**Name of Journal:** *World Journal of Clinical Cases*

**Manuscript NO:** 88712

**Manuscript Type:** META-ANALYSIS

**Analysis of the effectiveness of cognitive rehabilitation for patients with chronic mental illness: A meta-analysis**

Jang JS *et al*. Cognitive rehabilitation for patients chronic mental

Jong-Sik Jang, Seri Oh, Geonwoo Kim, Narae Lee, Hyesu Song, Jihye Park, Yushin Lee, Minji Kim, Mihwa Kwon

**Jong-Sik Jang, Hyesu Song, Jihye Park, Yushin Lee, Minji Kim,** Department of Occupational Therapy, Kangwon National University, Samcheok 25949, South Korea

**Seri Oh, Geonwoo Kim,** Department of Occupatioanl Therapy, Kangwon National University Graduate School, Samcheok 25949, South Korea

**Narae Lee,** Department of Occupational Therapy, U1 University, Chung-Cheong Bukdo 25949, South Korea

**Mihwa Kwon,** Department of Occupation Therapy, Dongnam Health University, Gyeonggi-do 16328, South Korea

**Author contributions:** Jang JS wrote the overall paper; Kwon M wrote the introduction, discussions, and methods, and is responsible for general contact on the paper; Oh S, Lee N and Kim G revised and supplemented the manuscript, and wrote and edited the article on methods, results, and references; Song H, Park J, Lee Y, and Kim M edited and revised the manuscript.

**Corresponding author: Mihwa Kwon, PhD, Professor,** Department of Occupational Therapy, Dongnam Health University, No. 50 Cheoncheon-ro 74beon-gil, Jangan-gu, Suwon-si, Gyeonggi-do 16328, South Korea. hotwith5625@hanmail.net

**Received:** October 7, 2023

**Revised:** October 21, 2023

**Accepted:** November 9, 2023

**Published online:**

**Abstract**

BACKGROUND

People suffering from chronic mental illness are sensitive to stressful stimuli, lack coping skills, and have low self-esteem due to problems such as social situations. They also experience depression, isolation, fear, and frustration. Due to cognitive dysfunction, people suffering from chronic mental illness have inadequate cognitive processes that lead to distorted thinking.

AIM

To confirm the effectiveness of cognitive rehabilitation therapy in improving cognitive function and alleviating behavioral and psychological symptoms in patients with chronic mental illness, and to identify the cognitive function that had the main effect.

METHODS

The quality of the studies was evaluated using the Assessment of Multiple Systematic Reviews criteria, and data published from 2011 to December 2022 were searched using PubMed, Cochrane, RISS, KISS, and DBpia. The keywords used in the search were “mental illness,” “cognitive rehabilitation,” “cognition,” and “mental.” A meta-analysis was conducted on the 12 selected papers.

RESULTS

The level of evidence for the 12 documents was that of a randomized experimental study. Intervention types in cognitive rehabilitation can be divided into cognitive behavior, cognitive training, cognitive rehabilitation, and computerized cognitive programs. Most of the studies were on schizophrenia, and the measurement areas were cognitive functions (*e.g*., concentration, memory, and executive function) as well as depression, sociability, and quality of life. As a result of the meta-analysis of each variable, the effect size for cognitive rehabilitation treatment was in the following order: Sociability, memory, concentration, executive function, quality of life, and depression. Particularly, sociability and memory exhibited significant effects.

CONCLUSION

Cognitive rehabilitation aids cognitive function and sociability in patients with chronic mental illness and can be used as evidence for cognitive rehabilitation in mental health and occupational therapy.

**Key Words:** Cognitive function; Mental illness; Cognitive rehabilitation; Cognitive training; Cognitive therapy; Schizophrenia; Occupational therapy

Jang JS, Oh S, Kim G, Lee N, Song H, Park J, Lee Y, Kim M, Kwon M. Analysis of the effectiveness of cognitive rehabilitation for patients with chronic mental illness: A meta-analysis. *World J Clin Cases* 2023; In press

**Core Tip:** This study demonstrates the effectiveness of cognitive rehabilitation in patients with chronic mental illness, both domestically and internationally, through a meta-analysis of 12 selected papers. Cognitive rehabilitation interventions can be divided into cognitive behavior, cognitive training, cognitive rehabilitation, and computerized cognitive programs. Based on the meta-analysis of each variable, the effect size of the cognitive rehabilitation treatment was in the following order: Sociability, memory, concentration, executive function, quality of life, and depression. Particularly, sociality and memory had significant effects. We aimed to investigate the effectiveness of cognitive rehabilitation for each mental illness and symptom, presenting applicable evidence for clinical use.

**INTRODUCTION**

A person with chronic mental illness refers to one who has suffered from a mental illness for more than two years and has physical, psychological, and social impairments due to the disease[1]. People with chronic mental illness react sensitively to stressful stimuli, lack coping skills, and develop low self-esteem due to personal and social situations and problems such as social prejudice, stigma, and lack of family formation; they also experience depression, isolation, fear, and frustration[2]. This further exacerbates various symptoms closely related to social relationships and causes cognitive dysfunction, which causes errors in information processing in specific situations[3].

Due to cognitive dysfunction, people with chronic mental illness have inappropriate cognitive processes that lead them to distorted thinking[4]. Consequently, it becomes difficult to properly recognize and interpret social information, judge others' intentions, and react appropriately[5]. Due to the influence of cognition, behavior, and perception, chronic mental illness has a significant impact on individual motivation, quality of life, social role, and adaptation[3]. Therefore, appropriate management and interventions for the cognitive function of patients with chronic mental illnesses are needed.

Although drug therapy is the most commonly used treatment method for patients with chronic mental illness, there have been reports that it does not have a significant effect on cognitive symptoms, even if there is an improvement in clinical mental symptoms[6]. In order to compensate for this, non-pharmacological treatment has recently been performed in parallel with drug treatment, and cognitive rehabilitation is a representative non-pharmacological treatment implemented to improve the cognitive function of mentally ill patients[7].

Cognitive rehabilitation therapy is a structured approach that can help with social adaptability in addition to reducing the main symptoms of chronic mental illness. It is based on the theory that a patient's emotions and behavior can be determined[8]. Effective treatment plans and interventions for cognitive dysfunction can be implemented through a method of applying relearning or compensation by distinguishing what can or cannot be performed during cognitive function processing[9]. In the treatment of mental disorders, cognitive rehabilitation is mainly applied to patients with chronic mental disorders, such as depression, anxiety disorders, schizophrenia, and alcoholism, and reduces anxiety or severity in stressful situations[10]. In addition, through the correction of thinking, negative thoughts change into positive ones, providing positive effects that increase motivation and participation in the work one wants to do[11].

Previous studies of cognitive rehabilitation in patients with chronic mental illness found improvements in concentration, attention, memory, and working memory after the implementation of cognitive rehabilitation in patients with chronic schizophrenia in hospital[12]. Cognitive behavior-based art and music therapies have shown significant effects on stress perception and coping methods in patients with chronic mental illness[13]. However, despite previous studies on cognitive rehabilitation for patients with chronic mental illness, discussions on its effectiveness continue because of different diseases, dependent variables, and the use of measurement tools; thus, there are limitations in generalizing the results[14]. Therefore, there is a need to supplement the limitations of individual studies on cognitive rehabilitation and to prove its effectiveness on a consistent and scientific basis[15].

A representative method for proving the effectiveness of research is meta-analysis[16]. Meta-analysis is a statistical method used to aggregate the effect estimates of multiple individual studies conducted on the same topic and is an objective method of deriving results that can be used to summarize a specific topic or efficiently synthesize a large amount of literature data[17]. However, previous studies on this subject have been mainly limited to systematic reviews, and although some meta-analyses have been conducted, they are difficult to generalize due to limited interventions and subjects, such as computerized cognitive rehabilitation and patients with severe mental illness[7,14]

Therefore, in this study, we attempted to prove the effectiveness of cognitive rehabilitation in patients with chronic mental illness at home and abroad through a meta-analysis. Through this, the effectiveness of cognitive rehabilitation according to each mental disease and symptom was investigated, and evidence data that can be applied in clinical practice were presented.

**MATERIALS AND METHODS**

***Criteria for selection of research papers and data collection method***

This study was a meta-analysis to analyze the effectiveness of cognitive rehabilitation treatment in patients with chronic mental illness. For literature collection, papers published in domestic and foreign journals between January 2011 and December 2022 were searched. A measurement tool, Assessment of Multiple Systematic Reviews, was used to improve the quality of research based on academic theses, including dissertations. The literature selection criteria for this study were as follows: Studies applying cognitive rehabilitation treatment to patients with chronic mental illness, studies that can confirm experimental data and expertise, and randomized controlled trials (RCTs) with experimental and control groups. Studies involving only drug interventions, single-case studies, reviews, qualitative studies, and academic conference literature were excluded.

For the literature search, online databases were used; PubMed and Cochrane were used for overseas databases, and the RISS, KISS, and DBpia databases were used for domestic databases. The keywords used in the search were selected in Korean and English as "mental illness" and "cognitive rehabilitation" or "cognition" or "mental" and "cognition" or "mental" and "cognition.” Literature collection and selection were performed by the authors reviewing papers individually. If the reviewed papers did not match, the authors reviewed them together. In total, 27523 papers were retrieved in the primary search using keywords from domestic and foreign databases. A secondary review was conducted on the titles and abstracts of the literature centering on the searched papers; 26976 papers that did not meet the criteria were excluded, and a total of 547 papers were selected. Afterwards, we checked the full text of 547 papers and excluded 56 subjects without chronic mental illness, 281 case studies, systematic reviews and meta-studies, 196 academic conference literature studies, and 3 studies where comparative analysis was difficult due to no common independent variables. A total of 12 articles were ultimately selected for final analysis(Figure 1).

***Meta-analysis***

The five-level classification method developed by Arbesman *et al*[18] was used for the level of evidence in the literature selected for this study. Because the literature selection was based on RCTs with experimental and control groups, it was confirmed that the qualitative evidence level of all target studies selected in this study corresponded to the highest level, stage 1 (random control study).

For data coding, the number of subjects in the experimental and control groups, mean and standard deviation, and a confidence interval of 95.0% were applied, and descriptive statistics were used for general characteristics. A meta-analysis was performed by coding the characteristics of the 12 selected studies, and the statistical heterogeneity, effect size, and publication bias were analyzed. Homogeneity was confirmed using a chi-squared test[19]. According to the statistical heterogeneity test of each study, a random-effects model was applied for statistically heterogeneous cases and a fixed-effects model was applied for homogeneous cases. Based on the results derived thereafter, the effect size and publication bias were analyzed, and the effect size was calculated using a forest plot and the publication bias was calculated using a funnel plot[20]. The meta-analysis program used Review Manager (RevMan) 5.3 provided by the Cochrane Alliance, and an effect size of 0.8 or more was interpreted as a large effect, an effect size of 0.5 as a moderate effect, and an effect size of 0.2 or less as a small effect[21]. After reviewing the selected studies, the results of each measurement tool suitable for this study were derived.

**RESULTS**

***General characteristics of meta-analysis target studies***

The general characteristics of the 12 articles selected for this study are presented in Table 1. All papers were published in professional journals, and 836 participants were included in the study. As for the housing type of the study subjects, were living in hospitals and nursing facilities. Schizophrenia was the most common diagnosis among the participants; there were more male subjects than female, and the average age was in their 40s. The cognitive rehabilitation treatments used in the study were cognitive behavior, cognitive training, cognitive rehabilitation, computerized cognitive programs, and various intervention methods. The intervention was applied twice a week for > 60 min.

***Meta-analysis on the effects of cognitive rehabilitation treatment***

To analyze the effects of cognitive rehabilitation treatment on patients with chronic mental illness, 12 studies were analyzed by dividing them into dependent variables. Dependent variables in the target studies were classified into 4 concentration, 4 memory, 3 executive function, 5 depression, 5 sociability, and 3 quality of life. As a result of the meta-analysis of each variable, the effect size for cognitive rehabilitation treatment was in the following order: sociability, memory, concentration, executive function, quality of life, and depression.

**Effects of cognitive rehabilitation therapy on concentration:** Among the 12 studies, there were 4 papers with concentration as the dependent variable. As a result of analyzing these 4 studies, the overall effect size was 0.75 (95%CI: 0.39 to 1.39), which showed a medium effect size and was statistically significant (*P* < 0.05) (Table 2)[22-25].

**The effect of cognitive rehabilitation treatment on memory:** Among the 12 studies, there were 4 papers that used memory as a dependent variable. As a result of analyzing these 4 studies, the overall effect size for memory was 0.96 (95%CI: 0.59 to 1.32), which showed a large effect size and was statistically significant (*P* < 0.05) (Table 3)[22-25].

**Effects of cognitive rehabilitation therapy on executive function:** Among the total of 12 studies, there were 3 papers that used executive function as a dependent variable. As a result of analyzing these 3 papers, the overall effect size for executive function was 0.29 (95%CI: 0.18 to 0.40), indicating a small effect size and statistically significant (*P* < 0.05) (Table 4)[22-24].

**Effects of cognitive rehabilitation therapy on depression**: Among the total of 12 studies, there were 5 papers with depression as a dependent variable. As a result of analyzing these 5 studies, the overall effect size was 0.20 (95%CI: 0.17 to 0.23), which was a small effect size and was statistically significant (*P* < 0.05) (Table 5)[26-30].

**The effects of cognitive rehabilitation therapy on sociality**: Among the 12 studies, there were 5 papers with sociality as a dependent variable. As a result of analyzing these 5 studies, the overall effect size was 1.21 (95%CI: 0.98 to 1.43), which showed a large effect size and was statistically significant (*P* < 0.05) (Table 6)[22,27,30-32].

**Effects of cognitive rehabilitation therapy on quality of life:** Among the 12 studies, there were 3 papers with quality of life as the dependent variable. As a result of analyzing these three studies, the overall effect size was 0.29 (95%CI: 0.25-0.33), which was small and statistically significant (*P* < 0.05) (Table 7)[28,30,33].

***Publication convenience***

As a result of analyzing the publication convenience of the effects of cognitive rehabilitation treatment on concentration, memory, executive function, depression, sociability, and quality of life in the selected studies using a funnel plot, they were found to be generally symmetrical. It was determined that there was no significant bias (Figure 2).

**DISCUSSION**

As a result of confirming the effectiveness of cognitive rehabilitation for mentally ill patients through meta-analysis, it was identified as a very effective intervention method for concentration and memory among cognitive functions. It was also a very suitable arbitration law to improve sociality. In the future, the focus of clinical trials should be on improving concentration, memory, and social skills for mentally ill patients.

Based on the general characteristics of the 12 studies selected for analysis, the types of cognitive rehabilitation interventions were largely divided into cognitive behavior, cognitive training, cognitive rehabilitation, and computerized cognitive programs. In a previous study by Tomás *et al*[34], which analyzed cognitive rehabilitation, training programs for enhancing cognitive function, compensatory rehabilitation programs, and computer training programs were used as intervention methods. Other programs include remediation therapy and cognitive enhancement therapy, and compensatory rehabilitation programs include errorless learning and cognitive adaptation training. Additionally, Gradior, RehaCom, and the Neuropsychological Educational Approach to Rehabilitation were presented as computer training programs. The dependent variables that confirmed the intervention effect in this study were primarily cognitive functions, such as concentration, memory, and executive function, and secondarily included behavioral and psychological variables related to cognition, such as depression, sociality, and quality of life. This may be because cognitive rehabilitation therapy is a method of systematic intervention that improves cognitive function by setting specific cognitive functions, such as memory, concentration, executive function, activities of daily living, and social skills, as treatment goals. The number of studies for each variable included 3 to 5, and the literature proving the effect on depression was the highest, with 5 studies.

According to the results of the meta-analysis, the overall effect size of the 12 studies on cognitive rehabilitation treatment appeared normal. By variable, the effect size for cognitive rehabilitation treatment appeared in the following order: sociability, memory, concentration, executive function, quality of life, and depression. Taken together, our findings show that cognitive rehabilitation treatment has an overall positive effect on the cognitive function of patients with chronic mental illness, and it has been confirmed that it is particularly effective in sociability, memory, and concentration. This may have also affected the fact that schizophrenia was the most common condition among the 12 studies included in this meta-analysis. In general, patients with schizophrenia show improved processing speed, attention, working memory, verbal and visual learning and memory, and reasoning. It has been found to have various cognitive problems, such as reasoning, problem solving, and social cognition, but among them, it is said that they show remarkable difficulties in attention, memory, and executive function[35]. In the studies included in this analysis, the effectiveness of memory and concentration among cognitive functions was confirmed through repeated application of various cognitive trainings in the form of group and individual provisions. Studies applying social cognitive training were also included. It is thought to have a positive effect on psychological symptoms, such as sociality. According to Fett *et al*[36], social cognitive theory, rather than neurocognitive factors, is a better predictor of improvement in the quality of life of patients with schizophrenia, and social cognitive rehabilitation programs are more likely to improve social functioning than non-social cognitive rehabilitation programs. noted that there is a higher effect size. Therefore, future research should verify this by dividing it into social and nonsocial programs according to the type of intervention used for cognitive rehabilitation.

This study will provide basic data for the use of cognitive rehabilitation therapy for the purpose of improving function and alleviating symptoms of patients with chronic mental illness, and expanding the role of occupational therapy in the field of mental health. In the treatment of mental disorders, cognitive rehabilitation is mainly applied to patients with chronic mental disorders such as depression, anxiety disorders, schizophrenia, and alcoholism[10]. However, in the case of chronic mental illness, despite the fact that various factors affect symptoms, such as the type of disease, functional level of the subject, prevalence and treatment period, medication compliance, and family support[9], the selected studies were not included in this analysis. Owing to the limitations of the analysis, which provided limited information based on the data, various factors could not be fully considered. In addition, analysis of the effect size according to the evaluation tool or intervention type was insufficient. Additional studies that can address and supplement these limitations should be conducted in the future.

**CONCLUSION**

Through a meta-analysis, this study confirmed the effectiveness of cognitive rehabilitation therapy for improving cognitive function and alleviating behavioral and psychological symptoms in patients with chronic mental illness and confirmed which functions were mainly effective. Among the 12 articles, the level of evidence was that of randomized experimental studies. Intervention types for cognitive rehabilitation can be largely divided into cognitive behavior, cognitive training, cognitive rehabilitation, and computerized cognitive programs. Most of the subjects were studies on schizophrenia, and the measurement areas were cognitive functions such as concentration, memory, and executive function, as well as depression, sociability, and quality of life. The meta-analysis showed that cognitive rehabilitation treatment applied to patients with chronic mental illness was effective in improving cognitive function and, in particular, showed a large effect size on sociability and memory. The results of this study can be used as basic evidence to provide cognitive rehabilitation treatment for patients with chronic mental illnesses in the fields of mental health and occupational therapy.

**ARTICLE HIGHLIGHTS**

***Research background***

People suffering from chronic mental illness have cognitive impairment and inadequate cognitive processes. The effectiveness of cognitive rehabilitation was shown.

***Research motivation***

Previous studies on this topic have been largely limited to systematic reviews, and although some meta-analyses have been performed, generalizations are difficult due to limited interventions and targets, including computerized cognitive rehabilitation and patients with severe mental illness.

***Research objectives***

The effectiveness of cognitive rehabilitation according to each mental disease and symptom was investigated, and evidence data that can be applied in clinical practice were presented.

***Research methods***

We attempted to prove the effectiveness of cognitive rehabilitation in patients with chronic mental illness at home and abroad through a meta-analysis.

***Research results***

When cognitive rehabilitation was performed on patients with mental illness, a basis for intervention was established. The results of the study revealed that it is effective in improving memory and social skills. There is a need to further prove the effectiveness of variables such as memory and quality of life in the future.

***Research conclusions***

The meta-analysis showed that cognitive rehabilitation treatment applied to patients with chronic mental illness was effective in improving cognitive function and, in particular, showed a large effect size on sociability and memory.

***Research perspectives***

In the future, based on the results of this study, it should become the basis for interventions to improve social skills and memory in patients with chronic mental illness. Additionally, the effectiveness of clinical interventions should be continuously verified based on these results.

**REFERENCE**

1 **Min SK**.Latest psychiatry; Ilchokak: Seoul. 2015.

2 **Copeland WE**, Wolke D, Shanahan L, Costello EJ. Adult Functional Outcomes of Common Childhood Psychiatric Problems: A Prospective, Longitudinal Study. *JAMA Psychiatry* 2015; **72**: 892-899 [PMID: 26176785 DOI: 10.1001/jamapsychiatry.2015.0730]

3 **Green MF**, Nuechterlein KH, Gold JM, Barch DM, Cohen J, Essock S, Fenton WS, Frese F, Goldberg TE, Heaton RK, Keefe RS, Kern RS, Kraemer H, Stover E, Weinberger DR, Zalcman S, Marder SR. Approaching a consensus cognitive battery for clinical trials in schizophrenia: the NIMH-MATRICS conference to select cognitive domains and test criteria. *Biol Psychiatry* 2004; **56**: 301-307 [PMID: 15336511 DOI: 10.1016/j.biopsych.2004.06.023]

4 **Chadwick P**, Birchwood M. The omnipotence of voices. A cognitive approach to auditory hallucinations. *Br J Psychiatry* 1994; **164**: 190-201 [PMID: 8173822 DOI: 10.1192/bjp.164.2.190]

5 **Kwon JS,** Kim JY, Oh YT, Yook JS, Jo HJ, Hong SP. Cognitive rehabilitation for occupational therapists; Pacific Books: Seoul. 2015.

6 **Goldberg TE**, Gold JM, Greenberg R, Griffin S, Schulz SC, Pickar D, Kleinman JE, Weinberger DR. Contrasts between patients with affective disorders and patients with schizophrenia on a neuropsychological test battery. *Am J Psychiatry* 1993; **150**: 1355-1362 [PMID: 8352346 DOI: 10.1176/ajp.150.9.1355]

7 **van Duin D**, de Winter L, Oud M, Kroon H, Veling W, van Weeghel J. The effect of rehabilitation combined with cognitive remediation on functioning in persons with severe mental illness: systematic review and meta-analysis. *Psychol Med* 2019; **49**: 1414-1425 [PMID: 30696500 DOI: 10.1017/S003329171800418X]

8 **Hyun MY,** Yu SJ, Lee JE. Effects of Cognitive-Behavioral Program on the Anxiety and Quality of Life in Schizophrenic Patients. J Korean Acad Psychiatr Ment Health Nurs 2004; **13**: 315-322

9 **Smith-Knapp K**, Corrigan JD, Arnett JA. Predicting functional independence from neuropsychological tests following traumatic brain injury. *Brain Inj* 1996; **10**: 651-661 [PMID: 8853868 DOI: 10.1080/026990596124070]

10 **Beck AT**, Brown GK, Steer RA. Psychometric characteristics of the Scale for Suicide Ideation with psychiatric outpatients. *Behav Res Ther* 1997; **35**: 1039-1046 [PMID: 9431735 DOI: 10.1016/s0005-7967(97)00073-9]

11 **Han KM**. The neural circuit model of depression and the therapeutic mechanism of cognitive behavioral therapy: A review of functional brain magnetic resonance imaging studies. *korean Asseciation of cognitive behavioral therapy* 2021; **21**: 665-688 [DOI: 10.33703/cbtk.2021.21.4.665]

12 **Lee WK,** Hwang TY, Park YJ. Efficacy of computerized cognitive rehabilitation training for inpatients with schizophrenia: a pilot study. *Journal of Korean Neuropsychiatric Association* 2009; 160-167

13 **Bak H,** Lee JA. meta-analysis of the music therapy research to reduce stress. *Korean Journal of Music Therapy* 2014; **16**: 29-47

14 **Song S,** Lee S. Effectiveness Analysis of Computerized Cognitive Rehabilitation Therapy in Patients with Mental Disorder: A Systematic Review and Meta-analysis. *Jsers* 2020; **59**: 383-399 [DOI: 10.23944/Jsers.2020.12.59.4.17]

15 **Yoo DH,** Lee JS, Kim HM, Hong DG. A Systemic Review and Meta-Analysis on the Effects of FES Intervention for Stroke Patients. *The Journal of Korean Society of Occupational Therapy* 2012; **20**: 111-126

16 **Glass GV. Primary,** secondary, and meta-analysis of research. Educational researcher 1976; **5**: 3-8 [DOI: 10.3102/0013189X005010003]

17 Paul LA. Transformative experience; OUP Oxford. 2014.

18 **Arbesman M,** Scheer J, Lieberman D. Using AOTA's critically appraised topic (cat) and critically appraised paper (cap) series to link evidence to practice. *OT practice* 2008; **13**: 18-22. Available from: https://www.proquest.com/trade-journals/using-aotas-critically-appraised-topic-cat-paper/docview/232422960/se-2?accountid=7411

19 Borenstein M. Computing effect sizes for meta-analysis; Wiley-Blackwell. 2013.

20 **Hedges LV,** Olkin I. Statistical methods for meta-analysis; Academic press. 2014.

21 **Cohen J**. Statistical power analysis for the social sciences; Erlbaum: NR. 2013.

22 **Iwata K**, Matsuda Y, Sato S, Furukawa S, Watanabe Y, Hatsuse N, Ikebuchi E. Efficacy of cognitive rehabilitation using computer software with individuals living with schizophrenia: A randomized controlled trial in Japan. *Psychiatr Rehabil J* 2017; **40**: 4-11 [PMID: 28182471 DOI: 10.1037/prj0000232]

23 **Jung S,** Oh S. The study on the effect of cognitive-behavioral group art therapy program on the self-esteem and empathy of chronic schizophrenic patients. *Journal of Arts Psychotherapy* 2015; **11**: 159-178. Available from: http://k-apa.com/html/sub0501.html?pageNm=article&journal=1&code=250537&issue=18901&Page=2&year=2015&searchType=title&searchValue=]

24 **Kim J,** Kim M. The effect of visuospatial rehabilitation on the visuospatial function and attention in patients with schizophrenia. *Korean J Clin Psychol* 2016, **35**: 843-857 [DOI: 10.15842/kjcp.2016.35.4.012]

25 **Song Y,** Song A, Kang S, Song J, Choi H, Jeong B. The effect of computerized cognition program (RehaCom) on the improvement of cognitive functions in patients with schizophrenia. *J Korean Soc Cogn Rehab* 2015; **4**: 65-79. Available from: https://m.riss.kr/link?id=A100665367

26 **Kim A**. The Effect of Cognitive-Behavior Group Art Therapy on Depression and Dysfunctional Attitudes of Schizophrenia. M.Sc. Thesis. KonkunUniversity, Seoul. 2017. Available from: https://m.riss.kr/link?id=T14427671

27 **Kim BM,** Cho OW. The Effect of the Cognitive-Behavioral Program on the Schizophrenia's Psychosocial Function. *The Journal of Welfare and Counselling Education* 2018; **7**: 311-330 [DOI: 10.20497/jwce.2018.7.2.311]

28 **Pijnenborg GHM**, de Vos AE, Timmerman ME, Van der Gaag M, Sportel BE, Arends J, Koopmans EM, Van der Meer L, Aleman A. Social cognitive group treatment for impaired insight in psychosis: A multicenter randomized controlled trial. *Schizophr Res* 2019; **206**: 362-369 [PMID: 30429078 DOI: 10.1016/j.schres.2018.10.018]

29 **Salomonsson S**, Santoft F, Lindsäter E, Ejeby K, Ljótsson B, Öst LG, Ingvar M, Lekander M, Hedman-Lagerlöf E. Stepped care in primary care - guided self-help and face-to-face cognitive behavioural therapy for common mental disorders: a randomized controlled trial. *Psychol Med* 2018; **48**: 1644-1654 [PMID: 29095133 DOI: 10.1017/S0033291717003129]

30 **Twamley EW**, Thomas KR, Burton CZ, Vella L, Jeste DV, Heaton RK, McGurk SR. Compensatory cognitive training for people with severe mental illnesses in supported employment: A randomized controlled trial. *Schizophr Res* 2019; **203**: 41-48 [PMID: 28823720 DOI: 10.1016/j.schres.2017.08.005]

31 **Hyun M**. The effects of cognitive behavioral group therapy improving social cognition on the self efficacy, relationship function and social skills for chronic schizophrenia. *J Korean Acad Psychiatr Ment Health Nurs* 2017; **26**: 186-195 [DOI: 10.12934/jkpmhn.2017.26.2.186]

32 **Kingston DA**, Olver ME, McDonald J, Cameron C. A randomised controlled trial of a cognitive skills programme for offenders with mental illness. *Crim Behav Ment Health* 2018; **28**: 369-382 [PMID: 29732624 DOI: 10.1002/cbm.2077]

33 **Lee DH,** Ko SM, Choi YS, Kim KJ, Park H. A randomized controlled pilot study of cognitive behavioral social skills training (Korean version) for middle-or older-aged patients with schizophrenia: a pilot study. *Journal of Korean Neuropsychiatric Association* 2012; **51**: 192-201 [DOI: 10.4306/jknpa.2012.51.4.192]

34 **Tomás P,** Fuentes I, Roder V, Ruiz JC. Cognitive rehabilitation programs in schizophrenia: current status and perspectives. *International Journal of Psychology and Psychological Therapy* 2010; **10**: 191-204. Available from: https://www.ijpsy.com/volumen10/num2/257.html]

35 **Rund BR**, Borg NE. Cognitive deficits and cognitive training in schizophrenic patients: a review. *Acta Psychiatr Scand* 1999; **100**: 85-95 [PMID: 10480194 DOI: 10.1111/j.1600-0447.1999.tb10829.x]

36 **Fett AK**, Viechtbauer W, Dominguez MD, Penn DL, van Os J, Krabbendam L. The relationship between neurocognition and social cognition with functional outcomes in schizophrenia: a meta-analysis. *Neurosci Biobehav Rev* 2011; **35**: 573-588 [PMID: 20620163 DOI: 10.1016/j.neubiorev.2010.07.001]

**Footnotes**

**Conflict-of-interest statement:** The authors deny any conflict of interest.

**PRISMA 2009 Checklist statement:** The authors have read the PRISMA 2009 Checklist, and the manuscript was prepared and revised according to the PRISMA 2009 Checklist.

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**Provenance and peer review:** Unsolicited article; Externally peer reviewed.

**Peer-review model:** Single blind

**Peer-review started:** October 7, 2023

**First decision:** October 9, 2023

**Article in press:**

**Specialty type:** Medicine, research and experimental

**Country/Territory of origin:** South Korea

**Peer-review report’s scientific quality classification**

Grade A (Excellent): A

Grade B (Very good): 0

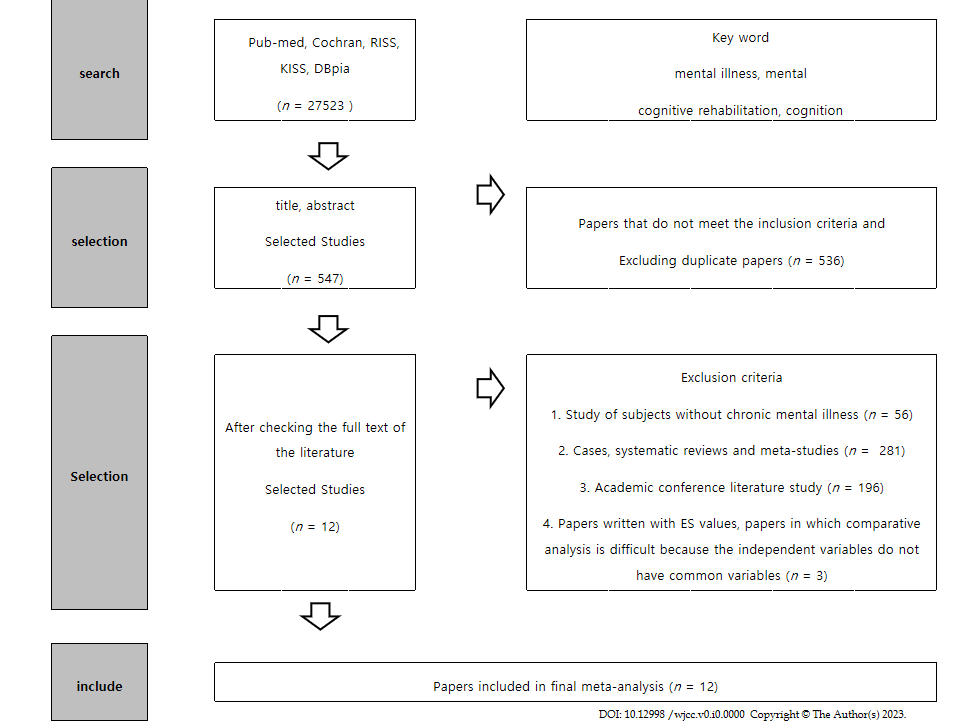
Grade C (Good): 0

Grade D (Fair): 0

Grade E (Poor): 0

**P-Reviewer:** Glumac S, Croatia **S-Editor:** Qu XL **L-Editor: P-Editor:**

**Figure Legends**



**Figure 1 Flow diagram of the literature selection process.**

도표, 라인, 평행이(가) 표시된 사진

자동 생성된 설명

**Figure 2 Publication convenience.** A: Attention; B: Memory; C: Executive function; D: Depression; E: Social skill; F: Quality of life.

**Table 1 Characteristics of included study**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Ref.** | **Intervention** | **Evaluation** | | **Experimental group** | | | **Control group** | | |
| **Pre (mean ± SD)** | **Post (mean ± SD)** | **Subjects (W/M)** | **Pre (mean ± SD)** | **Post (mean ± SD)** | **Subjects (W/M)** |
| 1 | Song *et al*[25] | Rehacom | CNT | Memory | 31.8 ± 6.2 | 36.4 ± 5.8 | 4/6 | 30.3 ± 5.1 | 31.2 ± 5.3 | 4/6 |
| Attention | 36.9 ± 7.6 | 50.9 ± 32.8 | 41.3 ± 9.8 | 60.5 ± 36.1 |
| 2 | Kim and Kim *et al*[24] | Visuospatial Rehabilitation | RCFT | Memory | 11.5 ± 5.7 | 14.6 ± 6.1 | 8/6 | 12.3 ± 9.9 | 12.3 ± 9.9 | 8/7 |
| Stroop | Executive Function | 33 ± 6.5 | 37.4 ± 7.1 | 34.7 ± 10.3 | 34.5 ± 12.7 |
| WCST | Attention | 44.1 ± 30.7 | 33.2 ± 23.9 | 9.5 ± 4.4 | 11.3 ± 4.3 |
| 3 | Pijnenborg *et al*[28] | REFLEX/CRT | QUID-Sr | Depression | 4.1 ± 1.7 | 3.7 ± 1.9 | 59 | 3.8 ± 1.8 | 3.7 ± 1.9 | 62 |
| MANSA | Quality of life | 58.179.2 | 58.8 ± 9.3 | 58.1 ± 9.9 | 56.9 ± 10.7 |
| 4 | Iwata *et al*[22] | CogPack | BACS‑J | Memory | 0.2 ± 0.8 | 0.6 ± 0.8 | 22/7 | -0.2 ± 1.1 | 0.1 ± 1.1 | 23/8 |
| Attention | 0.1 ± 1 | 0.5 ± 1 | -0.1 ± 1 | 0.1 ± 1.1 |
| Execution function | 0.1 ± 1.1 | 0.3 ± 0.7 | -0.1 ± 0.9 | -0.1 ± 0.9 |
| LASMI | Social skill | 14.1 ± 5.5 | 9.7 ± 5.4 | 14.5 ± 7.4 | 14.3 ± 7.5 |
| 5 | Kim[26] | Group art therapy | ATQ-N | Depression | 14 ± 5.3 | 11.7 ± 5.4 | 3/5 | 15.1 ± 4.9 | 15.6 ± 5.6 | 3/5 |
| 6 | Salomonsson *et al*[29] | CBT | MADRS-S | Depression | 15.6 ± 6.7 | 13.6 ± 8.3 | 58/23 | 14.6 ± 7.2 | 10.6 ± 7.3 | 51/29 |
| 7 | Jung and Oh[23] | Group art therapy | BES | Memory | 22.8 ± 2.5 | 24.6 ± 2.9 | 8/4 | 23.2 ± 2.9 | 22.4 ± 1.9 | 5/7 |
| Attention |
| Executive Function |
| 8 | Twamley *et al*[30] | CCT | SSPA | Social Skills | 4.1 ± .63 | 3.9 ± .11 | 34/43 | 4.2 ± .7 | 4 ± .1 | 32/44 |
| QOLI | Quality of life | 4 ± 1.5 | 4.8 ± .2 | 4.1 ± 1.38 | 3.8 ± .2 |
| Ham-D | Depression | 12.9 ± 6.9 | 10.4 ± 1.2 | 13 ± 6.8 | 14.9 ± 1.3 |
| 9 | Lee *et al*[33] | Cognitive behavioral social skills Training | WHOQOL-BREF | Quality of life | 6 ± 1.2 | 7.6 ± 1.2 | 5/3 | 6.7 ± 2.2 | 6 ± 2 | 7/5 |
| 10 | Kim and Cho[27] | CBT | MHCS | Depression | 3 ± .51 | 3.5 ± .6 | 6/7 | 3.2 ± .5 | 3.2 ± .7 | 5/8 |
| RCS | Social skill | 2.9 ± .6 | 3.4 ± .6 | 3 ± .7 | 3.1 ± .7 |
| 11 | Kingston *et al*[32] | Reasoning and  Rehabilitation 2 | CSS-M | Social skill | 36.4 ± 11.6 | 29.7 ± 14.1 | 48 | 35.6 ± 14.6 | 35.9 ± 15.2 | 49 |
| 12 | Hyun[31] | Cognitive Behavioral  Group Therapy | Social skills scale | Social skills | 39.1 ± 10.2 | 37.5 ± 9.6 | 13/13 | 39.7 ± 9.4 | 39.3 ± 9 | 15/11 |

CNT: Computer assisted cognitive rehabilitation; RCFT: Rey-osterrieth complex figure test; WCST: Wisconsin card sorting test; QUID-Sr: The Quick Inventory of Depressive Symptomatology Self-Report; MANSA: The self-rating Manchester Short Assessment of Quality of Life; BACS‑J: Brief assessment of cognition in schizophrenia-Japane; LASMI: Life Assessment Scale for Mentally; ATQ-N: Automatic Thoughts Questionnaire-Negative; MADRS-S: Montgomery-Asberg Depression Rating Scale; BES: Basic Empathy Scale; CCT: Compensatory cognitive training; SSPA: Social Skills Performance Assessmen; QOLI: Quality of life interview; HAM-D: Hamilton depression rating scale; WHOQOL-BREF: World Health Organization Quality of Lif-BREF; CBT: Cognitive-behavior therapy; MHCS: Mental health confidence scale; RCS: Relationship change scale; CSS-M: The criminal sentiments scale-modified.

**Table 2 Effect size of attention**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Study** | **Diagnosis** | **Intervention** | **Effect size** | **95%CI** | **Weight (%)** |
| Iwata *et al*[22] | Schizophrenia | CR using computer software | 0.66 | 0.14-1.18 | 46.2 |
| Jung and Oh[23] | Schizophrenia | CB group art therapy program | 0.89 | 0.04-1.74 | 17.5 |
| Kim and  Kim[24] | Schizophrenia | Visuospatial rehabilitation | 0.71 | -0.04-1.47 | 22.0 |
| Song *et al*[25] | Schizophrenia | CCP (RehaCom) | 0.92 | -0.01-1.85 | 14.4 |
| Total |  |  | 0.75 | 0.39-1.10 | 100 |

CR: Cognitive rehabilitation; CB: Cognitive behavior; CCP: Computerized cognition program.

**Table 3 Effect size of memory**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Study** | **Diagnosis** | **Intervention** | **Effect Size** | **95%CI** | **Weight (%)** |
| Iwata *et al*[22] | Schizophrenia | CR using computer software | 1.26 | 0.70-1.82 | 42.6 |
| Jung and Oh[23] | Schizophrenia | CB group  art therapy  program | 0.68 | -0.15-1.51 | 19.4 |
| Kim and Kim[24] | Schizophrenia | Visuospatial rehabilitation | 0.47 | -0.27-1.21 | 24.2 |
| Song *et al*[25] | Schizophrenia | CCP (RehaCom) | 1.26 | 0.28-2.24 | 13.8 |
| Total |  |  | 0.96 | 0.59-1.32 | 100- |

CR: Cognitive rehabilitation; CB: Cognitive behavior; CCP: Computerized cognition program.

**Table 4 Effect size of executive function**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Study** | **Diagnosis** | **Intervention** | **Effect Size** | **95% CI** | **Weight (%)** |
| Iwata *et al*[22] | Schizophrenia | CR using computer software | 0.22 | 0.09-0.35 | 71.2 |
| Jung and Oh[23] | Schizophrenia | CB group art theraly program | 0.28 | -0.04-0.60 | 11.8 |
| Kim and Kim[24] | Schizophrenia | Visuospatial rehabilitation | 0.60 | 0.33-0.87 | 17.0 |
| Total |  |  | 0.29 | 0.18-0.40 | 100 |

CR: Cognitive rehabilitation; CB: Cognitive behavior.

**Table 5 Effect size of depression**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Study** | **Diagnosis** | **Intervention** | **Effect size** | **95%CI** | **Weight (%)** |
| Kim[26] | Schizophrenia | CB group  art therapy  program | 0.42 | -0.04-0.89 | 0.4 |
| Kim and Cho [27] | Schizophrenia | CB Program | 0.38 | 0.09-0.68 | 1.0 |
| Pijnenborg *et al*[28] | Psychosis | Social Cognitive Group Treatment | 0.18 | 0.12-0.24 | 22.5 |
| Salomonsson *et al*[29] | Mental Disorders | CB Therapy | 0.29 | 0.24-0.33 | 40.3 |
| Twamley *et al*[30] | Mental Illnesses | Compensatory CT | 0.10 | 0.05-0.16 | 35.7 |
| Total |  |  | 0.20 | 0.17-0.23 | 100 |

CB: Cognitive behavior, CT: Cognitive training.

**Table 6 Effect size of social skill**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Study** | **Diagnosis** | **Intervention** | **Effect size** | **95%CI** | **Weight (%)** |
| Hyun[31] | Schizophrenia | CB group therapy | 0.41 | -0.14-0.96 | 17.2 |
| Iwata *et al*[22] | Schizophrenia | CR using computer coftware | 3.01 | 2.25-3.76 | 9.2 |
| Kim and Cho[27] | Schizophrenia | CB Program | 1.91 | 0.95-2.86 | 5.7 |
| Kingston *et al*[32] | Mental Illnesses | Cognitive skills program | 2.48 | 1.95-3.02 | 18.2 |
| Twamley *et al*[30] | Mental Illnesses | Compensatory CT | 0.60 | 0.27-0.92 | 49.6 |
| Total |  |  | 1.21 | 0.98-1.43 | 100 |

CB: Cognitive behavior, CT: Cognitive training.

**Table 7 Effect size of quality of life**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Study** | **Diagnosis** | **Intervention** | **Effect size** | **95%CI** | **Weight (%)** |
| Lee *et al*[33] | Psychosis | CBSS | 0.45 | 0.40-0.50 | 60.4 |
| Pijnenborg *et al*[28] | Psychosis | Socialcognitive group treatment | 0.04 | -0.03-0.10 | 38.7 |
| Twamley *et al*[30] | Mental illnesses | Compensatory CT | 0.96 | 0.53-1.38 | 0.9 |
| Total |  |  | 0.29 | 0.25-0.33 | 100 |

CBSS: Cognitive behavioral social skills, CT: Cognitive training.