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Prospective memory predicts the level of community living skills in schizophrenia

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ABSTRACT

Schizophrenia patients are known to have prospective memory (PM) deficits. There is no robust evidence showing that PM deficits have a major impact on community living skills in schizophrenia. The aim of this study was to examine the association between PM and community living skills in schizophrenia. Forty-four individuals with schizophrenia formed the study sample. Participants' psychopathology, prospective and retrospective memory, level of intelligence, and community living skills were measured with standardized instruments. In bivariate analyses, community living skills overall but not self-care correlated with PM total and subscales scores. In multivariate analyses, event-based PM was more predictive than time-based PM of the level of community living skills. In conclusion, PM has a significant impact on community living skills in schizophrenia and attention should be paid to this type of memory disturbance in rehabilitation of schizophrenia.

1. Introduction

Prospective memory (PM) is the memory involved in remembering to undertake activities in the future (Einstein and McDaniel, 1990). It is considered to have major implications for activities of daily living, with the successful execution of many tasks in daily life thought to depend on PM (Meacham and Leiman, 1982; Ceci and Bronfenbrenner, 1985; Dobbs and Rule, 1987). Examples of PM include remembering to attend appointments, transfer funds between bank accounts, and turn off electrical appliances or gas supply.

Ellis and Freeman (2008) conceptualized PM as a five-phase process: encoding of an intention, retention of that intention information, retrieval of the intention, execution of the intention, and evaluation of the outcome. In the encoding phase, an intention of a future action is registered (what to perform) in conjunction with timing (the retrieval criterion: when to perform) and a decision (whether the action is desired). In the retention phase, there is a period of delay during which an ongoing activity unrelated to the intention is taking place. In the retrieval phase, the situation or timing appropriate to the intended action is recognized. In the execution phase, that action is carried out. Finally, in the evaluation phase the action's implementation is assessed and further plans or actions are considered.

Two subtypes of PM have been described: time-based (TBPM) and event-based (EBPM) (Einstein and McDaniel, 1990; Marsh and Hicks, 1998; Guynn, 2008). TBPM is defined as remembering to perform an action at a specific time in the future, for example, remembering to attend an appointment next Tuesday afternoon, whereas EBPM refers to remembering to perform an action when an external cue appears, for example, passing on a message when a particular person appears.

Schizophrenia patients have been found to exhibit deficits in a wide range of cognitive processes, including learning, memory, and executive functions (Jeste et al., 1996; Heinrichs and Zakzanis, 1998;

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Sharma and Antonova, 2003; Barch, 2005; Holmen et al., 2010). These neuropsychological impairments are relatively stable over time (Rund, 1998; Friedman et al., 2001) and during different phases of the illness (Riley et al., 2000; Sponheim et al., 2010).

Cognitive impairment can hinder psychiatric treatment and rehabilitation thereby jeopardizing successful adjustment to life in the community (Green et al., 2013). A person's ability to function in the community depends on the possession and utilization of certain practical skills required for self-care, home-making, work and community life, and leisure (Dever, 1988; Moss, 1990). These skills entail managing the living area, budgeting, nutrition, health, and the ability to relate to the social environment (May et al., 1985; Smith et al., 1996).

A systematic review concluded that the functional skills level in schizophrenia is associated with cognitive functions but not with psychiatric symptoms (Green, 1996). Several studies have identified a correlation between functional and composite cognitive scores (Patterson et al., 1998; Velligan et al., 1997; Bowie et al., 2010). More specific relationships between functional skills and cognition have also been reported (Dickinson and Coursey, 2002; Rempfer et al., 2003; McClure et al., 2007; Zabala et al., 2010) and confirmed in a meta-analysis (Green et al., 2000) and longitudinal studies (Twamley et al., 2002; Green et al., 2004). Although the aforementioned studies have demonstrated the importance of cognitive functions for successful daily living in patients with schizophrenia, they have not examined the relationship between PM and community living skills and functioning.

Ventricular enlargement and abnormalities of the medial temporal, frontal, and parietal lobes and subcortical areas have been commonly reported in schizophrenia (Shenton et al., 2001). Prefrontal lobe pathology in these patients has also been confirmed in fMRI (Dumontheil et al., 2008) and post-mortem studies (Vogeley et al., 2003). Neuroimaging studies also point to the primary role played by the prefrontal lobes, particularly Brodmann area 10, in PM performance (Okuda et al., 2007; Burgess et al., 2008; Reynolds et al., 2009), although involvement of the parietal lobes has also been implicated (Burgess et al., 2011). PM deficits have been repeatedly found in schizophrenia (Shum et al., 2004; Wang et al., 2009; Au et al., 2012; Zhou et al., 2012; Raskin et al., 2013).

Although PM has been postulated to play a role in activities of daily living (Guimond et al., 2006), empirical evidence remains lacking. The impact of PM has been examined in healthy individuals (Woods et al., 2012) and HIV-infected persons (Doyle et al., 2012). To date, however, only Twamley et al. (2008) have reported that PM performance predicts financial and communication skills, which are partial representations of community living skills, in schizophrenia and schizoaffective disorder.

Table 1
TBPM and EBPM tasks of the Chinese version of the Cambridge Prospective Memory Test.

The three event-based PM tasks
(1) Give a map to the tester when reaching a question containing the words "great wall."
(2) Give a message envelope to the tester when the tester says "5 min left."
(3) Remind the tester about five objects placed in different locations in the room when the tester says "the test is over."
The three time-based PM tasks
(1) Skip the page you are doing and continue to the next page when 9 min are left to the end of the ongoing distraction task.
(2) Remind the tester about the keys when 7 min are left to the end of the ongoing distraction task.
(3) Remind the tester to ring the garage 5 min after the ongoing distraction task ends.

The aim of this study was to examine the functional implications of PM in schizophrenia. It was hypothesized that one or more of the subscale scores of a PM measure would predict the level of community living skills after controlling for socio-demographic, clinical, and neuropsychological variables.

2. Methods

2.1. Study design and participants

This was a cross-sectional correlational study. All individuals with a diagnosis of schizophrenia attending a university-affiliated psychiatric day hospital in Hong Kong between July 2009 and June 2010 were screened for inclusion. All of those approached agreed to participate. The inclusion criteria were: (1) aged between 18 and 65 years; (2) Chinese descent with the Cantonese dialect as mother tongue; (3) diagnosis of schizophrenia according to DSM-IV criteria (APA, 1994); (4) duration of illness of at least 5 years; (5) availability of at least one informant (a family member or other caregiver such as a social worker) to corroborate the socio-demographic and clinical data; (6) being literate and able to understand the study requirements; and (7) willingness and ability to give informed consent for participation. The exclusion criteria were (1) co-morbid psychiatric diagnoses; (2) electroconvulsive treatment in the past 12 months; (3) history of alcohol and/or substance abuse in the past year; and (4) significant medical condition(s) requiring ongoing treatment (e.g., diabetes mellitus, hypertension). The latter patients were excluded to avoid the potentially confounding effects of a medical condition and its treatment on a participant's cognitive performance.

2.2. Measures

All participants were interviewed to collect basic socio-demographic and clinical data, including sex, age, education level, age at onset, and length of illness.

Psychopathology was assessed with the Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987), which comprises 30 items subsumed into four subscales. PANSS took 30 min to complete. The PANSS+ and PANSS− subscales were used for statistical analysis.

Neuropsychological measures included PM, retrospective memory, and general intelligence expressed as IQ. PM was assessed with the Chinese version of the Cambridge Prospective Memory Test (CAMPROMPT-C; Lou et al., 2009), which is a validated standardized PM measure translated from the original English version of CAMPROMPT (Wilson et al., 2005). In this study, only Form A of CAMPROMPT-C was used. The test lasted for about 25 min. Participants were asked to work on a number of tasks ("ongoing activity") on paper-and-pencil worksheets comprising general knowledge quizzes or word-finding puzzles. While engaging in the ongoing activity by filling out the worksheets, they also had to perform three EBPM and TBPM tasks each (Table 1). The last TBPM task was performed 5 min after the quiz. Participants were rated on each PM task on a scale ranging from 0 (worst) to 6 (optimal) in accordance with the standard CAMPROMPT rating schedule (Wilson et al., 2005). The total score ranges from 0 to 36, and the two subscale scores range from 0 to 18.

Retrospective memory was measured by the delayed prose recall subtest of the Chinese version of the Rivermead Behavioral Memory Test (RBMT-C; Man and Li, 2002), which was translated from the original English version of the RBMT and validated (Wilson et al., 1991). The RBMT is a psychometric memory test using analogs of everyday situations. For the delayed prose recall subtest, a short passage is read out to the subject. Then, after 15 min and with no second reading, the subject is asked to recall as much of the passage as possible. Each correctly recited idea receives one point, for a maximum score of 21.

IQ was evaluated by the Test of Nonverbal Intelligence – Third Edition (TONI-3; Brown et al., 1997), a language-free intelligence test that measures abstract/figural problem-solving ability and is suitable for participants aged between 6 and 89 years. It can be administered by psychologists, psychological associates, teachers, or any qualified professionals who follow the guidelines in the manual. A 45-item picture book (one item per page arranged in order of difficulty) was presented to participants, who selected an answer from the picture on each page. The test continued until a scoring ceiling was reached – three incorrect answers in five consecutive items. A raw score was obtained by counting the number of correct responses between item 1 and the ceiling item. This raw score was then checked against an age norm table to obtain a deviation quotient for use in statistical analysis.

Functional skill level was measured by the Chinese version of the Functional Needs Assessment (FNA-C; Law, 1999), which was adapted from the original FNA and validated in Hong Kong (Dombrowski et al., 1990). The FNA-C is a performance-based assessment of psychiatric patients' daily living skills, and requires participants to carry out calculations, identify money (notes and coins), describe community facilities from photographs, etc. The test lasts for about 25 min. It comprises 26 items, each with five sub-items. Each sub-item is rated dichotomously (0 for inability to perform or 5 for ability to perform). Each item sum score ranges from 0 to 25. There are two subscales, self-care (SC) and community living