0 (0.00%)/− | I² = 0% (NA)/− 0 (0.00%)/− |
| Low                                           | 1 (1)                | 153–153         | $d = -0.08$ [N] (−0.30–0.14)                    | + 0 (0.00%)/− 0 (0.00%)/− | Not Applicable               |

#### Subgroup differences between follow-up cohorts

| K (studies outcomes) | N (baseline-FU) | Effect size (95% CI) and magnitude of effect ** | K (%) large effect** | Heterogeneity (I² (95% CI)) |
|----------------------|-----------------|-------------------------------------------------|----------------------|-----------------------------|
| Duration of illness at baseline ≥ 2 years study outcomes |                      |                                                 |                      |                             |
| Positive symptoms                             |                      |                                                 |                      |                             |
| High                                          | 2 (2)               | X                                              | X                    | X                           |
| Low                                           | 1 (1)               | X                                              | X                    | X                           |
| Schizophrenia diagnosis                       |                      |                                                 |                      |                             |
| Yes                                           | 1 (2)               | 122–125                                        | $d = 0.14$ [N] (−0.04–0.31) | + 0 (0.00%)/− 0 (0.00%)/− | I² = 0% (NA)/− 0 (0.00%)/− |
| No                                            | 1 (2)               | 122–122                                        | $d = 0.14$ [N] (−0.04–0.31) | + 0 (0.00%)/− 0 (0.00%)/− | I² = 0% (NA)/− 0 (0.00%)/− |

(continued on next page)
| Confounder                  | Rating | N (baseline-FU) | Duration of illness at baseline 5–10 years study outcomes | K (%) large effect** | K (studies (outcomes)) | Effect size (95% CI)* and magnitude of effect** | Heterogeneity (I² (95% CI)) |
|----------------------------|--------|-----------------|----------------------------------------------------------|----------------------|------------------------|-------------------------------------------------|--------------------------|
| Positive symptoms          | High   | 170–169         | d = 1.18 [L] (1.04–1.32)                                | + = 3 (100.00%)/= = 0 (0.00%) | 1 (3)                  | + = 3 (100.00%)/= = 0 (0.00%)                    | I² = 6% (0–90%)          |
|                           | Low    | 47–47           | d = 0.39 [S] (–0.02–0.80)                               | + = 0 (0.00%)/= = 0 (0.00%) | 1 (1)                 | + = 3 (60.00%)/= = 0 (0.00%)                     | I² = Not Applicable       |
| Schizophrenia diagnosis    | Yes    | X X             |                                                                 |                       |                        |                                                 |                          |
|                           | No     | 292–215         | d = 0.92 [L] (0.60–1.24)                                | + = 3 (60.00%)/= = 0 (0.00%) | 3 (5)                 | + = 3 (60.00%)/= = 0 (0.00%)                     | I² = 82% (60–92%)        |
| Baseline Independence      | Low    | X X             |                                                                 |                       |                        |                                                 |                          |

| Confounder                  | Rating | N (baseline-FU) | Duration of illness at baseline >10 years study outcomes | K (%) large effect** | K (studies (outcomes)) | Effect size (95% CI)* and magnitude of effect** | Heterogeneity (I² (95% CI)) |
|----------------------------|--------|-----------------|----------------------------------------------------------|----------------------|------------------------|-------------------------------------------------|--------------------------|
| Positive symptoms          | High   | 152–152         | d = 0.12 [N] (0.03–0.20)                                | + = 0 (0.00%)/= = 0 (0.00%) | 1 (13)                | + = 3 (42.78% /)= = 0 (0.00%)                     | I² = 42% (0–70%)          |
|                           | Low    | 78–78           | d = 0.11 [N] (–0.58–0.80)                               | + = 0 (0.00%)/= = 0 (0.00%) | 1 (2)                 | + = 3 (60.00%)/= = 0 (0.00%)                     | I² = 40% (0–60%)          |
| Schizophrenia diagnosis    | Yes    | 3202–3026       | d = 0.08 [N] (–0.01–0.16)                               | + = 0 (0.00%)/= = 0 (0.00%) | 3 (13)                | + = 3 (60.00%)/= = 0 (0.00%)                     | I² = 83% (48–73%)        |
|                           | No     | 163–137         | d = 0.43 [S] (0.09–0.78)                                | + = 0 (0.00%)/= = 0 (0.00%) | 4 (8)                 | + = 3 (78.00%)/= = 0 (0.00%)                     | I² = 78% (65–87%)        |
| Baseline Independence      | High   | 3080–2016       | d = 0.06 [N] (–0.12–0.00)                               | + = 0 (0.00%)/= = 0 (0.00%) | 2 (16)                | + = 3 (82.00%)/= = 0 (0.00%)                     | I² = 50% (0–58%)         |
|                           | Low    | 177–177         | d = 0.23 [S] (0.09–0.36)                                | + = 0 (0.00%)/= = 0 (0.00%) | 5 (9)                 | + = 3 (60.00%)/= = 0 (0.00%)                     | I² = 10% (0–57%)         |

| Confounder                  | Rating | N (baseline-FU) | Duration of illness at baseline <2 years study outcomes | K (%) large effect** | K (studies (outcomes)) | Effect size (95% CI)* and magnitude of effect** | Heterogeneity (I² (95% CI)) |
|----------------------------|--------|-----------------|----------------------------------------------------------|----------------------|------------------------|-------------------------------------------------|--------------------------|
| Publication year            | Recent | 1548–1426       | d = 1.01 [L] (0.49–1.53)                                | + = 3 (43.96%)/= = 0 (0.00%) | 4 (7)                  | + = 3 (98.99%)/= = 0 (0.00%)                     | I² = 99% (98–99%)        |
|                           | Dated  | 2941–1847       | d = –0.07 [N] (–0.12 to –0.01)                          | + = 0 (0.00%)/= = 0 (0.00%) | 1 (13)                | + = 3 (15% /)= = 0 (0.00%)                      | I² = 78% (9–20%)         |
| Subgroup differences between follow-up cohorts |        |                 | d = 16.24; df = 1; p < 0.01 |                       |                        |                                                 |                          |

| Confounder                  | Rating | N (baseline-FU) | Duration of illness at baseline 2–5 years study outcomes | K (%) large effect** | K (studies (outcomes)) | Effect size (95% CI)* and magnitude of effect** | Heterogeneity (I² (95% CI)) |
|----------------------------|--------|-----------------|----------------------------------------------------------|----------------------|------------------------|-------------------------------------------------|--------------------------|
| Publication year            | Recent | 764–673         | d = 0.25 [S] (0.17–0.32)                                | + = 0 (0.00%)/= = 0 (0.00%) | 1 (2)                  | + = 3 (87% /)= = 0 (0.00%)                      | I² = 87% (64–96%)        |
|                           | Dated  | 60–60           | d = –0.40 [S] (–0.83–0.02)                               | + = 3 (100.00%)/= = 0 (0.00%) | 1 (1)                 | + = 3 (100.00%)/= = 0 (0.00%)                    | I² = Not Applicable       |
| Subgroup differences between follow-up cohorts |        |                 | d = 1.16; df = 1; p < 0.01 |                       |                        |                                                 |                          |

| Confounder                  | Rating | N (baseline-FU) | Duration of illness at baseline 5–10 years study outcomes | K (%) large effect** | K (studies (outcomes)) | Effect size (95% CI)* and magnitude of effect** | Heterogeneity (I² (95% CI)) |
|----------------------------|--------|-----------------|----------------------------------------------------------|----------------------|------------------------|-------------------------------------------------|--------------------------|
| Publication year            | Recent | 170–169         | d = 2.08 [L] (1.63–2.53)                                | + = 3 (100.00%)/= = 0 (0.00%) | 3 (3)                  | + = 3 (100.00%)/= = 0 (0.00%)                     | I² = 87% (64–96%)        |
| Subgroup differences between follow-up cohorts |        |                 | d = 1.16; df = 1; p < 0.01 |                       |                        |                                                 |                          |

(continued on next page)
## Table 3 (continued)

### Activities

| (Sub)analysis | All studies and outcomes | N (baseline-FU) | Effect size (95% CI)* and magnitude of effect** | K (%) large effect** | Heterogeneity (I² (95% CI))
|---------------|--------------------------|----------------|-----------------------------------------------|----------------------|---------------------------|
| **Dated**     |                          |                |                                               |                      |                           |
| Subgroup differences between follow-up cohorts |                           |                |                                               |                      |                           |
|   | 60-60                   | 2 (2)          | $d = -0.28$ [S] (-0.64-0.08) $\chi^2 = 64.24$; $df = 1; p < 0.01$ $I^2 = 0\%$ (NA) |                      |                           |
| **Publication year** | Recent                  | X              | Yes $d = -0.05$ [N] (-0.10 to -0.00) $\chi^2 = 0.00$; $df = 0; p = 0.00$ $I^2 = 11\%$ (6-16%) |                      |                           |
| **Psychotherapy** |                          |                |                                               |                      |                           |
| Subgroup differences between follow-up cohorts |                           |                |                                               |                      |                           |
|   | 6 (22)                  | 2821-1727      | $d = -0.05$ [N] (-0.10 to -0.00) $\chi^2 = 0.00$; $df = 0; p = 0.00$ $I^2 = 11\%$ (6-16%) |                      |                           |
| **Combined treatment** |                          |                |                                               |                      |                           |
| Subgroup differences between follow-up cohorts |                           |                |                                               |                      |                           |
|   | Yes                     | 12 (40)        | $d = -0.58$ [M] (0.43-0.73) $\chi^2 = 21.31$; $df = 1; p < 0.01$ $I^2 = 86\%$ (83-89%) |                      |                           |
|   | No                      | 12 (22)        | $d = -0.05$ [N] (-0.18-0.08) $\chi^2 = 0.00$; $df = 0; p = 0.00$ $I^2 = 86\%$ (83-89%) |                      |                           |
| **Depression** |                          |                |                                               |                      |                           |
| Subgroup differences between follow-up cohorts |                           |                |                                               |                      |                           |
|   | High                    | 3 (12)         | $d = -0.14$ [N] (0.06-0.22) $\chi^2 = 38.50$; $df = 1; p < 0.01$ $I^2 = 39\%$ (21-53%) |                      |                           |
|   | Low                     | 5 (12)         | $d = -0.04$ [N] (-0.31-0.40) $\chi^2 = 0.00$; $df = 0; p = 0.00$ $I^2 = 94\%$ (91-96%) |                      |                           |
| **Positive symptoms** |                          |                |                                               |                      |                           |
| Subgroup differences between follow-up cohorts |                           |                |                                               |                      |                           |
|   | High                    | 5 (21)         | $d = -0.71$ [M] (0.53-0.89) $\chi^2 = 0.27$; $df = 1; p = 0.60$ $I^2 = 73\%$ (63-80%) |                      |                           |
|   | Low                     | 7 (21)         | $d = 0.22$ [S] (0.05-0.38) $\chi^2 = 0.00$; $df = 0; p = 0.00$ $I^2 = 85\%$ (81-89%) |                      |                           |
| **Negative symptoms** |                          |                |                                               |                      |                           |
| Subgroup differences between follow-up cohorts |                           |                |                                               |                      |                           |
|   | High                    | 6 (14)         | $d = -0.02$ [N] (-0.06-0.09) $\chi^2 = 15.77$; $df = 1; p < 0.01$ $I^2 = 41\%$ (23-54%) |                      |                           |
|   | Low                     | 10 (35)        | $d = 0.62$ [M] (0.45-0.78) $\chi^2 = 41.55$; $df = 1; p = 0.01$ $I^2 = 86\%$ (82-89%) |                      |                           |
| **Setting** |                          |                |                                               |                      |                           |
| Subgroup differences between follow-up cohorts |                           |                |                                               |                      |                           |
|   | Naturalistic            | 12 (21)        | $d = -0.12$ [N] (-0.23 to -0.01) $\chi^2 = 0.00$; $df = 0; p = 0.00$ $I^2 = 78\%$ (71-84%) |                      |                           |
|   | Health care             | 15 (44)        | $d = 0.56$ [M] (0.42-0.70) $\chi^2 = 0.00$; $df = 0; p = 0.00$ $I^2 = 87\%$ (84-89%) |                      |                           |
| **Publication year** |                          |                |                                               |                      |                           |
| Subgroup differences between follow-up cohorts |                           |                |                                               |                      |                           |
|   | Recent (<10 years)      | 15 (30)        | $d = 0.43$ [S] (0.28-0.58) $\chi^2 = 54.29$; $df = 1; p < 0.01$ $I^2 = 86\%$ (82-89%) |                      |                           |
|   | Dated (>10 years)       | 12 (35)        | $d = 0.21$ [S] (0.07-0.36) $\chi^2 = 0.00$; $df = 0; p = 0.00$ $I^2 = 99\%$ (86-91%) |                      |                           |
| **Baseline functioning** |                          |                |                                               |                      |                           |
| Subgroup differences between follow-up cohorts |                           |                |                                               |                      |                           |
|   | High                    | 14 (47)        | $d = 0.49$ [S] (0.35-0.62) $\chi^2 = 4.04$; $df = 1; p = 0.05$ $I^2 = 87\%$ (85-89%) |                      |                           |
|   | Low                     | 13 (18)        | $d = -0.09$ [N] (-0.24-0.06) $\chi^2 = 0.00$; $df = 0; p = 0.00$ $I^2 = 85\%$ (79-89%) |                      |                           |

### Vocational functioning

| (Sub)analysis | All studies and outcomes | N (baseline-FU) | Effect size (95% CI)* and magnitude of effect** | K (%) large effect** | Heterogeneity (I² (95% CI))
|---------------|--------------------------|----------------|-----------------------------------------------|----------------------|---------------------------|
| **Rehabilitation** |                          |                |                                               |                      |                           |
| Subgroup differences between follow-up cohorts |                           |                |                                               |                      |                           |
|   | Yes                     | 2 (4)          | $d = 0.81$ [L] (0.48-1.13) $\chi^2 = 0.00$; $df = 0; p = 0.00$ $I^2 = 64\%$ (48-86%) |                      |                           |
|   | No                      | 6 (7)          | $d = -0.43$ [S] (-0.69 to -0.17) $\chi^2 = 0.00$; $df = 0; p = 0.00$ $I^2 = 82\%$ (65-90%) |                      |                           |

(continued on next page)
### Table 3 (continued)

#### Vocational functioning

| (Sub)analysis | All studies and outcomes |
|---------------|--------------------------|
|               | K (studies (outcomes)) | N (baseline-FU) | Effect size (95% CI)* and magnitude of effect** | K (%) large effect*** | Heterogeneity (I² (95% CI)) |
|-----------------|--------------------------|
| (Sub)analysis   | All studies and outcomes |
|-----------------|--------------------------|
| Subgroup differences between follow-up cohorts | | |
| Psychotherapy Yes | 5 (6) | – | $\chi^2 = 33.34; df = 1; p < 0.01$ | – | – |
| No | 0 (0.00%)/- | – | $\chi^2 = 7.14; df = 1; p < 0.01$ | – | – |
| Publication year Recent (46 years) | 6 (8) | – | $\chi^2 = 27.03; df = 1; p < 0.01$ | – | – |
| Dated (> 78 years) | 4 (5) | – | $\chi^2 = 0.33 [S] (0.06-0.72)$ | – | – |
| Baseline functioning High | 2 (4) | – | $\chi^2 = 97.11; df = 1; p < 0.01$ | – | – |
| Low | 1 (2) | – | $\chi^2 = 6.24; df = 1; p < 0.05$ | – | – |

**Note:** $\chi^2$ denotes the chi-square statistic, df denotes degrees of freedom, and p denotes the probability level.
Table 3 (continued)

| Subgroup differences between follow-up cohorts | Not applicable |
|-----------------------------------------------|----------------|
| Setting                                       | Naturalistic   |
| X                                             | X              |
| Health care                                   | 698–609        |
| Publication year                              | Recent (<10 years) |
| X                                             | X              |
| Health care                                   | 698–609        |
| Publication year                              | Dated (>10 years) |
| X                                             | X              |
| Baseline functioning                          | High           |
| X                                             | X              |
| Dated (>10 years)                             | 698–609        |
| Publication year                              | Low            |
| X                                             | X              |
| Baseline functioning                          | X              |

| (Sub)analysis | Duration of illness at baseline 5–10 years study outcomes | Not applicable |
|----------------|-----------------------------------------------------------|----------------|
| Rating         | Rehabilitation                                             | Not applicable |
| Yes            | 1 (2)                                                      | 131–128        |
| No             | 2 (2)                                                      | 454–291        |
| Psychotherapy                                           | Not applicable |
| Yes            | 1 (1)                                                      | 362–199        |
| No             | 2 (3)                                                      | 223–220        |
| Combined treatment                                      | Not applicable |
| Yes            | 1 (2)                                                      | 131–128        |
| No             | 2 (2)                                                      | 454–291        |
| Depression                                              | Not applicable |
| High           | X                                                          | X              |
| Low            | X                                                          | X              |
| Positive symptoms                                       | Not applicable |
| High           | X                                                          | X              |
| Low            | 1 (2)                                                      | 131–128        |
| Negative symptoms                                       | Not applicable |
| High           | X                                                          | X              |
| Low            | 1 (2)                                                      | 131–128        |
| Setting                                                 | Naturalistic   |
| X                                                         | X              |
| Health care                                             | 585–419        |
| Publication year                                         | Recent (<10 years) |
| 2 (3)                                                     | 493–327        |
| Publication year                                         | Dated (>10 years) |
| 1 (1)                                                     | 92–92          |
| Publication year                                         | High           |
| 2 (3)                                                     | 493–327        |
| Publication year                                         | Low            |
| 1 (1)                                                     | 92–92          |

| (Sub)analysis | Duration of illness at baseline >10 years study outcomes | Not applicable |
|----------------|-----------------------------------------------------------|----------------|
| Rating         | Rehabilitation                                             | Not applicable |
| Yes            | 5 (23)                                                     | 990–990        |

| Effect size (95% CI)* and magnitude of effect** | K (%) large effect*** |
|------------------------------------------------|-----------------------|
| X                                              | X                     |
| X                                              | X                     |
| X                                              | X                     |
| X                                              | X                     |
| X                                              | X                     |
| d = 0.28 [S] (0.10–0.46)                       |                           |
| + = 3 (30.00%)/− = 0 (0.00%)(continued on next page) |
Outcomes in bold are significant (p < 0.05) after Benjamini-Hochberg correction; Outcomes underlined are no longer significant after Benjamini-Hochberg correction for multiple testing.

- significant (p < 0.05)

** N = No effect (d ≥ −0.20 • < 0.20); S = Small effect (d ≤ −0.20 and > −0.50•≥0.20 and < 0.50); M = Medium effect (d ≤ −0.50 and > −0.80•≥0.50 and < 0.80); L = Large effect (d < −0.80. > 0.80).

*** + = improvement of outcome at follow-up; - = deterioration of outcome at follow-up.

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**Appendix A. Supplementary data**

Supplementary data to this article can be found online at https://doi.org/10.1016/j.schres.2021.11.010.

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