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REVIEW ARTICLE

Effectiveness of Community-Based Rehabilitation Interventions on Symptoms and Functioning for People with Schizophrenia: A Systematic Review and Meta-Analysis

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Abstract
Schizophrenia is a serious mental illness that imposes huge burden of illness on the society. We aimed to conduct a meta-analytic and systematic review of literature on the effectiveness of community-based rehabilitation interventions on symptoms and functioning for people with schizophrenia. The PubMed, Embase, the Cochrane Library, Web of Science, and CINAHL databases were searched through April 16 and 17, 2021, including clinical trial registries and previous Cochrane reviews. We included 24 randomized controlled trials in this review. The content of interventions varied from single-faceted rehabilitation intervention or cognitive retraining, to multi-component rehabilitation interventions or case management. Among 20 studies that reported effects of community-based rehabilitation interventions on symptoms, the pooled SMDs across all interventions was 0.94 (95% CI = 0.11, 1.76; P < 0.001; I^2 = 99.1%; n = 3694), representing a strong effect. 21 included studies showed that community-based rehabilitation interventions also had beneficial impacts on functioning (SMD = 1.65; 95% CI = 0.88, 2.43; P < 0.001; I^2 = 98.9%; n = 3734). Overall quality of evidence was moderate with a high level of heterogeneity. Community-based rehabilitation interventions have positive effectiveness in improving patients' symptoms and functioning. Community-based rehabilitation interventions should therefore be provided as an adjuvant service in addition to facility-based care for people with schizophrenia.

Keywords Schizophrenia · Community-based rehabilitation · Effectiveness · Symptoms · Functioning

Introduction

Schizophrenia, as a serious and chronic mental disorder with high mortality, widely affects people's quality of life and is a major public health issue. Schizophrenia usually strikes in early adulthood and is often accompanied by persistent or recurrent symptoms as well as other severe or chronic illnesses, severely reducing the quality of life and the level of functioning [1]. It has been shown that the risk of death in people with schizophrenia is two to

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three times higher than in the general population [2]. People with schizophrenia have been shown to be associated with repeated hospitalization, low social functioning, low rate of employment [3], and they may suffer from strong stigma, discrimination and human rights violations [4], which further exacerbate the adverse consequences of the illness, such as low self-esteem, social withdrawal, psychological disorders, poverty, suicide, homelessness, low literacy and premature death [5]. People with schizophrenia require extensive healthcare services, resulting in a significant burden of disease for both family members and society [6].

Although studies have shown that the effectiveness of antipsychotics in controlling positive symptoms of schizophrenia [7], the role of antipsychotics in improving functions and negative symptoms is so limited that it cannot satisfy the rehabilitation needs of patients with chronic schizophrenia [8]. Previous studies have shown that community-based rehabilitation (CBR), as a broader supportive approach, is an effective way to treat schizophrenia [9]. There are five key components in CBR: health, education, livelihood, social inclusion and empowerment, which provide a basic framework for integrating community resources to address various difficulties in patients' lives [9]. In addition, CBR emphasizes self-determination and empowerment, i.e. supporting patients to make their own decisions, improving patients' ability to cope with difficulties, and prioritizing the needs that patients perceive as most urgent.

There is substantial evidence in high-income countries on five types of CBR interventions: psychoeducation [10], family interventions [11], enhanced case management [12], cognitive rehabilitation [13], and social skills training [14], which have been proved effective in alleviating symptoms of schizophrenia, reducing disease relapse and readmissions, promoting adherence to medication, improving social and occupational functions, and reducing stigma and discrimination [15]. CBR can make up for the shortcoming of antipsychotics alone in treating schizophrenia [16]. The World Health Organization's Mental Health Gap Action Program (mhGAP) Intervention Guide and the World Bank's Disease Control Priorities, Version 3 (DCP3) both recommended that CBR be given priority. However, in low—and middle-income countries where the majority of people with schizophrenia live [17], these interventions have also been shown by limited evidence to be effective and acceptable in meeting their broader survival and social needs [18].

While there is a growing body of evidence on the acceptability and feasibility of CBR for schizophrenia, there is currently a lack of evidence from high-quality trials. Silva's 2013 systematic review of randomized controlled trials of psychosocial interventions for schizophrenia in low- and middle-income countries showed that compared to antipsychotics alone, structural psychosocial interventions (e.g., psychoeducation, social skills training) combined with antipsychotic therapy can improve patients' social functioning, but studies were mostly of low quality and non-randomized design [19]. In 2017, Asher et al. conducted a systematic review of 259 studies published prior to April 2016, and found that most of the studies were of low quality, such as cross-sectional or short-term follow-up designs. Only 11 were randomized controlled trails (RCT) [20]. Based on the literature, there is limited evidence to support the feasibility and effectiveness of community-based rehabilitation interventions for patients with schizophrenia [20].

Preliminary studies conducted in May 2021 indicated that other relevant randomized studies had been published since Asher et al.'s review in 2016, which showed the need for conducting an up-to-date review. In addition, the scope of the review was expanded from low- and middle-income countries to all countries, and from psychosocial interventions to all community-based rehabilitation interventions of schizophrenia. The purpose of this review is to evaluate the effectiveness of various types of community-based rehabilitation interventions for

symptoms and functioning of patients with schizophrenia, thus providing a reliable basis for the promotion of rehabilitation interventions for schizophrenia.

Method

We conducted this systematic review under the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) recommendations for reporting systematic reviews [21] and meta-analyses of studies that evaluate healthcare interventions.

Search Methodology

On 16th and 17th April 2021, we used the following electronic databases in literature searches: PubMed, Embase, the Cochrane Library, Web of Science, and CINAHL. The search identified studies covering three domains: A: Schizophrenia or schizoaffective disorder + B: community-based rehabilitation intervention + C: randomized controlled study. A broad range of search terms were used for domain B, including terms relating to psychoeducation, adherence support, family support, rehabilitation, psycho-therapy and counselling, self help groups, health promotion and community-based care. The detailed search strategy is reported in Supplementary Tables 1–5.

Selection of Studies

We included individual and cluster randomized controlled trials. Eligible interventions were community-based rehabilitation interventions delivered to patients with schizophrenia or their caregivers with the aim of improving patients' outcomes (see Supplementary Table 6 for the inclusion and exclusion criteria). Community-based rehabilitation interventions were defined as interventions that addressed biological, psychological and/or social problems in community settings (including the participant's home) [18]. Interventions that are specifically conducted in health or other institutional facilities (hospitals, clinics, outpatient care centers or specialized care centers) were excluded. Interventions can have one or multiple components. Due to logistical constraints, no full papers in English were excluded.

Two reviewers (author 1 and author 2) performed the first screening of the literature search results by comparing titles and abstracts with the inclusion criteria. The full texts of potentially useful articles were then obtained and checked against the inclusion criteria. The final included study was agreed by both reviewers. The bibliographies of published review/overview papers identified from the search were checked to ensure that all relevant studies were included. All database search results were downloaded to Endnote X9. A final list of eligible studies was compiled after duplicates were removed. Table 1 shows the detailed results of the literature search.

Table 1 Literature search details

Database searched	No. of hits
1.PubMed via MEDLINE	5,299
2.Embase	329
3.The Cochrane Library	48
4.Web of Science	43
5.CINAHL	1,916
Total (after de-duplication)	7,464

Data Extraction and Quality Assessment

The main features and findings of each study were extracted into a dedicated data sheet. Data were extracted on study characteristics such as setting, design, participants, duration of follow-up, intervention characteristics (content, frequency, duration), personnel, comparison group, and outcomes, etc. Each included study was assessed using the Cochrane Collaboration risk of bias tool [22]. Low, high, or unclear risk of bias rating was given in the following areas: random sequence generation; allocation concealment; blinding of outcome assessment; incomplete outcome data; selective reporting and other bias. Due to the nature of the intervention, it is not possible to blind the participants and staff delivering the intervention, so this criterion was not used.

As the outcomes collected were all continuous, the post-treatment mean and standard deviation of the intervention and control groups and the sample size of each group were extracted to calculate a standardized mean difference (SMD) for each trial in order to aggregate the different outcome scales. SMD represents the size of the intervention effect relative to the variability observed in the study. If an increase in score means a worse outcome, the mean score would be inverted before the SMD was calculated. An SMD of 0.2 indicates a "small" effect, 0.5 a "medium" effect, and 0.8 a "large" effect [23]. Differences in baseline scores between treatment groups could not be taken into account when calculating SMD due to lack of data in the included papers. Given the heterogeneity of the interventions, random effects meta-analyses were performed for all intervention types and subgroup meta-analyses were performed for each intervention type. Heterogeneity between trials was assessed using I^2 statistics. Lastly, funnel plots for symptoms and functioning were generated to assess for publication bias.

Results

Figure 1 illustrates the literature selection process. From 7,464 records, 232 full texts were accessed for eligibility. 24 studies met inclusion criteria and were included in the systematic review, of which 20 studies were included in the meta-analysis.

Overview of Study Characteristics

Table 2 shows a summary of the design and findings of included studies. Among all included studies, the year of publication ranged from 2002 [24, 25] to 2018 [26], and sample size varied from 30 [27] to 1268 [28]. Follow-up period was 12 weeks [29] to

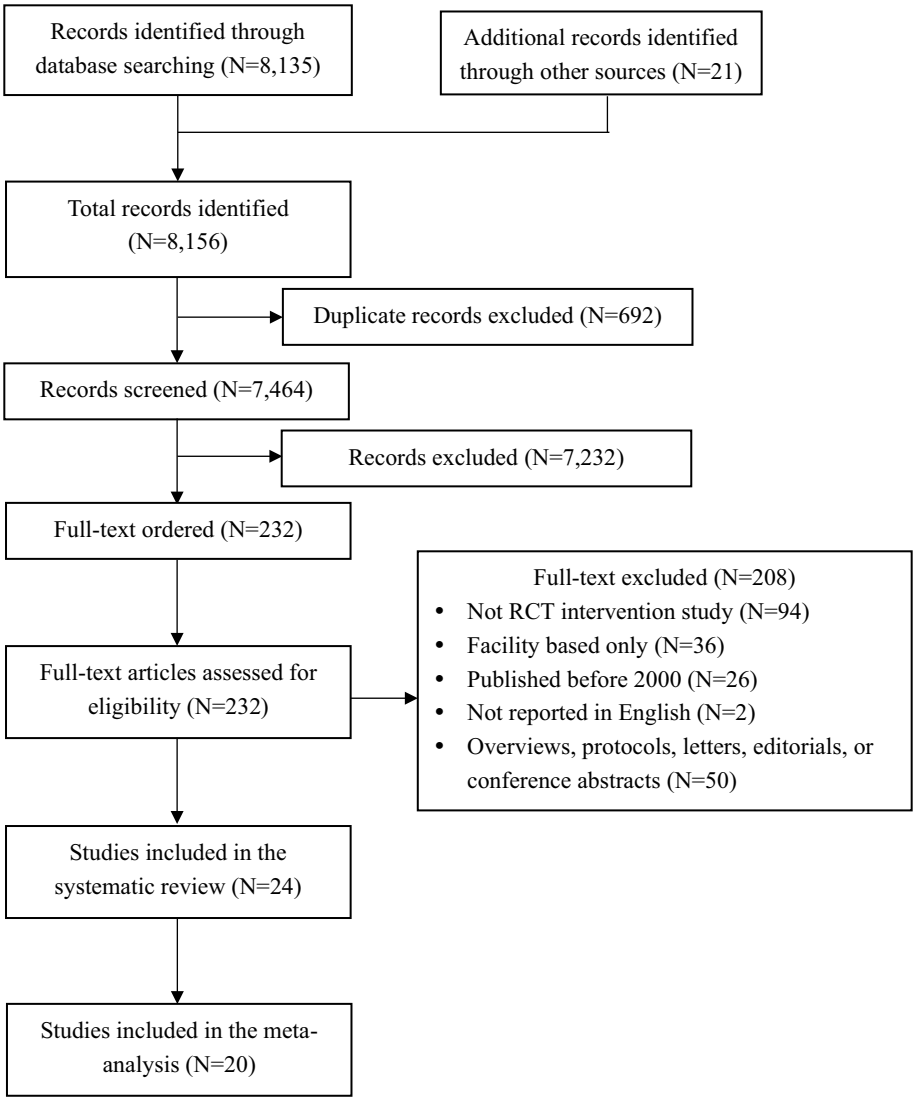

Fig. 1 Flow chart of literature section process

14 years [30], with a median of 12 months. Sixteen studies were evaluated immediately after the intervention ended, and the remaining eight were evaluated 6 months [31] to 13 years [30] after the intervention ended.

For developed countries, two studies were conducted in the United Kingdom [32, 33], and two studies were in America [25, 34]; three studies were conducted in Portugal [29], Sweden [35], and Italy [36], respectively. For developing countries, two studies, reported in three papers, were conducted in India [18, 31, 37]; seven studies, reported in eight papers, were conducted in China [24, 26, 28, 30, 38–41]; two studies were

Table 2 Summary of the design and findings of included studies

Source	Design and follow up period	Participants [I = intervention, C = control]	Intervention duration and content	Personnel delivering intervention	Community involvement	Comparison group	Key results
Group One: single-faceted rehabilitation							
Yildiz et al. (2004) [27] Turkey	Individual 8 months	Schizophrenia N = 30 [I = 15, C = 15]	8 months Psychosocial skills training	Psychologists and nurses	None	Standard care	A significant improvement in the mean total QLS, SFS, GAF, and in total PANSS scores
Li and Arthur (2005) [38] China	Cluster 9 months	Schizophrenia N = 101 [I = 46, C = 55]	3 months Family and patient psycho-education in hospital (8 h with patient, 36 h with family) and then at home (2 h/month for 3 months post-discharge). Phases: establish trust, assess needs; psychoeducation, develop coping skills. Medication	Trained nurses	None	Medication/ standard inpatient care	Significant improvement in knowledge about schizophrenia A significant difference in symptom scores and functioning at 9 months Patients who were non-adherent to medication regimens were more likely to relapse

Table 2 (continued)

Source	Design and follow up period	Participants [I = intervention, C = control]	Intervention duration and content	Personnel delivering intervention	Community involvement	Comparison group	Key results
Rathod et al.(2005) [32] The United Kingdom	Individual 12 months	Schizophrenia N = 353 [I = 225, C = 128]	3 months Cognitive behavioral therapy (CBT)	Trained nurses	None	Treatment as usual	The CBT group demonstrated significantly greater improvement in insight into compliance with treatment and the ability to re-label their psychotic symptoms as pathological
Zimmer et al. (2007) [29] Portugal	Individual 12 weeks	Schizophrenia N = 56 [I = 20, C = 36]	12 weeks Cognitive-behavioural intervention (IPT)	A clinical psychologist	None	Treatment as usual	The IPT program had a positive effect on cognition in domains of spatiotemporal orientation and memory; overall social adjustment, leisure/social life and family relations; overall functioning; social-occupational functioning; and quality of life in the psychological domain

Table 2 (continued)

Source	Design and follow up period	Participants [I = intervention, C = control]	Intervention duration and content	Personnel delivering intervention	Community involvement	Comparison group	Key results
Hegde et al. (2012) [31] India	Individual 6 months	Schizophrenia N = 45 [I = 22, C = 23]	2 months Home-based cognitive retraining and psychoeducation	Researcher	None	Treatment as usual (drug treatment and psychoeducation)	Cognitive retraining improved cognition and reduced negative symptoms
Chien and Chan (2013) [39] China	Individual 24 months	Schizophrenia N = 135 [I1 = 45, I2 = 45, C = 45]	9 months Family-led mutual support	Community psychiatric nurses, and family respite care	Community provides support resources	Standard care	Significantly greater improvement in family and patient functioning and social support for families, and in reducing patients' symptom severity and length of re-hospitalisations
Group Two: multi-faceted interventions							
Xianzuo et al. (2002) [24] China	Individual 6 months	Schizophrenia N = 76 [I = 38, C = 38]	1–3 month(s) Social rehabilitation	Full-time psychiatrists	None	Inpatient care	Social rehabilitation group was superior to inpatient Group Ones having less social dysfunction, lower relapse rate and lower cost

Table 2 (continued)

Source	Design and follow up period	Participants [I = intervention, C = control]	Intervention duration and content	Personnel delivering intervention	Community involvement	Comparison group	Key results
Malm et al. (2003) [35] Sweden	Individual 24 months	Schizophrenia N = 84 [I = 51, C = 33]	24 months Integrated care	Nurses, psychologists and psychiatrists	Community mental health center provided clinical practice	Rational Rehabilitation	Significantly improved social function and consumer satisfaction in favour of the program 'Integrated Care' (IC) at the 2-year follow-up
Guo et al. (2010) [28] China	Individual 12 months	Schizophrenia N = 1268 [I = 633, C = 635]	12 months Combined with psychosocial intervention	Therapists	None	Antipsychotic medication alone	Combined treatment showed lower risk of any-cause discontinuation, lower risk of relapse, greater improvement in insight, social functioning, activities of daily living, quality of life, and higher proportion of patients receiving combined treatment obtained employment or accessed education

Table 2 (continued)

Source	Design and follow up period	Participants [I = intervention, C = control]	Intervention duration and content	Personnel delivering intervention	Community involvement	Comparison group	Key results
Mueser et al. (2010) [34] America	Individual 24 months	Schizophrenia N = 183 [I = 90, C = 93]	24 months Social Rehabilitation and Integrated Health Care	Nurses	Community practice trips	Treatment as usual (TAU)	Significant improvements for older adults assigned to HOPES compared to TAU in performance measures of social skill, psychosocial and community functioning, negative symptoms, and self-efficacy
Chatterjee et al. (2003) [37] India	Individual multisite 12 months	Schizophrenia N = 207 [I = 127, C = 80]	12 months Community-based rehabilitation (CBR)	Mental health worker, psychiatrist, psychologist, family groups, village samitis	None	Out-patient care (OPC)	The CBR model was more effective in reducing disability, and had significantly better retention in treatment

Table 2 (continued)

Source	Design and follow up period	Participants [I = intervention, C = control]	Intervention duration and content	Personnel delivering intervention	Community involvement	Comparison group	Key results
Chatterjee et al. (2014) [18] India	Individual multisite 12 months	Schizophrenia N = 282 [I = 187, C = 95]	12 months Collaborative community-based care: Home visits fortnightly for 7 months, then monthly for 5 months. Psycho-education; address stigma and discrimination; adherence management strategies; health promotion; rehabilitation strategies to improve social/vocational functioning. Medication	Lay community health workers	Referrals to community agencies: address social inclusion, access to legal benefits, employment	Standard facility-based care. Psychiatrist consultations. Anti-psychotic medication, information about illness, encouraged medication adherence	Total PANSS and IDEAS scores were lower in patients in the intervention group A significant reduction in symptom and disability outcomes at the rural site

Table 2 (continued)

Source	Design and follow up period	Participants [I = intervention, C = control]	Intervention duration and content	Personnel delivering intervention	Community involvement	Comparison group	Key results
Cai et al. (2015) [40] Shanghai, China	Individual multisite 18 months	Schizophrenia N = 256 [I = 133, C = 123]	10 weeks Comprehensive family therapy (CFT): (i) Social skills training (medication and symptom management, community re-entry support, recreation for leisure and social independent living skills) 90–120 min/ session, 2 sessions/ week for 10 weeks (ii) Family psychoeducation. One session/ week for 10 weeks Medication	Psychiatric health professionals	None	Usual daily care (UDC)	No significant difference between the CFT and UDC for all demographic characteristics; Greater improvements in cognitive function

Table 2 (continued)

Source	Design and follow up period	Participants [I = intervention, C = control]	Intervention duration and content	Personnel delivering intervention	Community involvement	Comparison group	Key results
Ran et al. (2003) [41] China	Cluster 9 months	Schizophrenia N = 326 [I = 126, C1 = 103, C2 = 97]	9 months Psycho-educational family intervention: (i) Family education 1 ×/month: information about schizophrenia, relapse prevention, treatment, social functioning rehabilitation (ii) Family workshops 3 monthly (iii) Crisis intervention support. Medication	Psychiatrists and village doctors	Local village broadcast network used for health education for first 2 months	1.Medication alone 2. Control (no intervention, medication neither encouraged nor discouraged)	A gain in knowledge, a change in the relatives' caring attitudes towards the patients, and an increase in treatment compliance in the psychoeducational family intervention group Lower relapse rate

Table 2 (continued)

Source	Design and follow up period	Participants [I = intervention, C = control]	Intervention duration and content	Personnel delivering intervention	Community involvement	Comparison group	Key results
Ran et al. (2015) [30] China	Cluster 14 years	Schizophrenia N = 238 [I = 92, C1 = 73, C2 = 73]	9 months Psycho-educational family intervention: (i) Family education 1 ×/month: information about schizophrenia, relapse prevention, treatment, social functioning rehabilitation (ii) Family workshops 3 monthly (iii) Crisis intervention support. Medication	Psychiatrists and village doctors	Local village broadcast network used for health education for first 2 months	1.Medication alone 2. Control (no intervention, medication neither encouraged nor discouraged)	The psychoeducational family intervention group had a significantly higher rate of antipsychotic medication, a higher level of work ability, and lower rate of never-treated
Slade et al. (2015) [33] The United Kingdom	Cluster 12 months	Schizophrenia N = 297 [I = 153, C = 144]	12 months Care by community-based adult mental health teams	Informal care givers and team staff	Adult mental health teams are community-based	Usual treatment	Mean QPR total scores did not differ between the two groups. High team participation was associated with higher staff-rated scores for recovery-promotion behaviour change and patient-rated QPR interpersonal scores at follow-up

Table 2 (continued)

Source	Design and follow up period	Participants [I = intervention, C = control]	Intervention duration and content	Personnel delivering intervention	Community involvement	Comparison group	Key results
Li et al. (2018) [26] Guangzhou, China	Individual 9 months	Schizophrenia N = 327 [I = 169, C = 158]	9 months Strategies against stigma and discrimination, psycho-education, social skills training and cognitive behavioural therapy	The community psychiatrists or general practitioners	All modules were conducted at the local community health service centre	No interventions	A significant reduction on anticipated discrimination, BPRS and PANSS-N total scores, and an elevation on overcoming stigma and GAF in the intervention group
Group Three: case management							
Dyck et al. (2002) [25] America	Individual 24 months	Schizophrenia N = 106 [I = 55, C = 51]	24 months Psychoeducational multiple-family group treatment	Clinicians	Multiple-family group treatment or standard care were conducted in a community mental health centre	Standard care	Multiple-family group treatment was associated with a lower rate of psychiatric hospitalization. It was only marginally associated with lower use of crisis services, and it was not associated with the amount of outpatient service time

Table 2 (continued)

Source	Design and follow up period	Participants [I = intervention, C = control]	Intervention duration and content	Personnel delivering intervention	Community involvement	Comparison group	Key results
Sungur et al. (2011) [46] Turkey	Individual 24 months	Schizophrenia N = 100 [I = 50, C = 50]	24 months Optimal clinical management (OCM): psychoeducation, adherence strategies, relapse recognition, crisis intervention, family intervention, stress management, social/work skills training. 120 min every 2 weeks for 3 months at home. Then 45 min every month at outpatient clinic. Medication	Psychiatrists, psychologist, psychiatric nurses, supervised by CBT expert	Referrals to voluntary organizations	Routine clinical management (RCM) (outpatient clinic): psychoeducation, adherence support, crisis intervention, day hospital, referrals to rehab. 60 min/month for 3 months then 45 min/month. Medication	Positive association in symptoms, functioning, quality of life, and caregiver burden

Table 2 (continued)

Source	Design and follow up period	Participants [I = intervention, C = control]	Intervention duration and content	Personnel delivering intervention	Community involvement	Comparison group	Key results
Sharifi et al. (2012) [42] Iran	Individual 12 months	Schizophrenia, schizoaffective disorder, bipolar N = 130 [I = 66, C = 64]	12 months Home aftercare: Monthly visits with extra visits in first 3 months. Care plan, drug prescription, dose adjustment, psychoeducation, relapse recognition, referral to hospital. Medication	General practitioners, social workers, and plan reviewed by psychiatrists	Help family to access supportive and community resources	Hospital outpatient service (no psychosocial component)	Home aftercare led to greater reduction in rehospitalization rate, more improvement in psychotic symptoms and global illness severity, as well as greater service satisfaction
Terzian et al. (2013) [36] Italy	Individual 2 years	Schizophrenia N = 345 [I = 173, C = 172]	2 years Social network intervention	Psychiatrists, a qualified clinical social worker, and the study coordinator	Social activities taking place in the community	Routine treatment	A social network improvement was observed at year 1 in 25% of the patients allocated to routine treatment and in 39.9% of those allocated to the experimental arm. The difference remained statistically significant at year 2

Table 2 (continued)

Source	Design and follow up period	Participants [I = intervention, C = control]	Intervention duration and content	Personnel delivering intervention	Community involvement	Comparison group	Key results
Botha et al. (2014) [44] South Africa	Individual 36 months	Schizophrenia or schizoaffective disorder N = 56 [I = 32, C = 24]	12 months Assertive community treatment: individual caseload max 35. Visits > 50% at home, fortnightly or according to need Focused on engagement and maintaining adherence; referral to psychologist, occupational therapist; access to psychosocial rehab program. Medication	Key worker (social worker or nurse), supported by multi- disciplinary team (psychiatrist, psych nurse)	Strengthening access to existing community resources	Standard care models: Community mental health team: caseload 250 +, outpatient appts 1–3 monthly; no active follow up; referral to allied health professionals. Medication	Less readmissions and spent less days in hospital

Table 2 (continued)

Source	Design and follow up period	Participants [I = intervention, C = control]	Intervention duration and content	Personnel delivering intervention	Community involvement	Comparison group	Key results
Botha et al. (2010) [45] Cape Town, South Africa	Individual 12 months	Schizophrenia or schizoaffective disorder N = 60 [I = 34, C = 26]	12 months Assertive community treatment: individual caseload max 35. Visits > 50% at home, fortnightly or according to need Focused on engagement and maintaining adherence; referral to psychologist, occupational therapist; access to psychosocial rehab program. Medication	Key worker (social worker or nurse), supported by multi- disciplinary team (psychiatrist, psych nurse)	Strengthening access to existing community resources	Standard care models: Community mental health team: caseload 250 +, outpatient appts 1–3 monthly; no active follow up; referral to allied health professionals. Medication	Lower total PANSS as well as positive and general psychopathology subscales' scores Higher mean SOFAS score and lower mean number of psychiatric admissions

Table 2 (continued)

Source	Design and follow up period	Participants [I = intervention, C = control]	Intervention duration and content	Personnel delivering intervention	Community involvement	Comparison group	Key results
Ghadiri Vasfi et al. (2015) [43] Iran	Individual 20 months	Schizophrenia, schizoaffective and bipolar disorder N = 120 [I = 60, C = 60]	20 months Home after-care services: (i) Treatment follow up (home visits/ telephone and monthly outpatient visit) (ii) Family psychoeducation (six weekly 2 h sessions), (iii) social skills training (9 monthly visits). Medication	The research team	Contact with local NGOs and self help groups	Usual aftercare including monthly visits by psychiatrist	Length of stay was shorter Psychopathology was less severe

conducted in Iran [42, 43]; one study, reported in two papers, was conducted in South Africa [44, 45]; and two studies were conducted in Turkey [27, 46].

Participants and Design

There were some differences in diagnoses across studies, with two studies including participants with schizophrenia or schizoaffective disorder [44, 45], two studies including participants with schizophrenia, schizoaffective disorder or bipolar disorder [42, 43], and the remaining twenty studies including only participants with schizophrenia. Four studies used a cluster randomized design [30, 33, 38, 41], whilst rest of the studies used an individually randomized design. Four studies were conducted at multiple sites [18, 33, 37, 40].

Three Groups of Interventions

Given that the content and structure of interventions varied from among studies, three broad groups were identified. Group One consisted of single-faceted rehabilitation intervention such as psychoeducation or cognitive retraining. Two Chinese studies, Li and Arthur [38], Chien and Chan [39]; one Indian study, Hegde et al. [31]; one Turkey study, Yildiz et al. [27]; one study from the United Kingdom [32]; and one study from Portugal [29] were included into Group One.

Group Two consisted of more comprehensive multi-faceted interventions including family intervention, support for the development of social and independent living skills, drug adherence, crisis intervention and dealing with stigma. This group included the Indian community-based rehabilitation, Chatterjee et al. [37] and [18], six Chinese RCTs, Xianzuo et al. [24], Guo et al. [28], Cai et al. [40], Li et al. [26], Ran et al. [41] and [30], one Sweden study Malm et al. [35], one American study Mueser et al. [34], and one study from the United Kingdom, Slade et al. [33].

Group Three comprised studies focused on post-discharge care participation, as well as other elements such as social skills training. In this group, one American study Dyck et al. [25] and one Italian study Terzian et al. [36] accessed interventions after being discharged from hospital. Two South African studies, Botha et al. [45] and [44], were based on an assertive community treatment model, whilst two Iranian RCTs, Sharifi et al. [42] and Ghadiri et al. [43], assessed home-based aftercare services, and a Turkish RCT, Sungur 2011 [46], evaluated optimal case management.

Family-Based or Community Involvement Care

All interventions included family-based interventions, with the exception of the studies by Botha et al. in South Africa [44, 45], which did not explicitly mention family involvement in intervention delivery. In ten studies conducted in America [25, 34], the United Kindom [33], Sweden [35], Italy [36], China [26, 39], South Africa [44, 45], and Iran [42], individuals were supported by community resources including legal benefits, healthcare centers, and employment opportunities. In two studies in Iran [43] and Turkey [46], individuals received support from community-based organizations such as non-governmental organizations (NGOs) or self-help groups. The studies conducted in India [18, 37] drew

on community resources and organizations. Two Chinese studies, Ran et al. [41] and [30] used local village broadcast network for health education about mental illness. Eight interventions did not include any community involvement or promotion of support beyond the family-based intervention [24, 27–29, 31, 32, 38, 40]. Aside from using existing community agencies, no studies incorporated active participation of community members to support individuals with schizophrenia.

Personnel

The primary providers of the intervention varied among studies. In eleven studies, care was provided by mental health professionals such as psychiatrists or psychologists [24, 25, 27, 29, 30, 35–37, 40, 41, 46]; In nine studies, non-mental health professionals such as social workers or nurses were the primary personnel [26, 28, 32, 34, 38, 39, 42, 44, 45]. Only in two studies, Chatterjee 2014 and Mike Slade 2015, did the lay community health workers or informal care givers and team staff deliver the intervention [18, 33]. In two studies the professional background of the person conducting the intervention was unspecified or unclear [31, 43]; The presence of specialist supervision was also not specified in these studies.

Comparison

Most studies compared the intervention with the use of antipsychotics alone (typically delivered in an outpatient setting) [25–29, 32–36, 38–40, 42, 43]; Three studies, Chatterjee et al. (2003), (2014) and Hegde et al. (2012), explicitly stated that the control group included both outpatient medication and psychoeducation [18, 31, 37]; One study, Xianzuo Li 2002, compared social rehabilitation with inpatient care [24]; Case management studies in South African and Turkish, Botha 2010 and 2014, Sungur 2011, used outpatient care delivered by a community mental health team as a control [44–46]. One of the Chinese family intervention studies (Ran 2003 and 2015, Group Two) consisted of three arms that compared (i) a psycho-educational family intervention and medication (ii) medication alone and (iii) no intervention and medication neither encouraged or discouraged [30, 41].

Outcomes Assessed

A wide range of outcomes were assessed, including symptoms or clinical status [18, 24, 26–28, 30, 32–35, 37–40, 43, 45, 46], functioning [18, 24, 26–30, 32–35, 37–39, 45, 46], medication adherence [18, 30, 37, 38, 41], number of hospitalizations [25], readmissions and inpatient days [43–45], quality of life [42, 44–46], knowledge about schizophrenia [18, 30, 37, 38, 41], family burden [18, 37, 46], cognitive function [29, 31, 40], as well as stigma and discrimination [26]. The most common outcomes were symptoms and functioning. Clinical symptoms were measured by the Positive and Negative Syndrome Scale (PANSS), the Brief Psychiatric Rating Scale (BPRS), the Mania Rating Scale (MRS) and the Current Psychiatric Status-50. Functioning was measured by the Social and Occupational Functioning Assessment Scale (SOFAS), the Social Disability Screening Schedule

(SDSS), the Global Assessment of Functioning (GAF), the Global Assessment Scale (GAS), the Indian Disability Evaluation Assessment Scale (IDEAS) and "working ability".

Risk of Bias

Overall studies were of low to moderate quality. The risk of bias for each included study is summarized in Supplementary Table 7. Nine studies were considered to have a high overall risk of bias [24, 33, 36–38, 42, 43, 45]. Hegde 2012 was excluded from the results synthesis due to its high risk of bias and the low sample size (n = 12 in treatment group, n = 11 in control group) for analysis [31]. The results of other three studies were not included in the meta-analysis due to incomplete data.

Synthesis of Results: Symptoms

Amongst 20 studies that reported the effects of community-based rehabilitation Interventions on symptoms of people with schizophrenia, the pooled SMD across all intervention types was 0.94 (95% CI = 0.11, 1.76; P < 0.001; I^2 = 99.1%; n = 3694), representing a strong effect (see Fig. 2). For Group One (Single-faceted rehabilitation intervention), we observed a nonsignificant effect (SMD = 0.51, 95% CI = -0.14, 1.16; P = 0.122; I^2 = 91.2%); For Group Two (Multicomponent rehabilitation interventions), the effect was also nonsignificant (SMD = 0.11, 95% CI = -1.01, 1.23; P = 0.846; I^2 = 99.3%); However, all four Group Three (Case management) studies (including Sharifi et al. [42], which was excluded from the meta-analysis due to insufficient data) found a strong association with improvements in symptoms. The pooled SMD across three studies in Group Three was 5.82 (95% CI = 1.70, 9.95; P = 0.006; I^2 = 98.9%).

Synthesis of Results: Functioning

21 included studies showed that community-based rehabilitation interventions had beneficial impacts on functioning (see Fig. 3). The pooled SMD across all intervention types was 1.65 (95% CI = 0.88, 2.43; P < 0.001; I^2 = 98.9%; n = 3734). For Group One (Single-faceted rehabilitation intervention), we observed a significant medium effect (SMD = 0.64, 95% CI = 0.09, 1.19; P = 0.023; I^2 = 89.4%); For Group Two (Multicomponent rehabilitation interventions), the effect was large (SMD = 2.09, 95% CI = 0.98, 3.21; P = 0.000; I^2 = 99.2%); However, all four Group Three (Case management) studies found no significant association with functioning (SMD = 1.78, 95% CI = -0.31, 3.87; P = 0.094; I^2 = 96.0%).

Publication Bias

Funnel plots of symptoms and functioning showed some asymmetry (see Supplementary Figs. 1 and 2). This may indicate that smaller studies without statistically significant effects have not been published.

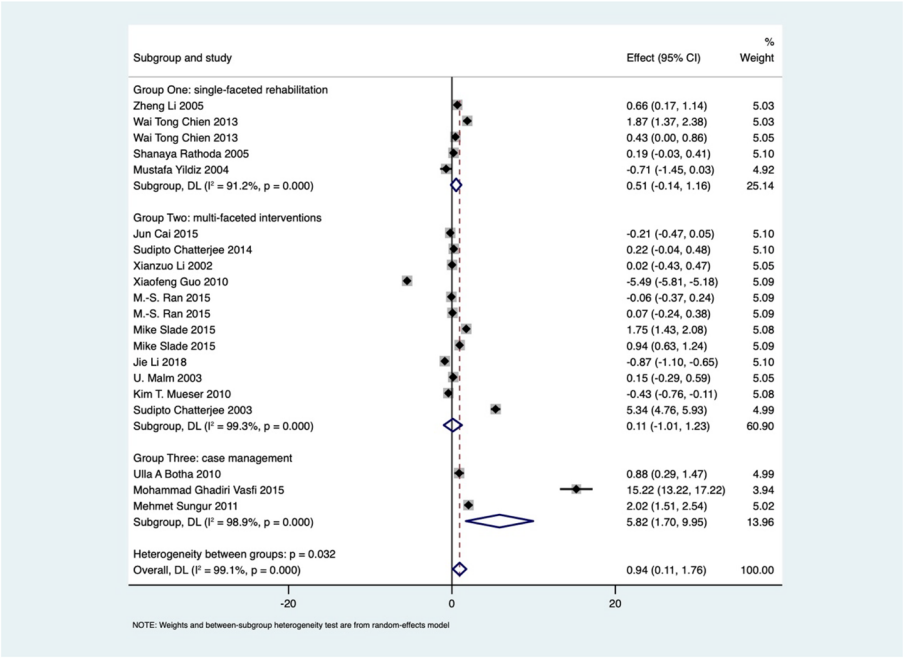

Fig. 2 Community-based rehabilitation intervention versus usual care: impact on symptoms

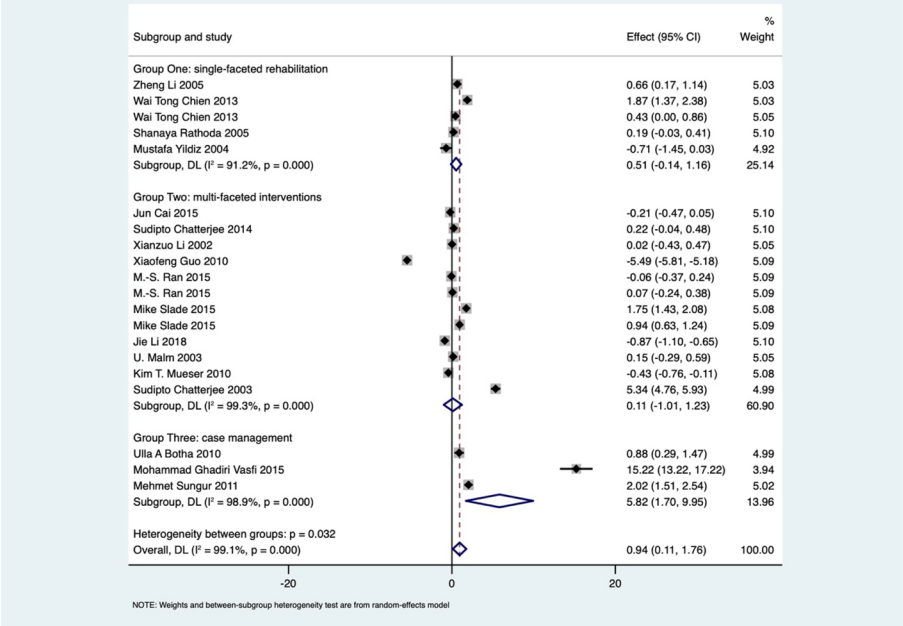

Fig. 3 Community-based rehabilitation intervention versus usual care: impact on functioning

Discussion

Summary of Results

Our systematic review and meta-analysis revealed evidence that overall community-based rehabilitation interventions have a strong effect on symptoms and functioning in people with schizophrenia. Most of the interventions included were delivered by health care workers, and in some cases by mental health specialists. In addition to antipsychotics, community-based rehabilitation interventions should be provided for people with schizophrenia. Such interventions may have a tangible impact on clinical outcomes. Overall, even though the value of community-based interventions is well-demonstrated, the range of effectiveness of these interventions will necessarily vary across studies, given the range of their various protocols. These findings were consistent with the systematic review of CBR for people with schizophrenia by De Silva et al. [19], and the systematic review of psychosocial interventions by Asher al. [20], but were arguably more robust given the more extensive topic and the inclusion of more recent RCTs.

Most studies did not assess effects in the long run. Only three follow-up studies of RCTs related to schizophrenia were found [18, 30, 44]. There is evidence that in South Africa, positive effects can last up to two years after the end of decisive community treatment interventions [44]. Much of the evidence was considered to be of low or unclear quality, which meant that conclusions about the effectiveness of these interventions should be drawn with caution. In assessing the strength of the evidence, consideration should also be given to the nature of routine care, which varies widely between studies in our review. In evaluations where usual care is comprehensive (for example medication, psychoeducation and adherence support offered by psychiatrists in Chatterjee et al. [18]), smaller gains may be expected from the provision of an auxiliary intervention, compared to evaluations with a low level of usual care.

Of all included studies, only Chatterjee 2014, conducted in-depth intervention development and pilot work in advance of the full evaluation [47], to ensure interventions were culturally appropriate and acceptable, such as identifying local patterns of interpretation or involving faith and traditional healers in the intervention [48]. Chatterjee et al. also collected process data [18] and conducted qualitative analysis along with the trial [49]. In the COPSI trial, community-based support was delivered by lay health workers, and participants received care from psychiatrists in parallel [18]. In this review, there was no clear indication that interventions delivered by non-mental health professionals resulted in different outcomes compared to those delivered by mental health professionals.

Mechanisms and Implications

Possible mechanisms for the impact of community-based rehabilitation interventions have been proposed. Supportive involvement in treatment and a better understanding about the nature of the disease and the effects of medication, by both caregivers and patients with schizophrenia, may improve medication compliance. This in turn may alleviate symptoms and thus reduce relapse rates and hospital admissions. Chatterjee et al. reported a trend of improvement in symptoms with improved medication compliance [18], which has been identified in cohort studies in other countries [50]. In addition, it may be due to an improvement in symptoms. Other possible pathways to improved functioning include

improved social skills, increased self-esteem, more caregiver support, less self-stigma or discrimination, or an increased sense of empowerment. However there was little evaluation of these potential mediators in the included studies.

Several implications can be drawn for future studies. First, the cross-cultural applicability of different scales to measure disability should be understood. Locally adaptive scales offer a more valid measure of disability [51], while only one included study used a functioning scale specific to the country context [18]. Second, studies assessing outcomes after the intervention termination can provide valuable information on how to shape psychosocial interventions for scaling up [30, 38, 40], which should be utilized where possible in future research. Third, for multi-component interventions, theoretical frameworks for the change process need to be developed to understand which factors contribute to the effects [52]. Fourth, whilst some of the included studies discussed the feasibility and relevance of the intervention for local health systems [18, 44], for many studies it was not clear whether or how interventions could be integrated [38, 40]. Future research should consider the broader health system, as well as the socioeconomic setting.

Strengths and Limitations

By evaluating the effectiveness of various types of community-based rehabilitation interventions for symptoms and functioning of patients with schizophrenia, our study can provide a reliable basis for the promotion of rehabilitation interventions for schizophrenia. Our study has several limitations. First, we excluded non-English language studies, which might bias our study. Second, the interventions varied widely in terms of content, intensity, duration and delivery personnel; Although the interventions were divided into subgroups for meta-analysis, there was differences within groups and overlap between groups. Third, we did not assess intermediate outcomes, so mechanisms through which these interventions achieve their impact were not clear.

Conclusions

In conclusion, the limited evidence from our systematic review and meta-analysis supports the feasibility and effectiveness of community-based rehabilitation interventions for schizophrenia. Community-based rehabilitation interventions should therefore be provided as an adjuvant service in addition to antipsychotics for people with schizophrenia.

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Author Contribution PH and XY were involved in the conception and design of the systematic review. XY, FZ and YW were involved in data acquisition, analysis and interpretation of data. XY were involved in drafting the article. XY, FZ, YW, RD, MZ, DZ and PH revised the article critically. PH supervised all aspects of this study. All authors provided final approval to submit the manuscript.

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Data Availability Data used in this study is available from corresponding author upon reasonable request.

Declarations

Research Involving Human Participants and/or Animals Not applicable.

Conflict of Interest All authors declare that they have no conflict of interest.

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