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Review

Can computer-assisted cognitive remediation improve employment and productivity outcomes of patients with severe mental illness? A meta-analysis of prospective controlled trials

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ABSTRACT

Background: Computer-assisted cognitive remediation (CACR) has been demonstrated to enhance cognition of patients with severe mental illness (SMI). Patients with improved cognitive skills may find it easier to be employed, and the ability to maintain employment is an important sign of recovery.
Aim: To assess whether CACR is an effective method to enhance work-related outcomes in patients with SMI.
Method: Prospective controlled trials evaluating CACR on productivity outcomes were systematically identified from the OVID databases. Employment rates, total days of work in a year, and total annual earnings were defined as the productivity outcomes.
Results: Nine trials were published between 2005 and 2014 and were conducted in the United States, Germany, Italy, Singapore and Japan. A total of 740 patients with mean age of 36.4 years were included. The duration of CACR ranged from 2 months to 2 years, and the patients were followed-up from 1 year to 3 years. Patients receiving CACR showed 20% higher employment rate (95% CI = 5%–35%), worked 19.5 days longer in a year (95% CI = 2.5–36.6 days), and earned US$959 more in total annual earnings (95% CI = US$285 to US$1634) than those not receiving CACR.
Conclusion: CACR can enhance productivity outcomes for patients with SMI, including higher employment rate, longer duration of work and higher income. The economic benefit of CACR can enhance the quality of life for patients with SMI, and may reduce financial burden on the health and welfare system. Therefore, CACR can be recommended and incorporated into regular vocational rehabilitation programs.

1. Introduction

People with mental illness often want to be employed as usual, and employment is regarded as a sign of recovery (Pachoud et al., 2010). However, employment rate for people with severe mental illness (SMI) is only around 10%–30% (Boardman et al., 2003; Mueser et al., 2001; Man et al., 2012). Long-term unemployment may lead to dependence on welfare support and cause a burden to the health and welfare system. When patients can work, it has been found to be associated with a wide range of benefits, including less severe symptoms of illness, improved sense of recovery, strengthened self-esteem with satisfaction of personal finance, and enhanced quality of living (Mueser et al., 2001; Man et al., 2012; McGurk et al., 2005). Studies have indicated that poor cognitive functioning affected vocational outcomes in patients with SMI, and even for those receiving vocational rehabilitation services (McGurk et al., 2005; McGurk and Mueser, 2004; Lysaker et al., 1995; Green et al., 2000; McGurk and Meltzer, 2000; Bell and Greig, 2001; Bell et al., 2005). The major cognitive deficiencies among the patients with SMI included speed of processing, attention/vigilance, working memory, verbal learning and memory, visual learning and memory, reasoning and problem solving, and social cognition (Man et al., 2012; Grynszpan et al., 2011). Therefore, with a key focus in interventions for improving vocational outcomes is to enhance cognitive functioning.

The definitions of cognitive remediation are generally categorized as manual-task training or computer-assisted training.

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Computer-assisted cognitive remediation (CACR) is a rehabilitation treatment utilizing computer-based cognitive exercises, individual instruction, group techniques, or combinations of these to enhance impaired cognitive functions and improve functioning (Bell et al., 2005; Kurtz et al., 2001; Twamley et al., 2003; McGurk et al., 2007; Wykes and van der Gaag, 2001). CACR interventions are relatively comparable across existing studies and so the study findings can be combined by meta-analysis. Some previous meta-analyses showed that CACR can improve cognitive functions in patients with schizophrenia (Grynszpan et al., 2011; McGurk et al., 2007; Wykes and van der Gaag, 2001; Wyes et al., 2011), even with different types of training methods and differing training duration or follow-up period (McGurk et al., 2007). Another two previous systematic reviews revealed that the improvement of cognitive functions were comparable among patients with schizophrenia, schizoaffective disorder, or affective disorder (Lewandowski et al., 2010; Anaya et al., 2012). These results demonstrated that CACR can generally improve cognitive functions in patients with mental illness.

Although CACR had been shown to enhance overall functional outcomes, which may include employment as one of the functional domains (Green et al., 2000; McGurk et al., 2007; Wykes and van der Gaag, 2001; Wyes et al., 2011; Fett et al., 2011; Medalia and Saperstein, 2013), the effectiveness of CACR in specifically improving productivity outcomes, such as employment rate or total annual earnings remains unclear. As a result, we performed this meta-analysis to combine all published studies which can increase the statistical power to determine the productivity benefits of CACR for patients with SMI.

2. Methodology

2.1. Search strategy

Literature searches were performed in MEDLINE, EMBASE and PsycINFO to identify prospective trials that evaluated CACR in patients with SMI, and measured employment rate and other productivity outcomes. Search terms included cognitive remediation, cognitive training, computerized training, neurocognitive therapy, mental illness, productivity outcomes, vocational outcomes, work rehabilitation, vocational rehabilitation, and randomized controlled trials. The selection was limited to peer-reviewed articles published before 1 September 2014 and from the earliest available dates stated in the individual databases. Manual searches were extended to the bibliographies of review articles and included studies.

2.2. Inclusion and exclusion criteria

The study inclusion criteria were: (i) patients diagnosed with schizophrenia, schizoaffective disorder or bipolar affective disorder according to an established criterion-based diagnostic system, e.g. the Diagnostic and Statistical Manual of Mental Disorder (DSM-IIIR, DSM-IV), International Classification of Diseases (ICD 10) (depending on the publication date of individual studies); (ii) prospective study with CACR as the intervention; (iii) participants aged 18 or above; and (iv) at least one of the productivity outcomes was reported, including employment rate, total days of work in a year, or total annual earnings. Studies were excluded if the full-text of manuscript was not written in English.

2.3. Data extraction

Two investigators (JYC, HWH) independently assessed the relevancy of search findings, and abstracted the data into a data extraction form. This form was used to record the demographic details of individual studies, including year of publication, study location, number of participants, mean age of patients, and the productivity outcomes. When discrepancies were found regarding inclusion of studies and data extraction, the third investigator (KKT) would make the definitive decision for trial eligibility or data extraction.

2.4. Intervention and control

All intervention patients received CACR and this was defined as a cognitive training program delivered on a computer to improve attention and concentration, psychomotor speed, working memory, and executive functions. There are several different types of CACR. First, neurocognitive enhancement therapy (NET) (Bell et al., 2005, 2008) combined computer-based cognitive exercise, feedback support groups and weekly social processing groups, to enhance the neurocognitive skills. Second, cognitive enhancement therapy (CET) (Eack et al., 2009, 2011) aimed to address social cognitive and neurocognitive deficits in schizophrenia, the program combined computerized cognitive training exercises with weekly social cognitive group therapy. Third, the thinking skills for work program (McGurk et al., 2005) included facilitator-based computer cognitive exercises, and teaching compensatory strategies to minimize the effects of cognitive impairment in work. The usual vocational rehabilitation services were provided in some studies. Patients in the control group received usual vocational rehabilitation services, or other clinical intervention, such as enriched supported therapy. When the studies provided the vocational supports in both the intervention and control groups, the supports were equivalent.

2.5. Productivity outcomes

The primary outcome of this study was employment rate, and the secondary outcomes were total days of work in a year, and total annual earnings. When a study reported the total hours of work, we transformed it to daily basis, assuming that employees work 8 h per day. All daily and weekly wages were transformed to yearly basis, and measured in the currency of United States with reference to the exchange rate on 28 Nov 2014. Both competitive and non-competitive employments were considered: competitive employment was defined as that providing comparable salaries to employees with or without mental illness in the same or similar job environment, and where jobs were not reserved for persons with disabilities (Cook et al., 2005). Non-competitive employment included jobs for people with disability in an institute or hospital, transitional employment, internship jobs, and sheltered workshop jobs. Both full-time and part-time work was taken into account.

2.6. Risk of bias and study quality

Potential sources of bias were evaluated with the Cochrane Risk of Bias tool (Higgins et al., 2011), and seven possible sources of bias were considered: 1. random sequence generation, which evaluates the degree of random allocation between intervention and control groups to ensure comparable groups; 2. allocation concealment, which assessed the method of concealment of allocation in order to avoid allocation being foreseen before or during enrollment; 3. blinding of participants and personnel, which evaluates if the intended blinding of participants and researchers was likely to be effective; 4. blinding of outcome assessment, which evaluates if the intended blinding of outcome assessors was effective; 5. incomplete outcome data, which evaluates the completeness of outcome data; 6. selective reporting, which evaluates the reported outcomes

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