Functional Significance of Prospective Memory in Schizophrenia and Bipolar Disorder

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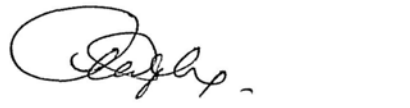
DECLARATION OF ORIGINALITY

I hereby declare that the work contained in this dissertation is entirely original and written by me. I designed the research protocol, conducted the study, performed the statistical analyses and wrote the thesis. This thesis embodies my own independent research, except where acknowledged otherwise in the text. No part of this thesis has been submitted to other universities or institutions for the purpose of obtaining a degree or a diploma.

Candidate: 

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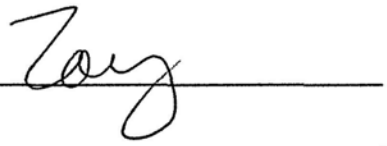
Supervisor: 

Professor Wai Kwong TANG

PUBLICATIONS

Journal papers

During my study period, 2007 to 2011, the three following papers were published in or submitted to international journals.

1. **Au, R.W.**, Shum, D., Man, D., Lee, E., Xiang, Y.T., Ungvari, G.S., Tang, W.K. Assessment of prospective memory in schizophrenia using the C-CAMPROMPT: A controlled study. *The Clinical Neuropsychologist* (submitted).

2. Zhou, F.C., Xiang, Y.T., Wang, C.Y., **Au, R.W.**, Zhou, J.J., Shum, D., Chiu, F.K., Man, D., Lee, E., Chan, R.C., Ungvari, G.S. Characteristics and clinical correlates of prospective memory performance in first-episode schizophrenia. *Schizophrenia Research* (submitted).

3. Lee, E., Xiang, Y.T., Man, D., **Au, R.W.**, Shum, D., Tang, W.K., Chiu, H.F., Wong, P., Ungvari, G.S. (2010). Prospective memory deficits in patients with bipolar disorder: A preliminary study. *Archives of Clinical Neuropsychology,* 25(7), 640-647.

Conference presentation

I have made one presentation at and submitted a free paper to international conferences:

1. Lee, E., Xiang, Y.T., Man, D., **Au, R.W.**, Shum, D., Tang, W.K., Chiu, H.F., Wong, P., Ungvari, G.S. Time-based and event-based prospective memory performance in Chinese patients with bipolar affective disorder. CINP World Congress, June, 2010, Hong Kong SAR.

2. **Au, R.W.**, Shum, D., Man, D., Lee, E., Xiang, Y.T., Ungvari, G.S., Tang, W.K. Using the C-CAMPROMPT to assess prospective memory in schizophrenia: A comparison study of schizophrenia patients and healthy participants. The 2011 IMH Conference, September, 2011, Hong Kong SAR.

ABSTRACT

Background – Prospective memory (PM), defined as the memory for undertaking activities in the future, is a relatively new construct. To date, only a few studies have reported impaired PM in schizophrenia. However, there is a dearth of studies on PM in bipolar disorder (BAD), and the functional implications of PM impairment have yet to be investigated in these patient groups.

Aims – This study applied the Chinese version of the Cambridge Prospective Memory Test (C-CAMPROMPT), a standardized psychometric test, to compare PM performance and its associated factors in schizophrenia and BAD patients and normal controls. In addition, the study explored the functional significance of PM in these two cohorts of patients.

Method – The sample for comparison of PM performance and its associated factors comprised 44 clinically stable

schizophrenia and BAD patients each and 44 normal controls. To determine the functional significance of PM in patients, the BAD group was extended to 76 to increase the statistical power of the study. All subjects' socio-demographic characteristics, PM, retrospective memory (RM), and Intelligence quotient (IQ) were measured, and the patients' clinical condition and level of community living skills (CLS) were also rated with standardized assessment instruments. Statistical analyses included analysis of variance (ANOVA), analysis of covariance (ANCOVA), correlational analyses, and multiple linear regression analyses.

Results – Both patient groups performed significantly worse than the normal controls on the C-CAMPROMPT. The schizophrenia patients performed significantly worse than the BAD patients in the event-based subscale of the C-CAMPROMPT. PM impairment was associated with IQ, RM, and education in schizophrenia and with depressive symptoms, RM, and age in BAD. CLS predicted PM

performance in both patient groups after controlling for the potentially confounding effects of sex, age, education, RM, IQ, and psychiatric symptoms.

Conclusion – This study was the first to administer the C-CAMPROMPT, a standardized psychometric test, to assess PM in schizophrenia and BAD. Its results confirm the presence of PM impairment in both major psychoses. The functional impact of PM has important clinical implications for psychiatric practice.

Keywords: Schizophrenia; Bipolar disorder; Prospective memory; Retrospective memory.

論文摘要

研究背景：前瞻性記憶（PM）定義爲執行未來活動的一種內存，它是一個相對較新的概念。迄今爲止，只有少量的研究報告指出精神分裂症病患存在前瞻性記憶的受損。然而，對躁狂抑鬱症的相關研究卻非常貧乏。另外，前瞻性記憶如何影響這些患者群體的社區生活技能的證據也欠奉。

研究目的：劍橋前瞻性記憶測驗中文版 (C- CAMPROMPT) 是一個標準化的心理測驗。本研究應用 C- CAMPROMPT 到精神分裂症患者，躁狂抑鬱症患者和正常對照組以比較他們的前瞻性記憶表現，並找出與前瞻性記憶相關的臨床因素。此外本研究更探討前瞻性記憶如何影響患者群的社區生活技能。

研究方法：對於比較前瞻性記憶的表現及相關因素的研究樣本包括臨床穩定的精神分裂症患者和躁狂抑鬱症患者各 44 位，另外加上 44 位正常對照組。在探討前瞻性記憶如何影響患者群的社區生活技能時，躁狂抑鬱症患者擴展至 76 人以增加此研究的統計力量。程序包括紀錄研究對象的個人資料並測試他們的前瞻性記憶（PM），回顧性記憶（RM）及智商 （IQ）。除以上的測試外，更以標準化的評估工具來評定病患的病情及社區生活技能。統計方法包括方差分

析，協方差分析，相關分析和多元線性回歸分析。

研究結果：兩個病人組的 C - CAMPROMPT 表現都顯著差於正常對照組。精神分裂症患者在 C- CAMPROMPT 中的基於事件的前瞻性記憶 (Event-based PM) 表現差於躁狂抑鬱症患者。精神分裂症患者的 PM 與 IQ，RM 和 教育 (Education) 有關聯，而躁狂抑鬱症患者的 PM 與 抑鬱水平 (Depressive symptoms) ，IQ 和 RM 有關聯。在控制了潛在的影響因素如性別，年齡，教育水平，智商和精神症狀後，前瞻性記憶能預測精神分裂症和躁狂抑鬱症患者的社區生活技能。

研究結論：本研究是首個研究應用 C – CAMPROMPT (一個標準化的心理測驗) 以評估精神分裂症和躁狂抑鬱症患者前瞻性記憶，並確認了這些患者的前瞻性記憶的確受損。前瞻性記憶對精神病患的社區生活技巧的影響，更應趕緊探索對前瞻性記憶的臨床治療。

關鍵字：精神分裂症; 躁狂抑鬱症; 前瞻性記憶; 回顧性記憶

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LIST OF ABBREVIATIONS

PM	Prospective Memory
TBPM	Time-based Prospective Memory
EBPM	Event-based Prospective Memory
RM	Retrospective Memory
BAD	Bipolar Disorder (Bipolar Affective Disorder)
SCHIZ	Schizophrenia
NC	Normal Controls
PANSS +	Positive subscale of the Positive and Negative Symptoms Scale (PANSS)
PANSS -	Negative subscale of the Positive and Negative Symptom Scale (PANSS)
PANSS general	General subscale of the Positive and Negative Symptom Scale (PANSS)
HDRS	Hamilton Depression Rating Scale

YMRS	Young's Mania Rating Scale
C-CAMPROMPT(TBPM)	Time-based PM score of the Chinese version of the Cambridge Prospective Memory Test
C-CAMPROMPT(EBPM)	Event-based PM score of the Chinese version of the Cambridge Prospective Memory Test
C-CAMPROMPT(PM Total)	Total score of the Chinese version of the Cambridge Prospective Memory Test
C-RBMT	Chinese version of the Rivermead Behavioural Memory Test (sum of immediate recall and delayed recall)
TONI-3	Test of Nonverbal Intelligence-Third Edition
ADL	Activities of daily living
CLS	Community living skills
CFNA	Chinese version of the Functional Needs

	Assessment
CFNA_SC	Self care subscale of the Chinese version of the Functional Needs Assessment
CFNA_CL	CLS subscale of the Chinese version of the Functional Needs Assessment

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CHAPTER 1

INTRODUCTION

Prospective memory (PM), that is, the memory involved in remembering to undertake activities in the future (Einstein & McDaniel, 1990), is a relatively new construct. Compared to retrospective memory (RM) – remembering things in the past – studies paid little attention to PM until the 1980s (Harris & Morris, 1984a). The body of research on PM has expanded over the past decade (Kvavilashvili & Ellis, 1996; McDaniel, 2007).

PM clearly has major implications for daily life. A common assumption is that many life events are related to and depend on PM (Ceci & Bronfenbrenner, 1985; Dobbs & Rule, 1987; Meacham & Leiman, 1982). Relevant examples include remembering to attend appointments, cash checks, turn off electrical appliances or the gas, etc. Sixty-two

percent of participants in memory training classes in a mid-sized German town over a two-year period complained of PM problems relating to their daily life (Kliegel & Martin, 2003). In short, PM appears very relevant to the daily living environment.

PM seems to be even more important for individuals with a variety of neuropsychiatric disorders (Kliegel et al., 2008c). Individuals with diminished PM ability may suffer embarrassment or frustration on a daily basis, and those with neuropsychiatric conditions associated with PM impairment can face insurmountable difficulties in everyday life. It is quite obvious that research into PM in various neuropsychiatric disorders will have important clinical and rehabilitation implications.

Schizophrenia and bipolar affective disorder (BAD) are two neuropsychiatric conditions that commonly involve cognitive impairment (Mayberg et al., 2002; Tamminga et al., 2002), and PM impairment has also been postulated to exist in those so affected (Shum et al., 2001).

In sum, PM is a relatively new construct, and the related research is gradually growing. Given that our understanding of the cognitive aspects of schizophrenia and BAD remains limited, an investigation of PM in these disorders is clearly warranted. The next chapter provides a detailed overview of the research data available to date to frame the current investigation.

CHAPTER 2

LITERATURE REVIEW

In this chapter, the PM concept and empirical studies of schizophrenia and BAD are reviewed. In addition, the functional significance of PM, with particular reference to both patient groups, is outlined. Finally, a review of PM assessments is given.

2.1. The definition and concept of prospective memory

PM is defined as memory for activities to be performed in the future (Einstein & McDaniel, 1990; Einstein et al., 1995). Examples related to clinical situations include remembering to take medication in a timely fashion or to attend a medical follow-up appointment.

PM usually requires the formation and later realization of intentions that must be delayed for minutes, hours, or days (Brandimonte et al., 1996). To give a more detailed account, PM can be divided into phases: the encoding of an intention, retention of this information, retrieval of the intention, execution of the intention, and evaluation of the outcome (Einstein & McDaniel, 1996; Ellis & Freeman, 2008). In the ***encoding*** phase, a person registers an intention comprising three components, namely, the WHEN (retrieval criterion), the WHAT (action to be performed), and the THAT (intent or decision to act). The ***retention*** phase constitutes a period of delay during which the person is usually engaged in an ongoing activity unrelated to the intention. This phase can vary from minutes to weeks, during which the intention representation must be retained until an opportunity or the need to act on the intention occurs. In the ***retrieval*** phase, the person recognizes that the situation and timing to carry out the intended action are appropriate. In the ***execution*** phase, the person carries out the intended action. Finally, in

the ***evaluation*** phase, the person identifies that the intended action was successfully implemented or needs to be re-planned. The five phases of PM are summarized in Figure 1.

Figure 1. Five phases of prospective memory

PROSPECTIVE MEMORY				
Encoding	Retention	Retrieval	Execution	Evaluation
• Intention forming: ➢ What to do ➢ When to do it ➢ That (decision to do)	• Delay of intention	• Recognition of the opportunity/ need to act	• Execution of intended action	• Successful action or re-planning of the action

2.2. Prospective memory and retrospective memory

Retrospective memory (RM) is the memory of people, words, and events encountered, experienced, or told/mentioned in the past (Baddeley et al., 2009). Various traditional forms of memory such as short-term and long-term memory (Squire et al., 1993) and declarative and non-declarative memory (Stern & Sackeim, 2002) are subsumed under the broad concept of RM.

However, the distinction between PM and RM is not clear-cut. As can be seen in Figure 1, PM involves an RM component in the encoding and retention phases. Searleman and Herrmann (1994) contrasted these two concepts of memory as follows: (i) RM is related to ***past*** information, whereas PM is concerned with ***future*** tasks; (ii) RM is about ***what*** is remembered, whereas PM is concerned with ***when (or if)*** something is to be done; and (iii) individuals are usually asked to ***recollect*** something in RM tasks, but PM requires them to determine the ***right time*** to

act.

2.3. Types of prospective memory tasks

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

Kvavilashvili and Ellis (1996) proposed a third type of PM task, namely, activity-based PM, which involves the retrieval of an intended action based on the appearance of an external cue at the end of an activity. Examples include switching off the oven after cooking or turning off the light when leaving a room. Nevertheless, activity-based PM is considered to be similar to EBPM (Smith, 2008).

2.4. The mechanisms proposed to explain prospective memory

A number of attempts have been made to explain the mechanisms of PM or, more precisely, how PM retrieval occurs, and several theories have been put forward in the literature.

The Preparatory Attentional and Memory Processes Theory (Smith, 2003, 2008; Smith & Bayen, 2004), for example, proposes that the success of PM performance depends on two interacting processes – the preparatory attentional and RM processes. The former is a continuous strategic monitoring process that involves checking the environment for cues for PM tasks, whereas the latter is responsible for the recollection of the intended action and the intention criteria.

The Multiprocess Model (Einstein et al., 2005; McDaniel & Einstein, 2000; McDaniel et al., 2004) argues that PM

retrieval relies on either strategic monitoring or automatic processes. The strategic processes may involve continuous monitoring or periodic checks for PM cues. The automatic processes may be simply attention to salient/distinctive PM cues, associative memory, or context-free recognition. Several factors determine which process is activated. They include the importance of PM tasks and the parameters of PM cues, as well as the ongoing task, planning the PM tasks, and individual differences related to personality styles.

The Retrieval Mode and Target Checking Theory (Guynn, 2003, 2008) is an elaboration on monitoring that comprises two processes. The retrieval mode is an ongoing mental process that compares environmental stimuli with stored intentions, whereas target checking is a mental process that involves looking for PM targets in the environment on an intermittent basis. When PM retrieval is mediated by monitoring, either of these processes or simply the retrieval mode may be involved.

2.5. Neuroanatomical involvement in prospective memory

Neuroimaging studies targeting PM point to the involvement of the prefrontal lobes, particularly the Brodmann Area 10 (Burgess et al., 2008), with evidence provided by both positron emission tomography (Burgess et al., 2001, 2003; Okuda et al., 2007) and functional magnetic resonance imaging (fMRI) (Reynolds et al., 2009; Simons et al., 2006). These studies examined healthy subjects performing PM tasks during neural activation of the cerebral cortex.

Ventricular enlargement and abnormalities of the medial temporal, frontal, and parietal lobes and subcortical areas are common findings in schizophrenia (Shenton et al., 2001). Prefrontal lobe pathology in schizophrenia has also been confirmed in fMRI (Dumontheil et al., 2008; Harrison, 1999; Rose et al., 2006; Thermenos et al., 2005; Yamada et al., 2007) and post mortem studies (Vogeley et al., 2003).

There is substantial overlap between BAD and schizophrenia with respect to pathology in the right hemisphere, particularly the prefrontal cortex, thalamus, left caudate, left medical temporal lobe, and right insula, whereas the left hemisphere involvement of the left insula and amygdale is characteristic only of schizophrenia (Yu et al., 2010). Dorsal lateral prefrontal cortex pathology in BAD has also been repeatedly reported (Beyer & Krishnan, 2002; Marvel & Paradiso, 2004).

2.6. Prospective memory and schizophrenia

2.6.1. Cognitive and memory deficits in schizophrenia

Schizophrenia patients have been found to exhibit deficits in a wide range of cognitive processes such as learning, memory, and executive function (Barch & Barch, 2005; Heinrichs & Zakzanis, 1998; Holmen et al., 2010; Jeste et al., 2003; Sharma et al., 2003), although these

neuropsychological impairments have been reported to be relatively stable over time (Friedman et al., 2001a; Rund, 1998) during different phases of the illness (Han et al., 2010; Riley et al., 2000; Sponheim et al., 2010).

Memory is an important aspect of cognitive functioning that has received considerable attention from psychologists, psychiatrists, and neuroscientists for obvious theoretical and practical reasons. First, memory deficits are commonly observed in patients with severe psychiatric illnesses. It is thus important to understand the nature, type, and severity of memory problems in this severely disabled patient population because memory impairment can hinder treatment and rehabilitation, thereby preventing their eventual return to the community to lead a fulfilling life. Second, compared to other cognitive functions, the study and assessment of memory benefit from standardized tests constructed from well-established theories.

2.6.2. Prospective memory in schizophrenia and its correlates

To date, there have been 18 reports of PM and its correlates in schizophrenia (Altgassen et al., 2008; Chan et al., 2008b; Elvevag et al., 2003; Henry et al., 2007; Kondel & Kondel, 2002; Kumar et al., 2005, 2008; Meissner et al., 2001; Ritch et al., 2003; Shum et al., 2004; Twamley et al., 2008; Ungvari et al., 2008; Wang et al., 2007, 2008, 2009, 2010b; Woods et al., 2007; Xiang et al., 2010b). PM impairment in schizophrenia was first reported in two open studies (Johnson, 1999; Ritch et al., 2003). Subsequently, two relatively small-scale studies employing normal controls (Elvevag et al., 2003; Meissner et al., 2001) confirmed PM deficit in this population group. More recently, more extensive studies (Shum et al., 2004; Ungvari et al., 2008) with sample sizes of 60 and 110, respectively, have added further evidence, and a recent meta-analysis also confirmed PM impairment in schizophrenia (Wang et al., 2009).

Several studies have attempted to identify the underlying mechanisms of PM deficit in schizophrenia. Kondel and Kondel (2002) hypothesized that the intact executive function of recalling specific intentions is an essential prerequisite for PM, a hypothesis supported by the work of Henry et al. (2007) and Woods et al. (2007). Elvevag et al. (2003) posited that source monitoring and temporal discrimination contribute to PM impairment, whereas Woods et al. (2007) attributed it to cue detection and the self-initiated retrieval components of future intention execution. Altgassen et al. (2008) reported that RM contributes to but cannot not fully explain PM. The relationship between frontal lobe function (the ability to recognize cues recognition and carry out an intended action on time) and PM has been reported by a number of researchers (Kumar et al., 2005; Shum et al., 2004; Woods et al., 2007). Some have found schizophrenia patients to have worse TBPM than EBPM (Shum et al., 2004; Wang et al., 2008), whereas others have not (Henry et al., 2007;

Woods et al., 2007). Wang et al. (2007) suggested that PM may be considered a potential endophenotype of schizophrenia.

Several studies have examined the correlates of PM in schizophrenia (Henry et al., 2007; Kumar et al., 2005, 2008; Shum et al., 2004; Twamley et al., 2008; Ungvari et al., 2008; Wang et al., 2007, 2008, 2010b; Woods et al., 2007; Xiang et al., 2010b), with several of them documenting an association between PM and the prefrontal functions (Kumar et al., 2008; Shum et al., 2004; Ungvari et al., 2008; Wang et al., 2008). Intelligence quotient (IQ) and RM (Henry et al., 2007; Twamley et al., 2008; Wang et al., 2008), age (Ungvari et al., 2008; Woods et al., 2007), and the duration of illness (Wang et al., 2008) have also been identified as correlates of PM. The relationship between PM and psychopathology, however, remains somewhat equivocal (Kumar, et al., 2005, 2008; Ungvari et al., 2008; Wang et al., 2007; Woods et al., 2007).

All of the aforementioned studies except two (Twamley

et al., 2008; Woods et al., 2007) employed experimental tests without psychometric properties and thus have questionable ecological validity. Moreover, the wide variation in the assessment methods adopted render comparison of their findings rather difficult. This wide variation may explain the differences reported in the level of difficulty between TBPM and EBPM (Henry et al., 2007; Shum et al., 2004; Wang et al., 2008; Woods et al., 2007), for example. Furthermore, with the exception of five reports (Altgassen et al., 2008; Kumar et al., 2008; Shum et al., 2004; Ungvari et al., 2008; Xiang et al., 2010b), most of these studies did not elaborate on the selection of subjects (e.g., sampling method or inclusion/exclusion criteria). Only a few studies (Twamley et al., 2008; Ungvari et al., 2008; Wang et al., 2008; Xiang et al., 2010b) controlled for covariants in identifying the variables associated with PM. Two studies (Kondel & Kondel, 2002; Ritch et al., 2003) did not use normal controls for comparison, and another two (Kumar et al., 2005, 2008) examined acutely ill psychotic

patients, many of whom could not recall the PM task. Hence, their PM impairment may have been confounded by RM.

2.7. Prospective memory and bipolar affective disorder

2.7.1. Cognitive and memory deficits in bipolar affective disorder

People suffering from BAD also display a variety of neuropsychological impairments even in remission (Arts et al., 2008; Ferrier et al., 1999; Jones et al., 1994; Martinez-Aran et al., 2004a; Marvel & Paradiso, 2004; Quraishi & Frangou, 2002; Robinson et al., 2006; Robinson & Travella, 2003; Sachs et al., 2007). These deficits are quite similar to those found in schizophrenia (Hill et al., 2008; Jabben et al., 2009; Jeste et al., 2003; Sharma et al., 2003), although they are usually less severe (Krabbendam et al., 2005; Maier et al., 2006; Quraishi & Frangou, 2002;

Stefanopoulou et al., 2009).

Memory problems and the way in which they are related to daily functioning are equally pressing issues for BAD and schizophrenia patients.

2.7.2. Prospective memory in bipolar affective disorder

There is a lack of research on PM in BAD, and only a few studies have investigated PM in depression. An early attempt failed to find a relationship between low mood and PM in 101 university students (Harris & Menzies, 1999), although in another study, 14 university students reporting a low mood were found to exhibit poorer PM performance relative to 48 euthymic students (Kliegel et al., 2005). A large-scale study involving 404 elderly people found no association between mood and PM performance (Livner et al., 2008), whereas Jeong and Cranney (2009) documented PM difficulties in 40 university students. Although these studies reported inconsistent findings with regard to low

mood and PM, they did not examine clinical samples of depressed patients.

In research comparing the PM performance of clinically depressed patients and normal controls, Rude et al. (1999) and Altgassen et al. (2009) found PM deficits in the former, whereas Zhang et al. (2009) reported negative findings in this regard. A recent project carried out by the thesis author and his colleagues (Lee et al., 2010) is to date the only published study on BAD. We found the patient group to exhibit worse TBPM performance than normal controls. In multivariate analysis, depressive symptoms, age, and RM were all found to contribute to the patients' relatively poor PM performance.

Studies of PM in BAD or depression are few compared to those of schizophrenia. Of those that do exist, four did not involve clinical samples (Harris & Menzies, 1999; Jeong & Cranney, 2009; Kliegel et al., 2005; Livner et al., 2008). Three others did consider clinically depressed subjects (Altgassen et al., 2009; Rude et al., 1999; Zhang et al.,

2009), but their PM assessments were non-standardized and lacked psychometric properties. Moreover, they were limited by their small sample size, unclear subject selection procedures, and the use of only subjective reports of depressive symptom severity. As previously noted, Lee et al. (2010) were the first to investigate BAD patients in this arena, but to date there has been no comparison of a BAD/depressed cohort with schizophrenia patients.

2.8. Functional significance of prospective memory

2.8.1. Community living skills construct and significance

The term "community living skills" (CLS) is used synonymously in the literature with such terms as "life skills", "independent living skills", "activities of daily living" (ADL), and "daily living skills". Brown and Munford (1983) and Hayes (1989) defined CLS as skills that are utilized to function independently in the community. Townsend and

Ryan (1991) elaborated further upon the meaning of community living, opining that it is related to participation in and contribution to every aspect of civic and economic life, including employment, community enrichment, sports, and recreational and leisure activities. May et al. (1985) and Orgen (1983) further delineated CLS by using the term to refer to the skills deemed essential to cope with the tasks of daily life, which, in the case of psychiatric patients, prevent hospital readmission. On the whole, CLS can be defined as the practical skills that allow a person to independently maintain a civic and economic life outside the hospital.

There are variations in the definition of CLS. In a broad sense, it covers the skills required for self-care, home-making, community life, occupational life, and leisure (Dever, 1988; Moss, 1990), and it thus overlaps with other functional concepts such as occupational functioning. In a more specific sense, CLS include management of the living area, budgeting, and nutrition, as well as the ability to relate to neighbors, community officials (e.g., police

officers), and other significant local figures such as shopkeepers (May et al., 1985; Smith et al., 1996).

2.8.2. Cognitive functions and community living skills

In a systematic review, Green (1996) found functional outcomes in schizophrenia to be associated with memory, but not with psychiatric symptoms. Several studies have identified a correlation between CLS and composite scores of cognitive functioning (Bowie et al., 2010; Patterson et al., 1998; Velligan et al., 1997). More specific relationships between CLS and cognitive functioning, such as memory and executive functioning, have also been reported (Dickinson & Coursey, 2002; McClure et al., 2007; Rempfer et al., 2003; Zabala et al., 2010) and confirmed by both a meta-analysis (Green et al., 2000) and a review paper (Sharma et al., 2003). Twamley et al. (2002) even found memory to be more predictive of CLS than executive functions, a finding supported by the review of longitudinal

studies carried out by Green et al. (2004).

Research into the association between CLS and cognitive function in BAD has not been as thorough in methodological terms as the corresponding literature on schizophrenia. It has primarily depended on the use of a global index of functioning, with the exception of two studies that employed a CLS measure (Bartels et al., 1997; Bowie et al., 2010). Tabares-Seisdedos et al. (2008) reported a correlation between a composite index of cognitive function and a global index of functioning, and both cross-sectional (Jabben et al., 2010; Martinez-Aran et al., 2004a, 2007; Wingo et al., 2009) and longitudinal research (Bonnin et al., 2010; Jaeger et al., 2007; Martino et al., 2009) has confirmed that both memory and executive functioning are predictive of global functioning in BAD.

2.8.3. Empirical evidence of functional significance of prospective memory

The aforementioned correlational studies demonstrate the importance of cognitive functions, particularly memory and executive functions, for the successful community living of patients with schizophrenia and BAD. However, none of these studies included PM as a predictor of CLS because it is a relatively new construct compared to other neurocognitive functions.

As a neuropsychological function, however, PM can be expected to play a role in these patients' community living ability. Uttl et al. (2001) posited that CLS has two components, RM and PM, whereas Guimond et al. (2006) hypothesized that comprises four – planning, PM, working memory, and RM. In fact, the link between PM and CLS is assumed, but has not yet been proved.

To date, only a few studies have examined the relationship between CLS and PM in schizophrenia (Ritch et al., 2003; Twamley et al., 2008; Ungvari et al., 2008; Xiang et al., 2010a), and none has considered this relationship in BAD. Employing stepwise multiple regression in a sample of

50 schizophrenia patients, Ritch et al. (2003) found that PM and memory accounted for 29% of the variance in scores on a performance-based measure of ADL. Twamley et al. (2008) also applied multiple regression in 58 outpatients with schizophrenia and schizoaffective disorder and found that PM (particularly EBPM) predicts functioning in the areas of finance and communication. Ungvari et al. (2008) and Xiang et al. (2010a), however, were unable to confirm any correlation between PM and ADL measures.

Preliminary evidence for the significance of PM in CLS exists for other neuropsychiatric conditions. For example, comparing 10 subjects with temporal lobe lesion with 12 normal controls, Fortin et al. (2003) found that strategic planning and PM underpin impairment in CLS. In a group of 66 Human Immunodeficiency Virus (HIV) infected persons, Woods et al. (2008b) identified a significant correlation between PM and a self-reported CLS measure.

As previously noted, the functional significance of PM in schizophrenia remains uncertain, and there are no data

concerning BAD in this arena. Given the expected relationship between PM and CLS, further studies are clearly warranted.

2.9. Instrumentation in prospective memory assessment

2.9.1. Experimental tasks

Most studies of PM in schizophrenia have adopted the dual-task experimental paradigm (Einstein et al., 1995), in which subjects are engaged in an ongoing assignment while required to perform PM tasks. The most commonly employed method is a paper-and-pencil test with general knowledge questions and PM tasks embedded in between (Altgassen et al., 2008; Kumar et al., 2005). Other investigations have adopted a computer-based method (Shum et al., 2004; Ungvari et al., 2008; Wang et al., 2007, 2008), in which subjects answer general knowledge

questions on a computer screen while, at the same time, they are required to respond to a number of PM tasks at a specific time (TBPM) or when a cue appears on the screen (EBPM). Kumar et al. (2008) assessed PM in the context of daily activities. While performing their usual daily activities, subjects were interrupted with specific cues for PM or were asked to remember to perform certain tasks at a specific time. Other investigators have developed similar PM tasks as part of a computer game (Elvevag et al., 2003; Henry et al., 2007). There are considerable variations in assessments across studies, however, and, more importantly, the experimental tasks therein lack psychometric properties.

2.9.2. Questionnaires

Chan et al. (2008b) used the Prospective and Retrospective Memory Questionnaire (PRMQ; Crawford et al., 2003; Roche et al., 2002; Smith et al., 2000), which is a measurement of subjective PM problems. The PRMQ

comprises eight items each for PM and RM.

The Prospective Memory Questionnaire (PMQ; Hannon et al., 1995) comprises 52 questions that evaluate only the PM construct. It is divided into four subscales, namely, the frequency of (1) forgetting short-term habitual intentions, (2) long-term episodic intentions, and (3) internal cued intentions and (4) the use of a strategy. The PMQ is the only questionnaire to assess strategy use.

The Comprehensive Assessment of Prospective Memory (CAPM; Waugh, 1999) contains 39 questions about respondents' daily living situation and tests only for PM. It evaluates the frequency of forgetting, the severity of memory errors, and the reasons for memory failure.

2.9.3. Standardized psychometric assessments

Questionnaires based on the subjective complaints of patients may be inconsistent with objective measures (Chan et al., 2008b), and non-standardized tests render

objective comparison across studies difficult. Moreover, non-psychometric tests can bias observations by imposing unnecessary measurement errors (Portney & Watkins, 1993).

To date, there is a paucity of standardized psychometric tests for PM assessment. The Rivermead Behavioural Memory Test (RBMT; Wilson et al., 1991) is an early standardized test that includes two PM items, but its dominant aim is to evaluate RM. Hence, the two PM items are rather simple, and the RMBT is thus considered insufficient to measure this type of memory reliably.

The Memory for Intentions Screening Test (MIST; Raskin, 2004; Shum et al., 2002) is a 30-minute-long standardized test featuring eight PM tasks that are evenly divided into time- and event-based categories. Four of these PM tasks require verbal responses, whereas the other four require an action. The MIST is reported to have satisfactory internal consistency and construct validity (Carey et al., 2006; Woods et al., 2008a).

The Cambridge Prospective Memory Test (CAMPROMPT; Wilson et al., 2005) consists of three event-based and three time-based PM tasks designed to simulate routine daily activities. It has a high degree of ecological relevance for people with neuropsychiatric conditions living in the community. Its ongoing activities include general knowledge quizzes and word-finder puzzles in a paper-and-pencil format, and the assessment lasts about 25 minutes. The CAMPROMPT has proved to be sufficiently sensitive to differentiate healthy individuals from those with neurological disorders such as traumatic brain injury and stroke (Wilson et al., 2005). The test has normative data on healthy people aged above 16 and a test-retest reliability of 0.64 (Wilson et al., 2005). It has also demonstrated good construct validity against the RBMT (Wilson et al., 1985), which has both RM and PM components. The CAMPROMPT also has a significant relationship with attention, executive processing, and the speed of verbal information processing.

The Chinese version of the CAMPROMPT (C-CAMPROMPT;

Chan et al., 2008a; Lou et al., 2009) was adapted through standard forward and backward translations, the face validity of which were ensured via an expert review. The C-CAMPROMPT has been shown to demonstrate very good reliability (test-retest, $r > .87$; inter-rater, $r > .70$; split half, $r > .81$), internal consistency, (Cronbach's alpha $> .73$), and criterion validity (Lou et al., 2009). It also enjoys good correlation with the Chinese versions of the RBMT (Man & Li, 2001) and the Stroop Word-Color Test (Lee & Chan, 2000).

The C-CAMPROMPT has a manual with standardized procedures for administering and scoring the test. Like the original English version, it has two equivalent versions, Form A and B, and the whole test lasts for about 25 minutes. The ongoing activity component requires subjects to reply to a number of questions that involve identifying famous people, recognizing common festivals, filling in Chinese idioms, and doing simple logical tasks. At the same time, they have to perform three TBPM and three EBPM tasks (Figure 2). Subjects are allowed to choose their own

strategies, such as taking notes, to help their memory functions. Two TBPM tasks are cued with a countdown timer: (i) reminding the tester to phone the garage five minutes after completing the ongoing task and (ii) reminding the tester not to forget his or her keys seven minutes before its end. The third TBPM task is cued by a clock, and the subjects have to change tasks (skip the page they are working on and continue on the next page) nine minutes prior to ongoing task completion. The EBPM tests are as follows: (i) reminding the tester about five objects placed in different locations of the room when the tester says the ongoing task is over; (ii) giving a map to the tester when a question containing the words "great wall" is reached; and (iii) handing over an envelope when the tester says "five minutes left". Subjects are rated on each PM task on a scale ranging from 0 (worst) to 6 (optimal). Hence, the total score ranges from 0 to 36, and the subscales (EBPM and TBPM) range from 0 to 18.

Figure 2. Prospective memory tasks in C-CAMPROMPT

TBPM	EBPM
1. Skip the page he or she is working on and continue on the next page when 9 minutes remain before the end of the ongoing activity	1. Give a map to the tester when reaching a question containing the words "great wall"
2. Remind the tester about keys when 7 minutes remain	2. Give a message envelope to the tester when the tester says "5 minutes left"
3. Remind the tester to ring the garage 5 minutes after the ongoing activity ends	3. Remind the tester about five objects placed in different locations in the room when the tester says "the test is over"

CHAPTER 3

RATIONALE OF THE STUDY

The foregoing review of the literature raises several issues that need to be addressed. They include the rare use of standardized psychometric PM assessments and other methodological flaws in prior studies, as well as the equivocal evidence base concerning the functional implications of PM. This chapter provides a more detailed account of these concerns, thereby supporting the study's rationale.

3.1. The potential advantages of a psychometric prospective memory test

The assessment of PM in recent studies has been largely dependent on experimental tasks that are

non-standardized and lack psychometric properties, with the exception of two reports (Twamley et al., 2008; Woods et al., 2007), which poses questions about the reliability and validity of prior measurements as well as the difficulty of making cross-study comparisons.

Measurement errors are inevitable, but they can be controlled (Portney & Watkins, 1993). There are two fundamental types of measurement error, namely, random error and systematic error (Mishel, 1998), which pose problems for reliability and validity, respectively. Random errors usually arise from fluctuations in patients' condition, inter-rater inconsistency, or changes in the testing process (Crocker & Algina, 1986; Ottenbacher & Tomchek, 1993). A test's validity concerns what the test measures and how well it does so, and it tells us what can be inferred from the test scores (Anastasi & Urbina, 1997; Foster & Cone, 1995; Nunnally & Bernstein, 1994). If a test cannot measure, or only poorly measures, what it is supposed to measure, then systematic error will ensue.

Although Twamley et al. (2008) and Woods et al. (2007) employed a standardized test, that is, the MIST (Raskin, 2004), there is another standardized psychometric test, the aforementioned CAMPROMPT (Wilson et al., 2005), that has been validated in a Chinese population (the C-CAMPROMPT; Lou et al., 2009). As noted, the CAMPROMPT has a high degree of ecological relevance for people living in the community, but it has yet to be applied to patients with schizophrenia. Moreover, the C-CAMPROMPT enjoys better psychometric properties than the MIST, particularly with regard to internal consistency (Carey et al., 2006; Lou et al., 2009; Woods et al., 2008). These reasons led the author of this thesis to believe that the use of the C-CAMPROMPT would strengthen the robustness of PM research and promote its application in clinical practice in terms of developing treatment options and evaluating their outcome.

3.2. Methodological flaws in recent prospective

memory studies

The foregoing literature review points to several methodological concerns in recent PM studies. First, the clear and systematic recruitment of subjects is necessary. Second, the use of a standardized rather than self-report psychiatric measurement is clearly warranted. Third, the exclusion of acutely ill patients is important to avoid the potential confounding effect of RM loss on PM performance. Finally, it is of paramount importance that confounding demographical and clinical variables be controlled in coming to a better understanding of the factors associated with PM. Recent studies have confined themselves primarily to schizophrenia, and there is a shortage of PM research in BAD. Although recent studies in this field have compared patients to normal controls, comparison of schizophrenia with other nosological entities such as BAD will further our understanding of the mechanisms of PM.

3.3. The evidence on functional implications of prospective memory

The functional significance of PM has yet to be proved. Although preliminary reports of the relationship between PM and CLS in schizophrenia have been published (Ritch et al., 2003; Twamley et al., 2008), the functional measures adopted in these studies represent only part of the CLS construct. Moreover, the research results (Ungvari et al., 2008; Xiang et al., 2010a) have been conflicting. There is no related study in BAD. Given its potentially important clinical implications, the issues of relationship between PM and CLS clearly warrant further investigation in both schizophrenia and BAD.

CHAPTER 4

STUDY AIMS AND OBJECTIVES

Based on the literature review in Chapter 2, the aims of the study reported herein can be summarized as follows.

1. To assess the utility of the C-CAMPROMPT in schizophrenia and examine whether it can corroborate recent PM findings in this nosological group.
2. To explore the utility of the C-CAMPROMPT and examine its correlates in BAD.
3. To compare PM performance and correlates in schizophrenia and BAD cohorts.
4. To explore the functional significance of PM by determining its predictive ability on measures of CLS.

4.1. The C-CAMPROMPT and prospective memory in schizophrenia

4.1.1. Hypothesis 1

If the C-CAMPROMPT is sensitive enough to differentiate schizophrenia patients from normal controls, then the patients will perform worse than controls in the PM total and EBPM and TBPM task scores in the C-CAMPROMPT.

4.1.2. Hypothesis 2

The study also seeks to clarify the relationship between PM and patients' socio-demographic and clinical characteristics such as age, educational level, duration of illness, psychopathologies, IQ, and RM. In view of previous findings (Henry et al., 2007; Twamley et al., 2008; Wang et al., 2008), it is hypothesized that the PM total and EBPM and TBPM task scores of the C-CAMPROMPT will have significant

correlations with at least IQ and RM.

4.2. The C-CAMPROMPT and prospective memory in bipolar affective disorder

4.2.1. Hypothesis 3

If the C-CAMPROMPT is sensitive enough to differentiate between BAD patients and normal controls, then the patients will perform worse than controls in one or more of the PM total, EBPM, and TBPM tasks scores of the C-CAMPROMPT.

4.2.2. Hypothesis 4

As BAD and schizophrenia patients have similar cognitive impairments (Hill et al., 2008; Jabben et al., 2009; Jeste et al., 2003; Sharma et al., 2003), it is hypothesized that the PM total and EBPM and TBPM task scores of the

C-CAMPROMPT will have significant correlations with at least IQ and RM in BAD patients.

4.3. Prospective memory in schizophrenia and bipolar affective disorder

4.3.1. Hypothesis 5

With regard to the cognitive profiles of the two patient groups (Krabbendam et al., 2005; Quraishi & Frangou, 2002; Stefanopoulou et al., 2009), it is hypothesized that schizophrenia patients will perform worse than BAD patients on one or more of the PM total, TBPM, and EBPM tasks scores of the C-CAMPROMPT.

4.3.2. Hypothesis 6

Another objective of this study was to clarify the relationship between PM and its correlates in the two

cohorts of patients. As schizophrenia and BAD patients share a similar cognitive profile (Hill et al., 2008; Jabben et al., 2009; Jeste et al., 2003; Sharma et al., 2003), it is hypothesized that the PM scores on the C-CAMPROMPT will independently associate with IQ and RM in both patient groups.

4.4. The functional significance of prospective memory

4.4.1. Hypothesis 7

With regard to the functional significance of PM, it is hypothesized that one or more of the PM total, EBPM, and TBPM scores of the C-CAMPROMPT will predict the level of CLS in schizophrenia patients after controlling for the potential confounding effects of clinical, neuropsychological, and socio-demographic variables.

4.4.2. Hypothesis 8

It is also hypothesized that one or more of the PM total, EBPM, and TBPM scores of the C-CAMPROMPT will predict the level of CLS in BAD patients after controlling for the potential confounding effects of clinical, neuropsychological, and socio-demographic variables.

4.4.3. Hypothesis 9

In connection with recent studies of schizophrenia (Wang et al., 2009) and our previous findings on BAD (Lee et al., 2010), the final hypothesis is that TBPM and EBPM will differentially predict the level of CLS in schizophrenia and BAD patients after controlling for the potential confounding effects of clinical, neuropsychological, and socio-demographic variables.

CHAPTER 5

METHODS

5.1. Study design

A cross-sectional comparative study of 44 schizophrenia patients (SCHIZ), 44 BAD patients, and 44 normal controls (NC) was designed. The patients and controls were compared with respect to PM and other psychological factors and basic socio-demographic data. Correlational study was conducted to determine PM's predictive ability on the CLS measures. In this connection, the BAD group was extended to 76 to increase the statistical power.

5.2. Settings and subjects

All patients with a diagnosis of schizophrenia attending the Psychiatric Day Hospital at Shatin Hospital, Hong Kong SAR, between July 2009 and June 2010 were screened for inclusion in the study. None of the patients declined to participate. The inclusion criteria were: (1) aged between 18 and 65 years old; (2) both sexes; (3) Chinese descent with the Cantonese dialect as a mother tongue; (4) diagnosis of schizophrenia according to DSM-IV (APA, 1994); (5) duration of illness of at least five years; (6) availability of at least one informant (a family member or other caregiver, including a social worker) to corroborate socio-demographic and clinical data; and (7) being literate, able to understand the study requirements, and willing to give informed consent for participation. The exclusion criteria were: (1) co-morbid psychiatric diagnoses; (2) electroconvulsive treatment (ECT) given in the past 12 months; (3) recent history of alcohol and/or substance abuse; and (4) significant medical condition(s) requiring ongoing treatment (e.g., diabetes mellitus, hypertension).

For the BAD sample, 44 patients were recruited from the Li Ka Shing (Psychiatric) Outpatient Clinic from October 2008 to June 2009, and 32 patients were recruited from the Psychiatric Day Hospital at Shatin Hospital between July 2009 and September 2010. Patients who met the following inclusion criteria entered the study: (1) aged between 18 and 65 years; (2) both sexes; (3) Chinese descent with the Cantonese dialect as a mother tongue; (4) diagnosis of BAD according to DSM-IV (APA, 1994); (5) availability of at least one informant (a family member or other caregiver, including a social worker) to corroborate socio-demographic and clinical data; and (6) being literate, able to understand the study requirements, and willing to give informed consent for participation. The exclusion criteria were: (1) co-morbid psychiatric diagnoses; (2) ECT given in the past 12 months; (3) recent history of alcohol and/or substance abuse; and (4) significant medical condition(s) requiring ongoing treatment (e.g., diabetes mellitus, hypertension).

The normal controls were recruited from a vocational

training center (Hong Kong College of Technology) between October 2008 and June 2009. The inclusion criteria were (1) aged between 18 and 65 years old; (2) both sexes; (3) Chinese ethnicity and fluency in the Cantonese dialect; (4) being literate and able to understand the requirements of the study; and (5) ability and willingness to give informed consent for participation. Subjects with a history of psychiatric or neurological disorders were excluded. The BAD and NC participants were matched in terms of ±2 years of age, ±2 years of education, and sex. The SCHIZ and NC participants were matched by age and education level. Matching by sex was unsuccessful due to the limited number of subjects.

Each subject was paid HK$300 for travel expenses and to defray the cost of missing work on the assessment day.

5.3. Assessment instruments

Socio-demographic data, including sex, age, and education

level, were collected from all subjects, and additional data on age at onset and length of illness were collected from the patients.

5.3.1. Psychopathology assessments

All of the rating instruments for clinical assessment were psychometric tests designed to measure the severity of symptom patterns known to have an impact on patients' memory functions. Cross-sectional psychopathology was assessed using the following scales.

(a) Positive and Negative Syndrome Scale (PANSS)

The PANSS (Kay et al., 1987) is a 30-item, operationalized instrument that comprises four scales measuring positive and negative syndromes, their differential, and general illness severity and takes 30 minutes to complete. The PANSS+ and PANSS- subscales were used for statistical

analysis.

(b) Hamilton Rating Scale for Depression (HRSD)

The HRSD (Hamilton, 1960) is a 21-item, structured rating scale that evaluates the severity of depressive symptoms. It takes about 30 minutes to complete. The HRSD sum score was used for statistical analysis.

(c) Young's Mania Rating Scale (YMRS)

The YMRS (Young et al., 1978) is an 11-item rating scale that assesses the severity of manic syndrome. Ratings generally take 15 to 30 minutes to complete and are based on self-reports combined with the clinician's observation.

5.3.2. Neuropsychological tests

The neuropsychological assessments covered PM, RM, and general intelligence expressed as IQ. The following

standardized psychometric tests were employed.

(a) Chinese version of the Cambridge Prospective Memory Test (C-CAMPROMPT)

The C-CAMPROMPT (Lou et al., 2009) was cross-culturally validated into Chinese from the original English-language CAMPROMPT (Wilson et al., 2005). In this study, only Form A of the C-CAMPROMPT was used. The test lasts for about 25 minutes, and subjects are asked to work on a number of ongoing activities on paper-and-pencil worksheets comprising general knowledge quizzes or word-finder puzzles. Subjects have to switch to another page (task) according to a written instruction they reach at a certain point in the worksheet. While filling out the worksheet, they also have to perform three EBPM tasks (give a book to the tester, give an envelope to the tester, and find objects in the room) and three TBPM tasks (change tasks, remind the tester to take his or her keys, and remind the tester to

phone the garage). The last TBPM task is performed five minutes after the quiz. Subjects are allowed to choose their own strategies, such as taking notes, to help their memory functions. They are rated on each PM task on a scale ranging from 0 (worst) to 6 (optimal); thus, the total score ranges from 0 to 36, and the subscales range from 0 to 18.

(b) Chinese version of the Rivermead Behavioural Memory Test (C-RBMT)

The RBMT (Wilson et al., 1991) is a psychometric memory test that uses analogues of everyday situations. It has been translated into Cantonese (C-RBMT; Man & Li, 2001), and the C-RBMT has a story subtest that measures immediate recall and delayed recall. Each correctly recited idea receives one point, and the maximum scores are 21 for both the immediate and delayed recalls. The sum of the two recall scores (score range: 0-42) was entered into the statistical analysis.

(c) Test of Nonverbal Intelligence – Third Edition (TONI-3)

The TONI-3 (Brown et al., 1997) is a language-free intelligence test that measures abstract/figural problem-solving ability and is suitable for subjects aged between 6 and 89 years old. It can be administered by psychologists, psychological associates, teachers, or any qualified professionals who can read and follow the guidelines in the manual. A 45-item picture book (one item per page arranged in order of difficulty) is presented to subjects who select an answer from the picture on each page. The test continues until a scoring ceiling is reached – three incorrect answers in five consecutive items. A raw score is obtained by counting the number of correct responses between item 1 and the ceiling item. This raw score is then entered into a table to obtain a deviation quotient. In this study, the deviation quotient, which ranges

from 60 to 150, was used in statistical analysis.

5.3.3. Measure of community living skills

(a) Chinese Version of the Functional Needs Assessment (CFNA)

The CFNA (Law, 1999) is a locally validated Chinese version of the Functional Needs Assessment (FNA; Dombrowski et al., 1990). It is a performance-based assessment of the daily living skills of psychiatric patients, and the entire test lasts about 25 minutes. It comprises 26 items, each of which has 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, namely, the self-care and CLS subscales, whose scores range from 0-175 and 0-475, respectively. The CLS subscale score was used in statistical analysis.

5.4. Procedures

The SCHIZ patients completed the PANSS and the neuropsychological and functional assessments, and the BAD patients were assessed on the HRSD, YMRS, and neuropsychological and functional tests. The NC subjects underwent the same assessments except for the psychopathological and functional evaluations, as it was assumed that they had a normal/optimal functional level. All tests were administered in one session that lasted for approximately three hours. If the subjects seemed uncertain about any tasks, then the instructions were repeated. Subjects were also given a break if they were tired.

A trained research assistant was responsible for assessing PM and IQ. A psychiatrist (YX), who was blind to the subjects' performance on the other tests, rated the PANSS and collected the socio-demographic data during the interviews. Another psychiatrist (EL), who was also blind to

the subjects' performance on the other tests, rated the HDRS and YMRS. The author, who was blind to the subjects' PM performance and psychiatric status, was responsible for assessing RM and CFNA.

5.5. Ethical considerations

The study protocol was approved by the Human Research and Ethics Committee of the Chinese University of Hong Kong-New Territories East Cluster (CUHK-NTEC). Approvals were also granted by the Hong Kong College of Technology and Shatin Hospital. Written consent was obtained from each subject.

5.6. Statistical analysis

The following statistical procedures were performed.

(a) Comparison of 44 SCHIZ, 44 BAD, and 44 NC subjects

Comparisons among the SCHIZ, BAD, and NC groups were performed using one-way analysis of variance (ANOVA) and the chi-square test, as appropriate. ANOVA was followed by post-hoc Turkey tests.

(b) Comparison after controlling for confounding variables

Analysis of covariance (ANCOVA) was employed to control for confounding socio-demographic and clinical variables and to test for differences in the PM total, TBPM, and EBPM C-CAMPROMPT scores between the patients and controls, as well as between the SCHIZ and BAD groups.

(c) Testing the prospective memory correlates in the patient groups

Correlation analyses were conducted among the PM total, TBPM, and EBPM scores and the socio-demographic and clinical variables using Pearson's correlation analysis for data that followed a normal distribution; otherwise, Spearman's rank correlation analysis was applied.

Next, stepwise multiple linear regression analyses were performed to identify the factors that predict PM in schizophrenia and BAD. The PM total, TBPM, and EBPM scores were entered separately as dependent variables. The independent variables were the significant correlates in the respective bivariate correlation analyses.

(d) Testing the predictors of community living skills in the patient groups

Correlation analyses were also performed between the CLS subscale of the CFNA and the socio-demographic and clinical variables using Pearson's correlation analysis for

data that followed a normal distribution; otherwise, Spearman's rank correlation analysis was applied.

Afterwards, hierarchical multiple linear regression analyses were performed to identify the predictors of CLS in the SCHIZ and BAD groups. Measures of the CLS subscale of the CFNA were entered as the dependent variables. The independent variables were the significant correlates in the respective bivariate correlation analyses.

(e) Checking assumptions for statistical tests

All of the data were analyzed using PASW 17.0 for Windows. To avoid multiple collinearity, tolerance was used to measure the strength of the linear relationships between the independent variables: a tolerance value of 0.6 or above was regarded as acceptable. The normality of the distributions for the continuous variables was checked with the one-sample Kolmogorov–Smirnov test. Two-tailed tests were used in all of the analyses, with the significance level

set as .05.

5.7. Estimation of sample size

ANOVA was used to compare PM performance among the three groups. To date, no study comparing SCHIZ, BAD, and NC subjects has been published. Considering that studies comparing schizophrenia and normal controls have reported effect sizes from 0.34 to 0.74 (Elvevag et al., 2003; Henry et al., 2007; Kumar et al., 2005; Shum et al., 2004; Ungvari et al., 2008; Wang et al., 2007) and that a study comparing depressed and non-depressed patients reported an effect size of 0.38 (Rude et al., 1999), it was deemed reasonable in this study to follow Cohen's (1992) advice and adopt a medium effect size of 0.25. Using PASS 2008 (Hintze, 2008) with the alpha set at .05 and the power set at .80, it was decided that the required sample size for each of the three groups was 40.

Correlational analyses were conducted to better

understand the association between PM and CLS. Very few studies can be found in this arena. Twamley et al. (2007) reported a Pearson correlation coefficient (r) of .47, whereas Ritch et al. (2003) reported a r of .54. Taking a more conservative position, an effect size of .40 was chosen for estimation in this part of the study. Using PASS 2008 (Hintze, 2008) with the alpha set at .05 and power set at .80, the sample size required for the comparison was 40 each for SCHIZ, BAD, and NC.

With regard to the multiple regression analyses, there are two related studies. Twamley et al. (2008) reported R^2 controlled and R^2 tested of 0.24 and 0.08, respectively. Woods et al. (2008a) reported R^2 controlled and R^2 tested of 0.34 and 0.12, respectively. According to the PASS 2008 (Hintze, 2008), a sample of 80 subjects is sufficient to detect an effect size smaller than that of Twamley's (2007) with power set at .80 and the alpha at .05. Hence, 80 patients with SCHIZ and 80 with BAD were required for the correlational study.

In sum, 40 subjects each for the SCHIZ, BAD, and NC samples were planned for comparison. For the correlational study and multiple regression analysis, 80 patients each with SCHIZ and BAD were planned. As will be seen in the next chapter, a sample size of 44 subjects each for the SCHIZ, BAD, and NC cohorts for the comparison, and 44 SCHIZ and 76 BAD patients for the correlational study has already achieved satisfactory statistical power.

CHAPTER 6

RESULTS

6.1. Comparison between patients and controls

Table 1 displays the socio-demographic and clinical data of the patients and the controls. It can be seen that there were differences in PM total, TBPM, EBPM, and RM scores between patients and controls. More specifically, post-hoc Turkey tests revealed the SCHIZ patients to have worse performance than the controls in the PM total ($p < .001$), TBPM ($p = .001$), EBPM ($p < .001$), and RM ($p < .001$) scores, and there was also a significant difference between them in terms of sex ($\chi^2 = 9.91$, $df = 1$, $p = .002$).

Post-hoc Turkey tests also revealed the BAD patients to have worse PM total ($p < .005$) and TBPM ($p < .001$), but

not EBPM (p = .195), scores than the controls, as well as lower RM scores (p = .001). As the BAD and control samples were matched in terms of age, sex, and education level, there were no significant differences between them in these socio-demographic variables.

A post-hoc Turkey test also revealed the SCHIZ patients to have worse EBPM scores (p = .037) than their BAD counterparts, and there was also a significant gender difference between these two groups (χ^2 = 8.42, df = 1, p = .004).

Table 1. *Comparison of the socio-demographic and clinical characteristics of the patient and control groups*

	NC (N = 44)		BAD (N = 44)		SCHIZ (N = 44)		Statistics		
	No	%	No	%	No	%	χ^2	*df*	*p-value*
Male	8	18.2	9	20.5	22	50	13.32	2	.001
	Mean	SD	Mean	SD	Mean	SD	*F*	*df*	*p-value*
Age	41.9	9.3	41.5	10.2	37.7	11.3	2.23	2, 129	.112
Education (years)	10.6	1.5	11.0	2.6	10.3	3.4	0.62	2, 129	.539
Length of illness	-	-	12.6	9.2	10.3	9.1	1.47	1, 86	.229
PANSS+	-	-	-	-	5.2	5.6	-	-	-
PANSS-	-	-	-	-	8.4	7.5	-	-	-
HDRS	-	-	10.1	7.3	-	-	-	-	-
YMRS	-	-	1.6	3.1	-	-	-	-	-
C-CAMPROMPT (TBPM)	14.7	3.0	10.8	4.9	11.1	4.7	10.96	2, 129	< .001
C-CAMPROMPT (EBPM)	15.0	2.2	13.8	3.1	12.1	3.8	9.02	2, 129	< .001
C-CAMPROMPT (PM Total)	29.6	4.2	24.6	6.8	23.3	7.5	12.39	2, 129	< .001
C-RBMT	15.0	5.0	11.1	4.8	9.2	5.6	14.05	2, 129	< .001
IQ (TONI3)	90.7	14.2	87.4	13.0	87.3	15.9	0.80	2, 129	.450
CFNA_CL	-	-	435.9	29.8	420.0	34.2	5.41	1, 86	.022

6.2. Differences in prospective memory between patients and controls

The PM total, TBPM, and EBPM scores remained significantly different between the SCHIZ patients and the controls after controlling for the potential confounding effects of sex, age, education, RM, and IQ (Table 2). The PM total and TBPM scores remained significantly different between the BAD patients and the controls (Table 3). Finally, there was a significant difference in EBPM scores between the two patient groups after controlling for the potential confounding effects of the socio-demographic and clinical variables (Table 4).

Table 2. Comparison between schizophrenia patients and controls with respect to prospective memory after controlling for the confounding effects of demographic and clinical variables via ANCOVA

SCHIZ (N = 44), NC (N = 44)		Cohen's d	95% CI of Cohen's d
C-CAMPROMPT (PM Total)	$F_{(1,84)} = 13.5$; $p < .001$	0.91	0.47-1.35
C-CAMPROMPT (TBPM)	$F_{(1,84)} = 12.3$; $p = .001$	0.89	0.44-1.31
C-CAMPROMPT (EBPM)	$F_{(1,84)} = 6.8$; $p = .011$	0.90	0.46-1.33

Table 3. Comparison between BAD patients and controls with respect to prospective memory after controlling for the confounding effects of demographic and clinical variables via ANCOVA

SCHIZ (N = 44), NC (N = 44)		Cohen's d	95% CI of Cohen's d
C-CAMPROMPT (PM Total)	$F_{(1,84)} = 8.31$; $p = .005$	0.63	0.20-1.05
C-CAMPROMPT (TBPM)	$F_{(1,84)} = 11.4$; $p = .001$	0.75	0.31-1.18

Table 4. Comparison between the schizophrenia and BAD groups with respect to prospective memory after controlling for the confounding effects of demographic and clinical variables via ANCOVA

SCHIZ (N = 44), NC (N = 44)		Cohen's d	95% CI of Cohen's d
C-CAMPROMPT (EBPM)	$F_{(1,84)} = 7.10$; $p = .009$	0.59	0.16-1.02

6.3. Demographic and clinical factors associated with prospective memory

The correlations between the SCHIZ patients' PM scores and their socio-demographic and clinical factors are shown in Table 5. The results of the stepwise multiple regression analyses are presented in Table 6. TBPM was predicted only by IQ, whereas EBPM was predicted by education and RM, and the PM total score was predicted by IQ and education level.

The correlations between PM scores and socio-demographic and clinical factors in the BAD cohort are shown in Table 7, and the results of the stepwise multiple regression analyses are presented in Table 8. TBPM was predicted by depression, age, and education, EBPM by age and RM, and the PM total score by depressive symptoms, age, and RM.

RM was associated with EBPM in both nosological groups. Depressive symptoms predicted PM in the BAD patients, but

the psychopathological variables were not correlated with any of the PM scores for their SCHIZ counterparts.

Table 5. Correlation of prospective memory with socio-demographic and clinical variables for the cohort of schizophrenia patients

N = 44	C-CAMPROMPT (TBPM)	C-CAMPROMPT (EBPM)	C-CAMPROMPT (PM Total)
Age	-.24	-.23	-.27
Education (Years)	.41**	.45**	.49**
Age at onset	-.28	-.13	-.24
Length of illness	.02	-.13	-.05
PANSS+	-.06	-.09	-.09
PANSS-	-.08	-.03	-.07
PANSS general	-.05	.02	-.02
C-RBMT	.15	.41**	.30*
IQ (TONI3)	.48**	.36*	.49**

*p < .05; **p < .01

Table 6. Stepwise multiple regression analysis on prospective memory correlates for the schizophrenia cohort of patients

Dependent variable		Predictor(s)	Beta	p-value	SE Beta
C-CAMPROMPT (TBPM)	$R^2 = .23$	IQ (TONI-3)	0.14	.001	0.04
	$F_{(1,42)} = 12.78$; $p = .001$				
C-CAMPROMPT (EBPM)	$R^2 = .30$	Education	0.41	< .001	0.15
	$F_{(2,41)} = 8.63$; $p = .001$	RBMT	0.22	< .05	0.09
C-CAMPROMPT (PM Total)	$R^2 = .33$	IQ (TONI-3)	0.16	< .05	0.07
	$F_{(2,41)} = 10.05$; $p < .001$	Education	0.73	< .05	0.31

Table 7. Correlation of prospective memory with socio-demographic and clinical variables in the BAD group

N = 44	C-CAMPROMPT (TBPM)	C-CAMPROMPT (EBPM)	C-CAMPROMPT (PM Total)
Age	-.38*	-.42**	-.47**
Education (Years)	.35*	.22	.35*
Age at onset	-.16	-.17	-.20
Length of illness	-.27	-.30*	-.33*
HDRS	-.47**	-.09	-.38*
YMRS	-.34	.16	-.17
C-RBMT	.34*	.43**	.44**
IQ (TONI3)	.30*	.26	.34*

*p < .05; **p < .01

Table 8. Stepwise multiple regression analysis on prospective memory correlates for the cohort of BAD patients

Dependent variable		Predictor(s)	Beta	p-value	SE Beta
C-CAMPROMPT (TBPM)	$R^2 = .44$	HDRS	-0.32	< .001	0.08
	$F_{(3,40)} = 10.42$; $p < .001$	Age	-0.14	.025	0.06
		Education	0.54	.026	0.23
C-CAMPROMPT (EBPM)	$R^2 = .31$	Age	-0.11	.011	0.04
	$F_{(2,41)} = 8.99$; $p = .001$	C-RBMT	0.23	.009	0.09
C-CAMPROMPT (PM Total)	$R^2 = .46$	HDRS	-0.31	.006	0.11
	$F_{(3,40)} = 11.49$; $p < .001$	Age	-0.27	.001	0.08
		C-RBMT	0.46	.009	0.17

6.4. Prediction of community living skills by prospective memory

The socio-demographic and clinical data of the extended BAD group (N = 76) are shown in Table 9, and the correlations between PM scores and socio-demographic and clinical factors in the SCHIZ group are shown in Table 10. The results of the hierarchical multiple regression analyses for schizophrenia are presented in Tables 11 and 12. The PM total and EBPM scores were found to predict the level of CLS in these patients after controlling for the potential confounding effects of socio-demographical and clinical variables.

The results of the hierarchical multiple regression analyses for the BAD patients are presented in Tables 13 and 14. The PM total and TBPM scores were found to be significantly positively correlated with CLS after controlling for the potential confounding effects of the socio-demographical and clinical variables for this group.

After controlling for the effects of potential confounding variables, the PM total scores were found to predict the level of CLS in both patient groups in the regression model. TBPM and EBPM contributed independently to the CLS prediction in the BAD and SCHIZ cohorts, respectively.

Table 9. Socio-demographic and clinical characteristics of the extended BAD sample

N = 76	BAD	
	No	%
Male	23	30.3
	Mean	SD
Age	42.1	12.2
Education (years)	11.2	3.3
Age at onset	28.87	9.1
Length of illness	13.4	10.1
PANSS+	-	-
PANSS-	-	-
HDRS	6.8	7.2
YMRS	1.1	2.5
C-CAMPROMPT (TBPM)	11.0	4.6
C-CAMPROMPT (EBPM)	13.7	3.3
C-CAMPROMPT (PM Total)	24.6	6.8
C-RBMT	12.1	5.7
IQ (TONI3)	90.1	13.9
CFNA_CL	438.4	25.3

Table 10. Correlation of CLS with socio-demographic and clinical variables in BAD and schizophrenia groups

	BAD (N = 76)	SCHIZ (N = 44)
	CFNA_CL	CFNA_CL
Age	-.23*	-.20
Education (years)	-.44**	.50**
Age at onset	-.04	-.17
Length of illness	-.25*	-.05
PANSS+	-	-.16
PANSS-	-	-.12
HDRS	-.21	-
YMRS	-.06	-
C-CAMPROMPT (TBPM)	.43**	.40**
C-CAMPROMPT (EBPM)	.24*	.55**
C-CAMPROMPT (PM Total)	.41**	.53**
C-RBMT	.36**	.45**
IQ (TONI3)	.31**	.47**

*p < .05; **p < .01

Table 11. Hierarchical regression analysis on PM total score in predicting community living skills in schizophrenia

Dependent variable = CFNA_CL		Predictor(s)	Beta	p-value	SE Beta
Block 1	$R^2 = .20$; $F_{(1,42)} = 10.54$; $p = .002$	C-RBMT	2.72	< .001	0.84
Block 2	$R^2 = .37$; $F_{(2,41)} = 12.20$; $p < .001$	C-RBMT	1.92	.019	0.79
	$\Delta R^2 = .17$; $F_{(1,41)} = 11.28$; $p = .002$	PM Total	1.99	.002	0.59

Table 12. Hierarchical regression analysis on EBPM score in predicting community living skills in schizophrenia

Dependent variable = CFNA_CL		Predictor(s)	Beta	p-value	SE Beta
Block 1	$R^2 = .22$; $F_{(1,42)} = 12.02$; $p = .001$	IQ	1.02	.001	0.29
Block 2	$R^2 = .39$; $F_{(2,41)} = 13.18$; $p < .001$	IQ	0.68	0.02	0.28
	$\Delta R^2 = .17$; $F_{(1,41)} = 11.37$; $p = .002$	EBPM	3.92	0.002	1.16

Table 13. Hierarchical regression analysis on PM total score in predicting community living skills in BAD

Dependent variable = CFNA_CL		Predictor(s)	Beta	p-value	SE Beta
Block 1	$R^2 = .20$; $F_{(1,74)} = 18.01$; $p < .001$	Education	3.39	< .001	0.80
Block 2	$R^2 = .27$; $F_{(2,73)} = 13.46$; $p < .001$	Education	2.63	.002	0.82
	$\Delta R^2 = .07$; $p = .008$	PM Total	1.08	.008	0.40

Table 14. Hierarchical regression analysis on TBPM in predicting community living skills in BAD

Dependent variable = CFNA_CL		Predictor(s)	Beta	p-value	SE Beta
Block 1	$R^2 = .20$; $F_{(1,74)} = 18.01$; $p < .001$	Education	3.39	< .001	0.80
Block 2	$R^2 = .28$; $F_{(2,73)} = 14.01$; $p < .001$	Education	2.48	.004	0.83
	$\Delta R^2 = .08$; $p = .005$	TBPM	1.71	.005	0.60

6.5. Statistical power

Cohen's effect size was calculated using the effect size generator (Devilly, 2004), the power of ANCOVA was generated using PASW 17.0, and the power of the multiple regressions was calculated via the PASS (Hintze, 2008). The power calculations for all of the study's statistical analyses are summarized in Table 15.

Table 15. Effect size and observed power calculations

	Statistical Test	Effect Size	Power
PM total difference between SCHIZ and NC	ANCOVA	Cohen's d = 0.91	.95
TBPM difference between SCHIZ and NC	ANCOVA	Cohen's d = 0.89	.93
EBPM difference between SCHIZ and NC	ANCOVA	Cohen's d = 0.90	.73
PM total difference between BAD and NC	ANCOVA	Cohen's d = 0.63	.81
TBPM difference between BAD and NC	ANCOVA	Cohen's d = 0.75	.92
EBPM difference between SCHIZ and BAD	ANCOVA	Cohen's d = 0.59	.75
PM total correlates in SCHIZ	Multiple regression	R^2 = .23	.99
TBPM correlates in SCHIZ	Multiple regression	R^2 = .30	.94
EBPM correlates in SCHIZ	Multiple regression	R^2 = .33	.97
PM total correlates in BAD	Multiple regression	R^2 = ..44	.98
TBPM correlates in BAD	Multiple regression	R^2 = .31	.99
EBPM correlates in BAD	Multiple regression	R^2 = .46	.99
PM total predicts CFNA_CL in SCHIZ	Multiple regression	ΔR^2 = .17; R^2_c = .20	.92
EBPM predicts CFNA_CL in SCHIZ	Multiple regression	ΔR^2 = .17; R^2_c= .22	.93
PM total predicts CFNA_CL in BAD	Multiple regression	ΔR^2 = .07; R^2_c = .20	.76
TBPM predict sCFNA_CL in BAD	Multiple regression	ΔR^2 = .08; R^2_c = .20	.82

CHAPTER 7

DISCUSSION

This study set out four main objectives, namely: (1) to apply the C-CAMPROMPT to an assessment of PM performance in schizophrenia and investigate whether it could corroborate earlier findings in the literature; (2) to explore the utility of the C-CAMPROMPT and examine its correlates in BAD; (3) to compare PM and its associated factors between schizophrenia and BAD patients; and (4) to explore the functional significance of PM through an examination of its predictive ability on the level of CLS. The study's findings are discussed in this chapter in line with these four main objectives.

7.1. The utility of the C-CAMPROMPT and prospective

7.1.1. Hypothesis 1

To the best of my knowledge, this was the first study to administer the C-CAMPROMPT to evaluate PM in schizophrenia. The first hypothesis, which posited that schizophrenia patients would perform worse than controls in all aspects of PM measured with the C-CAMPROMPT, was confirmed. The C-CAMPROMPT was sensitive enough to detect differences between the PM performance of these two groups.

PM deficits have been repeatedly described in schizophrenia (Wang et al., 2009) in both the TBPM (Elvevag et al., 2003) and EBPM subtypes (Altgassen et al., 2008; Kumar et al., 2005). Henry et al. (2007) and Twamley et al. (2008) both reported these patients to exhibit worse TBPM and EBPM performance than normal subjects. Other controlled studies investigating TBPM and EBPM in

schizophrenia came to the same conclusion (Chan et al., 2008b; Shum et al., 2004; Ungvari et al., 2008). In light of neuroimaging studies showing PM is related to prefrontal lobe functions in normal persons (Burgess et al., 2001, 2003; Okuda et al., 2007; Reynolds et al., 2009; Simons et al., 2006) and prefrontal pathology in schizophrenia (Dumontheil et al., 2008; Harrison, 1999; Rose et al., 2006; Thermenos et al., 2005; Vogeley et al., 2003; Yamada et al., 2007), this finding was expected.

7.1.2. Hypothesis 2

The study's second hypothesis was that the PM total, TBPM, and EBPM scores would all have significant correlations with IQ and RM in schizophrenia patients, and it was also confirmed.

IQ was found in the bivariate analyses to be positively associated with all subtypes of PM, and, after controlling for confounding variables, it remained correlated with the PM

total and TBPM scores. This finding is in line with those of previous studies reported in the literature (Henry et al., 2007; Twamley et al., 2008; Wang et al., 2008, 2010a; Wang et al., 2008). TBPM requires a subject to have greater PM capacity to check time cues (Einstein et al., 1995; Groot et al., 2002; Shum et al., 2004; Woods et al., 2007), and it seems to be associated with the executive function of planning (Shum et al., 2004; Ungvari et al., 2008). IQ is generally viewed as an overall index of cognitive functions (Wang et al., 2009), both combining and synthesizing knowledge acquired in the past and coping with new situations (Buschkuehl & Jaeggi, 2010). It is plausible to assume that a higher IQ would be associated with better strategic time estimation and performance monitoring during a TBPM test.

In this study, RM was positively associated only with EBPM in multivariate analysis, a finding that is in accordance with earlier reports (Henry et al., 2007; Wang et al., 2008; Xiang et al., 2010b). PM is considered to comprise

multiple cognitive processes, one of which is RM (Einstein & McDaniel, 1996). RM plays a role in the cue detection and intention retrieval stages of PM (Wang et al., 2008; Woods et al., 2007), which explains its association with PM. However, RM alone cannot fully account for the impaired PM performance witnessed in schizophrenia (Altgassen et al., 2008), which may be the reason it did not appear among the predictors of the PM total score in this study. TBPM requires self-initiated retrieval and the subsequent interruption of an ongoing activity, in contrast to EBPM, which requires only the interruption of that activity (Kvavilashvili & Ellis, 1996). TBPM may thus place greater demand on executive functions than RM (Einstein et al., 1995; Shum et al., 2004; Ungvari et al., 2008).

In the bivariate analyses, education level was positively associated with all subtypes of PM. Having adjusted the covariants, it remained correlated with the EBPM and total PM scores, thus replicating earlier findings (Twamley et al., 2008; Ungvari et al., 2008). Wang et al. (2009) proposed

that patients with higher levels of education have greater opportunities to undertake and practice PM tasks during their school years. Also, education may enhance such cognitive functions as intellectual efficiency, processing speed, attention, executive function, and memory (Avila et al., 2009) and increase the choice of strategies available for problem solving (Springer et al., 2005). EBPM performance has also been found to have an association with executive functions (Shum et al., 2004; Ungvari et al., 2008; Wang et al., 2010a). It thus seems likely that education level has an impact on PM performance by modulating executive functions.

The relationship between age and PM is a matter of controversy, with an association between the two found in some (Ungvari et al., 2008; Wang et al., 2010b; Woods et al., 2007), but not all, investigations (Kumar et al., 2005; 2008; Twamley et al., 2008). The current study also failed to find such an association, similar to studies carried out with normal subjects alone (Henry et al., 2004). Several

factors, including the complexity of PM tasks, difficulty of PM cues, and varying demand of the ongoing activities embedded in the PM tasks, have been postulated to modulate the relationship between age and PM (Cherry et al., 2001; Eusop-Roussel & Ergis, 2008; Mantyla, 1994; Rendell et al., 2007).

This study also found no correlation between any aspects of psychopathology and PM. Most (Kumar et al., 2008; Ungvari et al., 2008; Wang et al., 2007, 2010b), but not all (Twamley et al., 2008; Woods et al., 2007), studies in this arena have failed to identify a relationship between the negative psychotic symptoms of schizophrenia and PM. Hughes et al. (2002) suggested that the relationship between symptoms and cognition varies with schizophrenia progression, and Harvey et al. (1996) observed that cognitive deficits are more stable over time than negative symptoms. Hence, the discrepancy in prior results concerning the relationship between negative symptoms and PM may be explained by the inclusion of patients who

were at different stages of their illness. As there appears to be no compelling evidence to suggest a causal relationship between improvement in psychopathology and cognitive function in schizophrenia (Hughes et al., 2002), the lack of any correlations between psychiatric symptomatology and PM is not surprising.

7.2. The utility of the C-CAMPROMPT and prospective memory in bipolar affective disorder

7.2.1. Hypothesis 3

The study's third hypothesis, that is, that the BAD patients would perform worse than the controls in one or more of the PM total, EBPM, and TBPM scores of the C-CAMPROMPT, was partially confirmed. These patients had poorer PM total and TBPM, but not EBPM, scores than the controls.

The presence of PM impairment in BAD is in line with findings reported in other neuropsychiatric conditions

(Altgassen et al., 2009; Rude et al., 1999; Wang et al., 2009; Woods et al., 2008b). Successful PM performance is held to be dependent on multiple cognitive processes (Einstein & McDaniel, 1996), and BAD has been shown to involve cognitive impairments in memory and executive functions (Arts et al., 2008; Quraishi & Frangou, 2002; Robinson et al., 2006). In addition, the findings also lend indirect support to prefrontal involvement in PM in this patient group (Beyer & Krishnan, 2002; Burgess et al., 2008; Marvel & Paradiso, 2004; Yu et al., 2010).

The fact that there was a greater difference in TBPM than EBPM between the BAD group and the controls may be interpreted as indicative of the difference in difficulty between the two types of PM tasks. TBPM is believed to be more demanding on cognitive resources than EBPM (Einstein et al., 1995; Shum et al., 2004; Wang et al., 2008). The TBPM task requires self-initiated retrieval and the subsequent interruption of an ongoing activity, in contrast to the EBPM task, which requires only the interruption of

that activity (Kvavilashvili & Ellis, 1996). It could be that TBPM, but not EBPM, is sufficiently difficult to cause such impairment in BAD patients.

7.2.2. Hypothesis 4

The fourth hypothesis that the PM total and EBPM and TBPM task scores of the C-CAMPROMPT would have significant correlations with IQ and RM in the BAD cohort was partially confirmed.

In bivariate analysis, RM was positively associated with all subtypes of PM, whereas in multivariate analysis, it remained correlated only with the EBPM and PM total scores. This finding provides support for the conception of RM as a component process of PM (Einstein & McDaniel, 1996; Woods et al., 2007) and concurs with the findings of previous studies of schizophrenia patients (Henry et al., 2007; Wang et al., 2008; Xiang et al., 2010b). The association between RM and EBPM, but not TBPM, can be

explained by the different processes involved in the two PM subtypes. As previously noted, TBPM requires self-initiated retrieval and the subsequent interruption of an ongoing activity, in contrast to EBPM, which requires only the interruption of that activity (Kvavilashvili & Ellis, 1996). TBPM may thus place greater demand than RM on executive functions (Einstein et al., 1995; Shum et al., 2004; Ungvari et al., 2008).

In the bivariate analyses, education level was positively associated with the TBPM and PM total scores of the BAD subjects, whereas the multivariate analyses showed it to predict only TBPM. Similarly, education had an impact on the PM performance of schizophrenia patients. Better educated individuals are likely to have more opportunities to practice PM activities (Wang et al., 2009), and the educational process may also enhance intellectual efficiency, memory, and problem-solving strategies (Avila et al., 2009; Springer et al., 2005). As noted, TBPM requires subjects to check time cues (Einstein et al., 1995; Groot et al., 2002;

Shum et al., 2004; Woods et al., 2007), and it seems to be associated with the executive function of planning (Shum et al., 2004; Ungvari et al., 2008). Hence, it is plausible that education enhances the cognitive strategies needed for cue detection in the TBPM task.

In both the bivariate and multivariate analyses, depressive symptoms were found to be negatively associated with the TBPM and PM total scores of BAD patients. Similar results have been reported in clinically depressed persons compared to normal controls (Altgassen et al., 2009; Rude et al., 1999). In healthy persons, depressive features have also been found to affect PM performance (Jeong & Cranney, 2009; Kliegel et al., 2005; Schmidt, 2004). These findings could be interpreted in light of the Resource Allocation Model (Ellis & Ashbrook, 1988), according to which persons suffering from depression are accompanied by intrusive, self-deprecating, and irrelevant thoughts that compete with relevant cognitive activities. As PM involves multiple cognitive processes (Einstein &

McDaniel, 1996; Ellis & Freeman, 2008), it is unsurprising that a deterioration in PM performance would be observed in depressed individuals.

Age was found to be negatively correlated with all subtypes of PM in the BAD cohort in both the bivariate and multivariate analyses, which accords with the findings of research carried out on normal subjects (Einstein et al., 1995) and schizophrenia patients (Ungvari et al., 2008; Wang et al., 2010b; Woods et al., 2007). This finding can be explained in terms of the ageing effect on the dysfunction of the prefrontal cortex (Bergfield et al., 2010; Manji et al., 2001) that mediates PM (Burgess et al., 2008; Okuda et al., 2007; Reynolds et al., 2009; Simons et al., 2006).

7.3. Prospective memory performance in schizophrenia and bipolar affective disorder

7.3.1. Hypothesis 5

To the best of my knowledge, this was the first study to compare PM performance between schizophrenia and BAD patients. The study's fifth hypothesis was that the former would exhibit worse performance than the latter on one or more of the PM total, TBPM, and EBPM scores of the C-CAMPROMPT, and it was partly confirmed. The schizophrenia patients had worse EBPM scores than their BAD counterparts.

Earlier findings (Wang et al., 2009) indicated that schizophrenia patients do worse than controls in both TBPM and EBPM, whereas the results of this study suggest that BAD patients suffer only impaired TBPM relative to normal controls.

The results of this study also showed BAD patients to have less severe PM impairment than schizophrenia patients. There is substantial evidence to suggest that BAD patients display cognitive deficits similar to those found in schizophrenia (Hill et al., 2008; Jabben et al., 2009), although usually to a lesser extent (Krabbendam et al.,

2005; Maier et al., 2006; Stefanopoulou et al., 2009).

Neuroimaging studies have suggested prefrontal lobe involvement in normal subjects performing PM tasks (Burgess et al., 2003; Reynolds et al., 2009; Simons et al., 2006). Furthermore, Okuda et al. (2007) argued that the regions within the prefrontal cortex have differing degrees of involvement in TBPM (medial and left superior lateral prefrontal) and EBPM (lateral prefrontal). Although prefrontal lobe pathology features in both schizophrenia and BAD, the former seems to be more generalized, whereas the latter has more specific involvement (Marvel & Paradiso, 2004; Shenton et al., 2001; Vogeley et al., 2003; Yu et al., 2010), which may explain the PM differences found in the two patient groups.

7.3.2. Hypothesis 6

The sixth hypothesis that the PM scores of the C-CAMPROMPT would have independent associations with

IQ and RM in both the schizophrenia and BAD patients was only partially confirmed. Multivariate analysis showed PM to be associated with IQ, RM, and education level in schizophrenia patients and with depressive symptoms, age, and RM in BAD patients (Figure 3).

Figure 3. Comparison of PM correlates in schizophrenia and bipolar affective disorder

	SCHIZ	BAD
Dependent variable	Predictors	Predictors
TBPM	IQ	HDRS Age Education
EBPM	Education C-RBMT	Age C-RBMT
PM total	IQ Education	HDRS Age C-RBMT

Multivariate analysis showed RM to be positively associated with EBPM in both patient groups, a finding that further confirms RM as a component process of PM (Einstein & McDaniel, 1996; Woods et al., 2007). Furthermore, RM remained a predictor of the PM total scores in the BAD

cohort, but not in their schizophrenia counterparts, in the multivariate analyses. Altgassen et al. (2008) argued that RM plays a role in, but cannot fully account for, PM performance. Taken together, the evidence suggests that RM plays a more significant role in PM impairment in BAD than in schizophrenia.

In the multivariate analyses, education level was positively associated with EBPM in schizophrenia and TBPM in BAD. Education is considered to enhance cognitive functions, such as intellectual efficiency, processing speed, attention, executive function, and memory (Avila et al., 2009), as well as offer a greater choice of problem-solving strategies (Springer et al., 2005), all of which can improve PM performance. Furthermore, Wang et al. (2009) argued that those with more education may have more opportunities to practice PM tasks and may thus exhibit better corresponding performance.

The multivariate analyses showed IQ to be positively associated with the TBPM and PM total scores in the

schizophrenia patients, but not in their BAD counterparts. The role played by IQ in PM performance seems less significant in BAD than in schizophrenia. IQ may help to combine and synthesize knowledge acquired in the past, as well as help to cope with new situations (Buschkuehl & Jaeggi, 2010), which in turn contributes to strategic time estimation and monitoring in PM performance (Einstein et al., 2005). Morrison et al. (2006) found that IQ declines over time in schizophrenia, which may account for the positive association between PM and IQ in this population.

In this study, depressive symptoms had an impact on PM in the BAD patients, but psychopathology had no effect on PM in the schizophrenia patients. The difference may be interpreted in terms of the two groups' cognitive profiles across different stages of their illness. The relative stability in cognitive profiles across the acute to chronic phases of schizophrenia has been documented, although it remains a matter of controversy (Sponheim et al., 2010). In contrast, BAD patients in remission have been reported to display

better cognitive performance than in the symptomatic phase of their illness (Quraishi & Frangou, 2002).

The results of the current study also show age to be negatively correlated with all subtypes of PM in BAD, contrary to the findings for the schizophrenia group. A number of previous schizophrenia studies have also yielded positive results for the association between age and PM (Ungvari et al., 2008; Wang et al., 2010b; Woods et al., 2007). Such factors as the complexity of PM tasks, difficulty of PM cues, and the varying demands of the ongoing activities embedded in the PM tasks have been hypothesized to modulate between age and PM (Cherry et al., 2001; Eusop-Roussel & Ergis, 2008; Mantyla, 1994; Rendell et al., 2007). These factors should have been constant across both patient groups in this study, although the data suggest a greater age-related decline in PM performance in BAD compared to schizophrenia. A longitudinal study carried out by Friedman et al. (2001a) found the cognitive status of schizophrenia patients to

remain fairly stable until after the age of 65. The effect of age on neurocognitive abilities appears more obvious in BAD patients (Burdick et al., 2006; Wingo et al., 2009).

7.4. The functional significance of prospective memory

7.4.1. Hypothesis 7

The seventh hypothesis, that is, that one or more of the PM total, EBPM, and TBPM scores of the C-CAMPROMPT would predict the level of CLS in schizophrenia patients after controlling for the potential confounding effects of clinical, neuropsychological, and socio-demographic variables, was confirmed.

In the bivariate analyses, all three PM scores were positively correlated with CLS, and, in the multivariate analyses, the PM total and EBPM scores remained predictors of CLS. This finding is in line with the results of two recent

studies. The paper published by Ritch et al. (2003) may be the earliest report on the role played by PM in predicting a performance-based measure of ADL, whereas Twamley et al. (2008) found PM to predict finance and communication skills. Two other studies (Ungvari et al., 2008; Xiang et al., 2010a), in contrast, reported a non-significant correlation between PM and ADL, including self-care.

Ellis and Freeman (2008) opined that self-care tasks are supported by environmental cues as well as repeat practice and thus are unrelated to PM. It could be that the inclusion of self-care measures obscured the impact of PM on functional outcomes in the studies of Ungvari et al. (2008) and Xiang et al. (2010a). Importantly, the positive findings obtained in the current study were reflected by the use of a single CLS construct as the functional outcome assessment. In fact, the self-care subscale of this functional measure was not associated with any of the PM scores. Moreover, these positive findings can be interpreted in light of the fact that memory and executive functioning have been

consistently identified as predictors of CLS (Green et al., 2000; McClure et al., 2007; Rempfer et al., 2003; Sharma et al., 2003), whereas PM comprises multiple cognitive processes, including RM and executive control (Einstein & McDaniel, 1996; McDaniel et al., 2004).

7.4.2. Hypothesis 8

The study's eighth hypothesis that one or more of the PM total, EBPM, and TBPM scores of the C-CAMPROMPT would predict the level of CLS in BAD after controlling for the potential confounding effects of socio-demographic, clinical, and neuropsychological variables was also confirmed.

In the bivariate analyses, all three scores were positively associated with CLS, with the PM total and TBPM scores remaining predictors of CLS in the multivariate analyses. There is no other study on BAD in the literature, but preliminary evidence for the significance of PM in CLS exists for other neuropsychiatric conditions. As discussed earlier

(Section 7.3.1), the functional significance of PM in schizophrenia is well established. Fortin et al. (2003) reported that strategic planning and PM underpin the CLS of persons with temporal lobe lesion. Woods et al. (2008b) also found PM to play a significant part in CLS performance in a sample of 66 individuals infected with HIV.

In the BAD literature, both memory and executive function have been identified as predictors of global functioning (Bonnin et al., 2010; Laes & Sponheim, 2006; Martino et al., 2009; Wingo et al., 2009), which can be broken down into the areas of occupational and social functions and community living (Dever, 1988). Given the established relationship between PM and RM and executive functioning (Henry et al., 2007; Kumar et al., 2008; Shum et al., 2004; Twamley et al., 2008; Ungvari et al., 2008; Wang et al., 2008), the functional significance of PM in the performance of CLS in BAD patients in this study is unsurprising.

Furthermore, the positive findings of this study support

the postulation (Uttl et al., 2001; Guimond et al., 2006) that CLS comprises the components of planning, PM, working memory, and RM.

7.4.3. Hypothesis 9

The ninth and final hypothesis, that is, that TBPM and EBPM would predict the level of CLS in schizophrenia and BAD patients differentially after controlling for the potential confounding effects of socio-demographic, clinical, and neuropsychological variables, was also confirmed.

In the multivariate analyses, the PM total score was positively correlated with the level of CLS in both patient groups. When the subtypes of PM were entered into the multiple regression analyses, EBPM and TBPM remained predictors of CLS in the schizophrenia and BAD cohorts, respectively.

The findings for the BAD group replicate an earlier study reporting that these patients have only TBPM impairment

(Lee et al., 2010), whereas those for the schizophrenia group are consistent with the report of Twamley et al. (2008), who found only EBPM to predict the level of CLS in this patient group. Twamley et al. (2008) attributed their results to the relationship between EBPM and impaired cue detection and intention-cue pairings, which are particularly prevalent in schizophrenia (Woods et al., 2007). However, in the current study, the schizophrenia patients displayed not only EBPM deficits, but also TBPM impairment (Section 7.1.1). These patients' TBPM was positively correlated with CLS in bivariate analysis, but not in multivariate analysis. These findings may reflect the different mechanisms underpinning PM's role in CLS in schizophrenia and BAD. TBPM and EBPM are considered to have different relationships to the prefrontal cortex (Okuda et al., 2007). Although schizophrenia and BAD sufferers both exhibit prefrontal pathology, the two PM subtypes may affect the brain regions differently in the two groups (Marvel & Paradiso, 2004; Shenton et al., 2001; Vogeley et al., 2003;

Yu et al., 2010).

7.5. Strengths and limitations of the study

The strengths of this study include its inclusion of normal controls, the use of standardized assessment instruments, explicit entry criteria for the subjects, and independent assessment of various aspects of the investigation. The BAD patients were matched with the controls, whereas the schizophrenia patients were close to the controls in terms of IQ, age, and education level, but not sex due to the small sample size.

However, the study's results should be interpreted with caution because of certain methodological limitations. First, illiterate and more severely ill patients were excluded. Second, important cognitive domains such as executive functions were not examined, as my primary neuropsychological focus was on assessing the confounding effect of RM on PM. Third, drug treatment, a potential

covariant, was not tested for logistical reasons. Finally, the sample size for the comparison study was relatively small, although the study had satisfactory statistical power.

CHAPTER 8

CONCLUSION

This study contributes to the literature on PM in schizophrenia and BAD in the following ways. First, it reports an improved PM assessment of patients through the application of a standardized psychometric PM test, the C-CAMPROMPT. Second, it provides a better understanding of PM performance in schizophrenia and BAD, as well as its associated socio-demographic and clinical factors. Third, it confirms the functional significance of PM in patients' CLS, which has far-reaching implications for their successful rehabilitation.

8.1. The Utility of the C-CAMPROMPT

All but two (Twamley et al., 2008; Woods et al., 2007) of the

PM studies of schizophrenia published so far have employed experimental tasks without psychometric properties, and they thus have questionable ecological validity. The C-CAMPROMPT (Chan et al., 2008a; Lou et al., 2009; Wilson et al., 2005) is a standardized psychometric PM test, which, in this study, proved to be sensitive enough to differentiate both schizophrenia and BAD patients from normal controls. The study's findings corroborate other recent PM findings in schizophrenia. Its use of the C-CAMPROMPT will undoubtedly strengthen the robustness of PM research and promote the test's application in clinical practice in terms of developing treatment options and evaluating their outcome.

8.2. Prospective memory in schizophrenia and bipolar affective disorder and its association with demographic and clinical factors

Compared to schizophrenia, little is known about PM in BAD.

This study found BAD patients to display better EBPM performance than their schizophrenia counterparts. PM is a complex construct that involves multiple cognitive processes (Einstein & McDaniel, 1996; McDaniel et al., 2004), and its socio-demographic and clinical correlates were shown to differ in the two patient groups in this study. In the schizophrenia sample, PM was associated with IQ, RM, and education, whereas in the BAD sample, it was correlated with RM, depressive symptoms, and age.

8.3. The functional implications of prospective memory for community living skills

Although preliminary evidence of the significance of PM in CLS has been reported (Ritch et al., 2003; Twamley et al., 2008), the narrow construct of the functional measures used in previous studies and the ambiguous results due to methodological shortcomings (Ungvari et al., 2008; Xiang et al., 2010a) warrant further investigation. In the current

study, PM was found to predict the level of CLS in both schizophrenia and BAD patients. In further analyses, EBPM was found to have a greater impact on everyday functioning in schizophrenia, whereas TBPM was found to be more influential in BAD.

8.4. Significance of the study

This study's successful use of the C-CAMPROMPT, a standardized PM test, undoubtedly strengthens the robustness of PM research and can be expected to promote the test's application in clinical practice in terms of developing treatment options and evaluating their outcome. The further clarification of PM performance that this study offers, as well as its identification of the factors associated with PM in schizophrenia and BAD and comparison between the two groups, helps to further our understanding of PM. Moreover, the evidence presented here of PM's predictive ability for such functional measures as CLS will promote its

inclusion in psychiatric practice.

8.5. Directions for future research

As this study has proved the functional significance of PM, the next logical step would be the inclusion of PM in clinical investigations, namely, in treatment and related outcome studies. Furthermore, the impact of PM on other aspects of everyday functioning, such as occupational and social functioning, warrants future investigations. Compared to schizophrenia, PM research in BAD is in the very early stages, and further study of this patient group is clearly necessary. As for further research, PM studies should include a variety of other psychiatric disorders and to expand the scope of investigation to involve detailed neuropsychological assessments and functional neuroimaging studies (fMRI).

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APPENDICES

APPENDIX I: Project database

Case No.		
Residence	1 / 2 / 3 / 4	1 = home 2 = re family house or LSC 3 = hospital
Sex	1 / 2	1=male 2=female
Age		
Education	1 / 2 / 3 / 4	1=No education 2=Primary education 3=Secondary education 4=University or above
Diagnosis	1 / 2 / 3	1=Normal 2=Schizophrenia 3=Bipolar Affective Disorder
Age at onset		
Length of illness		
Suicide attempt	1 = no / 2 = yes	
Violence	1 = no / 2 = yes	
Family (1st degree relatives) Psychosis	1 = no / 2 = yes	
Forensic record	1 = no / 2 = yes	
Ongoing alcohol / drug abuse	1 = no / 2 = yes	
Ongoing major medical conditions	1 = no / 2 = yes	
Pathological lab results		
Medications (doses)		
Correctional Discharge	1 = no / 2 = yes	
PPU	1 = no / 2 = yes	
Regular smoking	1 = no / 2 = yes	
Regular drinking	1 = no / 2 = yes	

Database (page 2)

PANSS	P1 _____ P2 _____ P3 _____ P4 _____ P5 _____ P6 _____ P7 _____ Positive _____
	N1 _____ N2 _____ N3 _____ N4 _____ N5 _____ N6 _____ N7 _____ Negative _____
	G1 _____ G2 _____ G3 _____ G4 _____ G5 _____ G6 _____ G7 _____ General _____
	SUM _____
Hamilton	1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____ 8 _____ 9 _____ 10 _____ 11 _____ 12 _____ 13 _____ 14 _____ 15 _____ 16 _____ 17 _____ 18A _____ 18B _____ 19 _____ 20 _____ 21 _____ SUM _____
Young's mania scale	1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____ 8 _____ 9 _____ 10 _____ 11 _____ SUM _____
GAF	SUM _____
TOWB	SUM _____
RBMT	Immediate recall _____ Delayed recall _____ SUM _____
CAMPROMPT	Time _____ Event _____ SUM _____
Computer PM test	Not distracted _____ / Distracted _____
WHOQOL-BREF	SUM _____
CPNA	EC _____ CL _____ SUM _____

Database (page 3)

SUCISC self	1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____ 8 _____ 9 _____ 10 _____ 11 _____ 12 _____ 13 _____ 14 _____ 15 _____ SUM _____
SUCISC caregiver	1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____ 8 _____ 9 _____ 10 _____ 11 _____ 12 _____ 13 _____ 14 _____ 15 _____ SUM _____
Lawton	1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____ 8 _____ 9 _____ SUM _____

APPENDIX II: Positive and Negative Syndrome Scale (PANSS)

0=Absent	1=Minimal	2=Mild	3=Moderate	4=Moderate severe	5=Severe	6=Extreme

1-12 dupl

CARD NUMBER [__] 13-14

POSITIVE SCALE (P)

P1 Delusions [_] 15
Beliefs which are unfounded, unrealistic, and idiosyncratic. Basis for rating: Thought content expressed in the interview and its influence on social relations and behavior.

P2 Conceptual disorganization [_] 16
Disorganized process of thinking characterized by disruption of goal-directed sequencing, e.g., circumstantiality, tangentiality, loose associations, non sequiturs, gross illogicality, or thought block. Basis for rating: Cognitive-verbal processes observed during the course of interview.

P3 Hallucinatory behavior [_] 17
Verbal report or behavior indicating perceptions which are not generated by external stimuli. These may occur in the auditory, visual, olfactory, or somatic realms. Basis for rating: Verbal report and physical manifestations during the course of interview as well as reports of behavior by primary care workers or family.

P4 Excitement [_] 18
Hyperactivity as reflected in accelerated motor behavior, heightened responsivity to stimuli, hypervigilance, or excessive mood lability. Basis for rating: Behavioral manifestations during the course of interview as well as reports of behavior by primary care workers or family.

P5 Grandiosity [_] 19
Exaggerated self-opinion and unrealistic convictions of superiority, including delusions of extraordinary abilities, wealth, knowledge, fame, power, and moral righteousness. Basis for rating: Thought content expressed in the interview and its influence on behavior.

P6 Suspiciousness/persecution [_] 20
Unrealistic and exaggerated ideas of persecution, as reflected in guardedness, a distrustful attitude, suspicious hypervigilance, or frank delusions that others mean one harm. Basis for rating: Thought content expressed in the interview and its influence on behavior.

P7 Hostility [_] 21
Verbal and nonverbal expressions of anger and resentment, including sarcasm, passive-aggressive behavior, verbal abuse, and assaultiveness. Basis for rating: Interpersonal behavior observed during the interview and reports by primary care workers or family.

NEGATIVE SCALE (N)

N1 Blunted affect [_] 22
Diminished emotional responsiveness as characterized by a reduction in facial expression, modulation of feelings, and communicative gestures. Basis for rating: Observation of physical manifestations of affective tone and emotional responsiveness during the course of interview.

N2 Emotional withdrawal [_] 23
Lack of interest in, involvement with, and affective commitment to life's events. Basis for rating: Reports of functioning from primary care workers or family and observation of interpersonal behavior during the course of interview.

N3 Poor rapport [_] 24
Lack of interpersonal empathy, openness in conversation, and sense of closeness, interest, or involvement with the interviewer. This is evidenced by interpersonal distancing and reduced verbal and nonverbal communication. Basis for rating: Interpersonal behavior during the course of interview.

N4 **Passive/apathetic social withdrawal** [_] 22
Diminished interest and initiative in social interactions due to passivity, apathy, anergy, or avolition. This leads to reduced interpersonal involvements and neglect of daily activities.

N5 ***Difficulty in abstract thinking*** [_] 24
Impairment in the use of the abstract-symbolic mode of thinking, as evidenced by difficulty in classification, forming generalizations, and proceeding beyond concrete or egocentric thinking in problem-solving tasks. Basis for rating: Responses to questions on similarities and proverb interpretation, and use of concrete vs. abstract mode during the course of interview.

N6 ***Lack of spontaneity and flow of conversation*** [_] 25
Reduction in the normal flow of communication associated with apathy, avolition, defensiveness, or cognitive deficit. This is manifested by diminished fluidity and productivity of the verbal-interactional process. Basis for rating: Cognitive-verbal processes observed during the course of interview.

N7 **Stereotyped thinking** [_] 26
Decreased fluidity, spontaneity, and flexibility of thinking, as evidenced in rigid, repetitious, or barren thought content. Basis for rating: Cognitive-verbal processes during the course of interview.

GENERAL PSYCHOPATHOLOGY SCALE (G)

G1 **Somatic concern** [_] 28
Physical complaints or beliefs about bodily illness or malfunctions. This may range from a vague sense of ill being to clear-cut delusions of catastrophic physical disease. Basis for rating: Thought content expressed in the interview.

G2 **Anxiety** [_] 29
Subjective experience of nervousness, worry, apprehension, or restlessness, ranging from excessive concern about the present or future to feelings of panic. Basis for rating: Verbal report during the course of interview and corresponding physical manifestations.

G3 **Guilt feelings** [_] 30
Sense of remorse or self-blame for real or imagined misdeeds in the past. Basis for rating: Verbal report of guilt feelings during the course of interview and the influence on attitudes and thoughts.

G4 **Tension** [_] 31
Overt physical manifestations of fear, anxiety, and agitation, such as stiffness, tremor, profuse sweating, and restlessness. Basis for rating: Verbal report attesting to anxiety and, thereupon, the severity of physical manifestations of tension observed during the interview.

G5 **Mannerisms and posturing** [_] 32
Unnatural movements or posture as characterized by an awkward, stilted, disorganized, or bizarre appearance. Basis for rating: Observation of physical manifestations during the course of interview as well as reports from primary care workers or family.

G6 **Depression** [_] 33
Feelings of sadness, discouragement, helplessness, and pessimism. Basis for rating: Verbal report of depressed mood during the course of interview and its observed influence on attitude and behavior.

G7 **Motor retardation** [_] 34
Reduction in motor activity as reflected in slowing or lessening of movements and speech, diminished responsiveness to stimuli, and reduced body tone. Basis for rating: manifestations during the course of interview as well as reports by primary care workers or family.

PANSS (page 3)

G8 Uncooperativeness [_] 36
Active refusal to comply with the will of significant others, including the interviewer, hospital staff, or family, which may be associated with distrust, defensiveness, stubbornness, negativism, rejection of authority, hostility, or belligerence. Basis for rating: Interpersonal behavior observed during the course of interview as well as reports by primary care workers or family.

G9 Unusual thought content [_] 37
Thinking characterized by strange, fantastic, or bizarre ideas, ranging from those which are remote or atypical to those which are distorted, illogical, and patently absurd. Basis for rating: Thought content expressed during the course of interview.

G10 Disorientation [_] 38
Lack of awareness of one's relationship to the milieu, including persons, place, and time, which may be due to confusion or withdrawal. Basis for rating: Responses to interview questions on orientation.

G11 Poor attention [_] 39
Failure in focused alertness manifested by poor concentration, distractibility from internal and external stimuli, and difficulty in harnessing, sustaining, or shifting focus to new stimuli. Basis for rating: Manifestations during the course of interview.

G12 Lack of judgment and insight [_] 40
Impaired awareness or understanding of one's own psychiatric condition and life situation. This is evidenced by failure to recognize past or present psychiatric illness or symptoms, denial of need for psychiatric hospitalization or treatment, decisions characterized by poor anticipation of consequences, and unrealistic short-term and long-range planning. Basis for rating: Thought content expressed during the interview.

G13 Disturbance of volition [_] 41
Disturbance in the willful initiation, sustenance, and control of one's thoughts, behavior, movements, and speech. Basis for rating: thought content and behavior manifested in the course of interview.

G14 Poor impulse control [_] 42
Disordered regulation and control of action on inner urges, resulting in sudden, unmodulated, arbitrary, or misdirected discharge of tension and emotions without concern about consequences. Basis for rating: Behavior during the course of interview and reported by primary care workers or family.

G15 Preoccupation [_] 43
Absorption with internally generated thoughts and feelings and with autistic experiences to the detriment of reality orientation and adaptive behavior. Basis for rating: Interpersonal behavior observed during the course of interview.

G16 Active social avoidance [_] 44
Diminished social involvement associated with unwarranted fear, hostility, or distrust. Basis for rating: Reports of social functioning by primary care workers or family.

FORMALE DENKSTÖRUNGEN

Z1 Verschwommenes Denken [_] 45
Die Begriffe sind unscharf und vage, die Äusserungen sind in grösseren Zusammenhängen nicht verständlich. Ein vager thematischer Zusammenhang bleibt erkennbar, Themenwechsel vollziehen sich durch allmähliches Entgleiten des bisherigen Themas. Typisch finden sich auch Vorbeireden, Kontaminationen, Verschiebungen und Substitutionen sowie Neologismen.

Z2 Sprunghaftes Denken [_] 46
Das Denken ist assoziativ gelockert, es treten zahlreiche, den Sinnzusammenhang durchbrechende Gedankensprünge auf, so dass der Eindruck einer bei jedem Einfall wechselnden Denkrichtung entsteht.

APPENDIX III: Hamilton Depression Rating Scale (HRDS)

THE HAMILTON RATING SCALE FOR DEPRESSION

(to be administered by a health care professional)

Patient's Name

Date of Assessment

To rate the severity of depression in patients who are already diagnosed as depressed, administer this questionnaire. The higher the score, the more severe the depression.

For each item, write the correct number on the line next to the item. (Only one response per item)

1. **DEPRESSED MOOD** (Sadness, hopeless, helpless, worthless)

_____
0= Absent
1= These feeling states indicated only on questioning
2= These feeling states spontaneously reported verbally
3= *Communicates feeling states non-verbally—i.e., through facial expression, posture, voice, and tendency to weep*
4= Patient reports VIRTUALLY ONLY these feeling states in his spontaneous verbal and non-verbal communication

2. **FEELINGS OF GUILT**

_____
0= Absent
1= Self reproach, feels he has let people down
2= Ideas of guilt or rumination over past errors or sinful deeds
3= *Present illness is a punishment. Delusions of guilt*
4= Hears accusatory or denunciatory voices and/or experiences threatening visual hallucinations

3. **SUICIDE**

_____
0= Absent
1= Feels life is not worth living
2= Wishes he were dead or any thoughts of possible death to self
3= Suicidal ideas or gesture
4= Attempts at suicide (any serious attempt rates 4)

4. **INSOMNIA EARLY**

_____
0= No difficulty falling asleep
1= Complains of occasional difficulty falling asleep—i.e., more than 1/2 hour
2= Complains of nightly difficulty falling asleep

5. **INSOMNIA MIDDLE**

_____
0= No difficulty
1= Patient complains of being restless and disturbed during the night
2= Waking during the night—any getting out of bed rates 2 (except for purposes of voiding)

HDRS (page 2)

---

6. INSOMNIA LATE

_____
0= No difficulty
1= Waking in early hours of the morning but goes back to sleep
2= Unable to fall asleep again if he gets out of bed

7. WORK AND ACTIVITIES

_____
0= No difficulty
1= Thoughts and feelings of incapacity, fatigue or weakness related to activities; work or hobbies
2= Loss of interest in activity; hobbies or work—either directly reported by patient, or indirect in listlessness, indecision and vacillation (feels he has to push self to work or activities)
3= Decrease in actual time spent in activities or decrease in productivity
4= Stopped working because of present illness

8. RETARDATION: PSYCHOMOTOR (Slowness of thought and speech; impaired ability to concentrate; decreased motor activity)

_____
0= Normal speech and thought
1= Slight retardation at interview
2= Obvious retardation at interview
3= Interview difficult
4= Complete stupor

9. AGITATION

_____
0= None
1= Fidgetiness
2= Playing with hands, hair, etc.
3= Moving about, can't sit still
4= Hand wringing, nail biting, hair-pulling, biting of lips

10. ANXIETY (PSYCHOLOGICAL)

_____
0= No difficulty
1= Subjective tension and irritability
2= Worrying about minor matters
3= Apprehensive attitude apparent in face or speech
4= Fears expressed without questioning

11. ANXIETY SOMATIC: Physiological concomitants of anxiety, (i.e., effects of autonomic overactivity, "butterflies," indigestion, stomach cramps, belching, diarrhea, palpitations, hyperventilation, paresthesia, sweating, flushing, tremor, headache, urinary frequency). Avoid asking about possible medication side effects (i.e., dry mouth, constipation)

_____
0= Absent
1= Mild
2= Moderate
3= Severe
4= Incapacitating

HDRS (page 3)

---

12. SOMATIC SYMPTOMS (GASTROINTESTINAL)

_____
0= None
1= Loss of appetite but eating without encouragement from others. Food intake about normal
2= Difficulty eating without urging from others. Marked reduction of appetite and food intake

13. SOMATIC SYMPTOMS GENERAL

_____
0= None
1= Heaviness in limbs, back or head. Backaches, headache, muscle aches. Loss of energy and fatigability
2= Any clear-cut symptom rates 2

14. GENITAL SYMPTOMS (Symptoms such as: loss of libido; impaired sexual performance; *menstrual disturbances)*

_____
0= Absent
1= Mild
2= Severe

15. HYPOCHONDRIASIS

_____
0= Not present
1= Self-absorption (bodily)
2= Preoccupation with health
3= Frequent complaints, requests for help, etc.
4= Hypochondriacal delusions

16. LOSS OF WEIGHT

_____
A. When rating by history:
0= No weight loss
1= Probably weight loss associated with present illness
2= Definite (according to patient) weight loss
3= Not assessed

17. INSIGHT

_____
0= Acknowledges being depressed and ill
1= Acknowledges illness but attributes cause to bad food, climate, overwork, virus, need for rest, etc.
2= Denies being ill at all

18. DIURNAL VARIATION

_____
A. Note whether symptoms are worse in morning or evening. If NO diurnal variation, mark none
0= No variation
1= Worse in A.M.
2= Worse in P.M.

_____
B. When present, mark the severity of the variation. Mark "None" if NO variation
0= None
1= Mild
2= Severe

HDRS (page 4)

---

19. **DEPERSONALIZATION AND DEREALIZATION** (Such as: Feelings of unreality; Nihilistic ideas)

_____
0= Absent
1= Mild
2= Moderate
3= Severe
4= Incapacitating

20. **PARANOID SYMPTOMS**

_____
0= None
1= Suspicious
2= Ideas of reference
3= Delusions of reference and persecution

21. **OBSESSIONAL AND COMPULSIVE SYMPTOMS**

_____
0= Absent
1= Mild
2= Severe

Total Score _____

APPENDIX IV: Young's Mania Rating Scale (YMRS)

Mania Rating Scale

Guide for Scoring Items-The purpose of each item is to rate the severity of that abnormality in the patient. When several keys are given for a particular grade of severity, the presence of only one is required to qualify for that rating.

The keys provided are guides. One can ignore the keys if that is necessary to indicate severity, although this should be the exception rather than the rule.

Scoring between the points given (while not best practice is possible and encouraged after experience with the scale is acquired. This is particularly useful when severity of a particular item in a patient does not follow the progression indicated by the keys.

1. Elevated Mood

0. Absent
1. Mildly or possibly increased on questioning
2. Definite subjective elevation; optimistic, self confident; cheerful; appropriate to content
3. Elevated, inappropriate to content; humorous
4. Euphoric; inappropriate laughter; singing

2. Increased Motor Activity-Energy

0. Absent
1. Subjectively increased
2. Animated; gestures increased
3. Excessive energy; hyperactive at times; restless (can be calmed)
4. Motor excitement; continuous hyperactivity (cannot be calmed)

3. Sexual Interest

0. Normal: not increased
1. Mildly or possibly increased
2. Definite subjective increase on questioning
3. Spontaneous sexual content; elaborates on sexual matters; hypersexual by self-report
4. Overt sexual acts (toward patients, staff, or interviewer)

4. Sleep

0. Reports no decrease in sleep
1. Sleeping less than normal amount by up to one hour
2. Sleeping less than normal by more than one hour
3. Reports decreased need for sleep
4. Denies need for sleep

5. Irritability

0. Absent
2. Subjectively increased
4. Irritable at times during interview; recurrent episodes of anger or annoyance on ward
6. Frequently irritable during interview; shgy cuts throughout
8. Hostile, uncooperative; interview impossible

6. Speech (Rate and Amount)

0. No increase
2. Feels talkative
4. Increased rate or amount at times, verbose times
6. Push; consistently increased rate and amount difficult to interrupt
8. Pressured; uninterruptible, continuous speech

7. Language-Thought Disorder

0. Absent
1. Circumstantial, mild distractibility, quick thoughts
2. Distractible; loses goal of thought; changing topics frequently; racing thoughts
3. Flight of ideas; tangentiality follow, rhyming, echolalia
4. Incoherent; communication impossible

8. Content

0. Normal
2. Questionable plans, new interests
4. Special project(s) ; hyperreligious
6. Grandiose or paranoid ideas; ideas of relence
8. Delusions; hallucinations

9. Disruptive-Aggressive Behaviour

0. Absent, co-operative
2. Sarcastic; loud at times, guarded
4. Demanding; threats on ward
6. Threatens interviewer; shouting; interview difficult
8. Assaultive; destructive; interview impossible,

10. *Appearance*

0. Appropriate dress and grooming
1. Minimally unkempt
2. Poorly groomed; moderately dishevell4 overdressed
3. Dishevelled; partly clothed; garish make-up',
4. Completely unkempt; decorated; bizarre gar

11. Insight

0. Present; admits illness; agrees with need for treatment
1. Possibly ill
2. Admits behaviour change, but denies illness
3. Admits possible change in behaviour, but denies illness
4. Denies any behaviour change

APPENDIX V: Chinese version of Rivermead Behavioural Memory Test (C-RBMT) – Story-telling, Immediate Recall, and Delayed Recall

C-RBMT – Story telling

姓名：_____ 編號：_____

讀出指示：「我會讀一篇大概五至六行字嘅文章俾你聽，你留心聽住，當我讀完後，你要講我嘅內容俾我聽。」

標題：消防員同一群義工 全日救熄西貢 大網仔以南六公里嘅一場山火。 由於消防車唔能夠直達火場，全部消防設備 都要由直昇機運送。 附近嘅大生農場被白色濃煙遮蓋，所有家畜都要疏散。

C-RBMT (page 2)

Immediate Recall.

尋日 / 消防員 / 同一群義工 / 全日 / 撲救 / 係西貢 / 大網仔 / 以南 / 六公嘿 / 嘅一場山火 。 / 由於消防車 / 唔能夠直達火場， / 全部消防設備 / 都要由直昇機運送。 / 附近嘅 / 大生農場 / 被白色 / 濃煙 / 遮蓋， / 所有家畜 / 都要疏散。.

(字數：77　資料：21).

分數 _____.

.

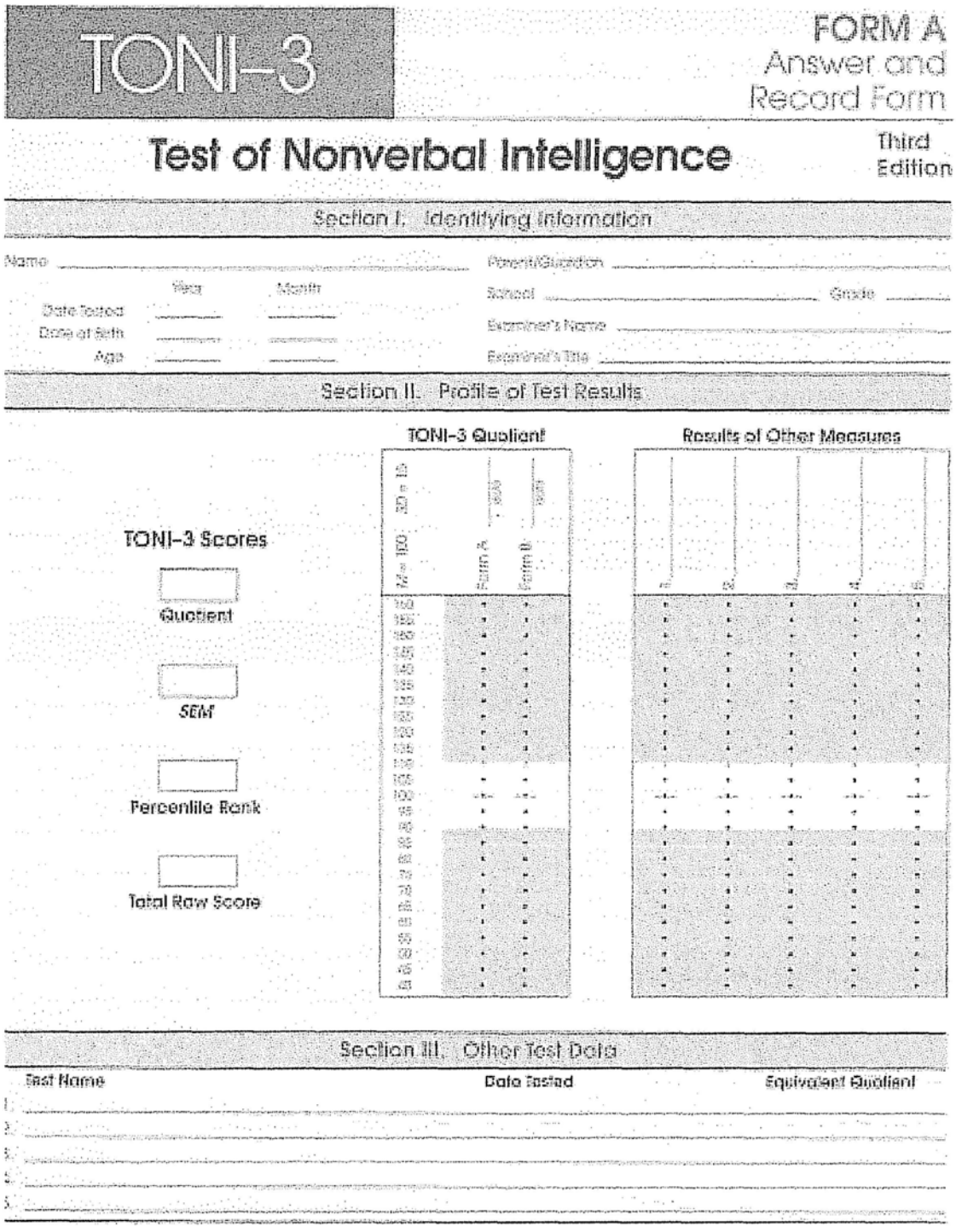
Delay Recall.

尋日 / 消防員 / 同一群義工 / 全日 / 撲救 / 係西貢 / 大網仔 / 以南 / 六公嘿 / 嘅一場山火 。 / 由於消防車 / 唔能夠直達火場， / 全部消防設備 / 都要由直昇機運送。 / 附近嘅 / 大生農場 / 被白色 / 濃煙 / 遮蓋， / 所有家畜 / 都要疏散。.

(字數：77　資料：21).

分數 _____.

APPENDIX VI: Test of Nonverbal Intelligence-Third Edition



TONI-3

FORM A
Answer and
Record Form

Test of Nonverbal Intelligence

Third
Edition

Section I. Identifying Information

Name _____ Parent/Guardian _____

Year Month

Date Tested _____ _____ School _____ Grade _____

Date of Birth _____ _____ Examiner's Name _____

Age _____ _____ Examiner's Title _____

Section II. Profile of Test Results

TONI-3 Scores

Quotient

SEM

Percentile Rank

Total Raw Score

TONI-3 Quotient

Results of Other Measures

Section III. Other Test Data

Test Name	Date Tested	Equivalent Quotient
1.		
2.		
3.		
4.		
5.		

TONI-3 (page 2)

Section VI. Responses to the TONI-3 Form A

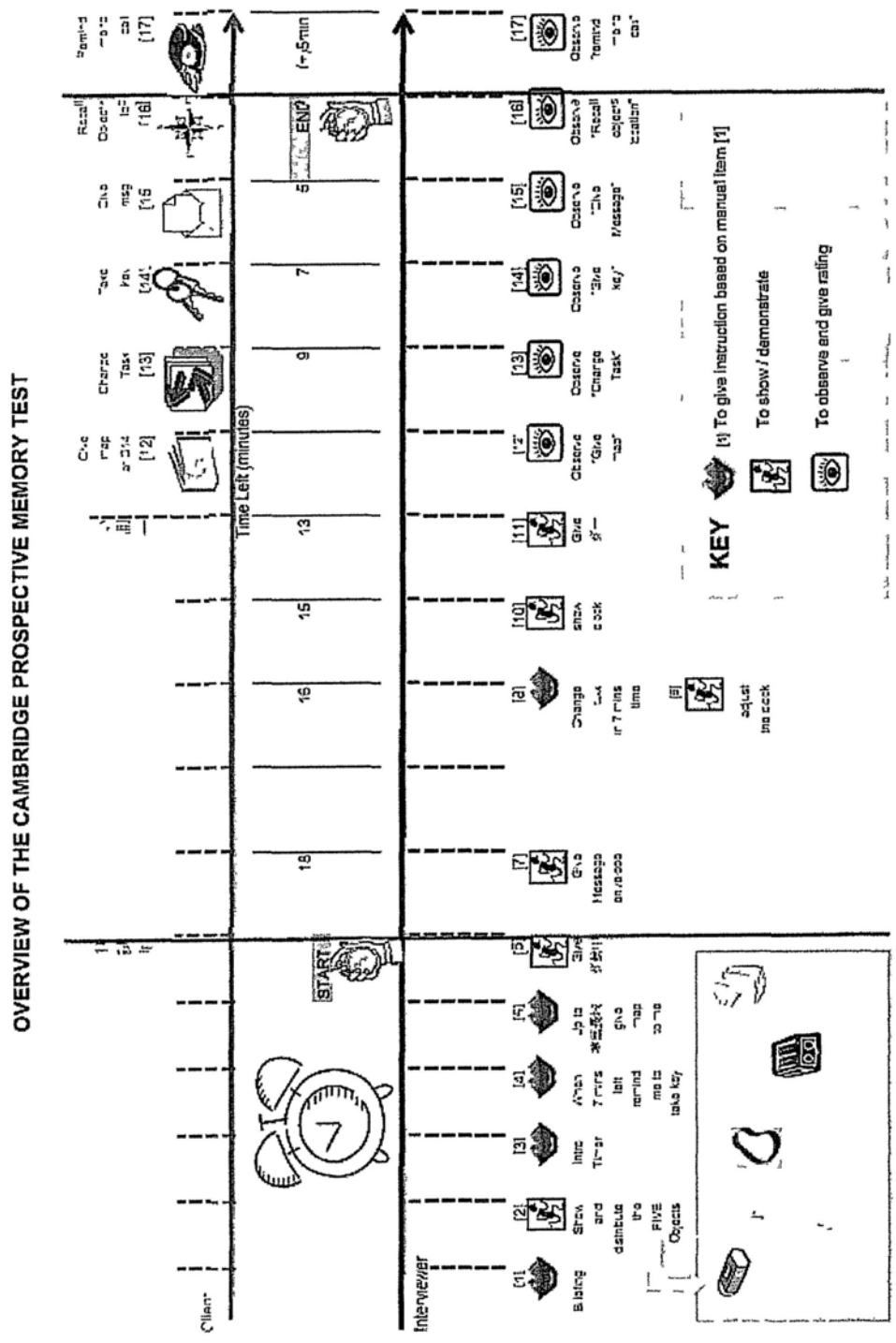
____	1.	1	2	**3**	4	5	6	____	24	1	**2**	3	4	5	6
____	2.	1	2	3	4	**5**	6	____	25.	1	2	3	**4**	5	6
____	3.	1	2	3	**4**	5	6	____	26	1	2	**3**	4		
____	4.	1	**2**	3	4	5	6	____	27	1	2	3	4	**5**	6
____	5	1	2	3	4	5	**6**		28	1	**2**	3	4		
	6.	**1**	2	3	4	5	6	____	29	1	2	3	4	5	**6**
____	7.	**1**	2	3	4	5	6	____	30	1	2	**3**	4	5	6
____	8	1	**2**	3	4	5	6	____	31	**1**	2	3	4	5	6
____	9.	1	2	3	4	5	**6**	____	32	1	**2**	3	4		
____	10	1	2	**3**	4	5	6	____	33.	1	2	3	4	**5**	6
____	11	1	2	3	**4**			____	34	1	**2**	3	4	5	6
____	12.	1	2	3	4	**5**	6	____	35	1	2	3	4	5	**6**
____	13	1	**2**	3	4	5	6	____	36	**1**	2	3	4		
____	14	1	2	3	**4**	5	6	____	37	1	**2**	3	4		
____	15	1	2	3	4	**5**	6	____	38	1	2	**3**	4	5	6
____	16.	1	2	3	4	5	**6**	____	39.	1	2	3	4	**5**	6
____	17.	1	2	**3**	4			____	40	1	2	3	**4**		
____	18	**1**	2	3	4	5	6	____	41	1	2	3	4	5	**6**
____	19	1	2	3	4	5	**6**	____	42	1	**2**	3	4	5	6
____	20	1	2	3	4	**5**	6	____	43	1	2	**3**	4	5	6
____	21	1	2	**3**	4	5	6	____	44	1	2	3	**4**	5	6
	22	**1**	2	3	4	5	6	____	45	1	2	3	**4**	5	6
____	23	1	2	3	**4**	5	6	____	**Total Raw Score**						

Begin testing at item A1 and continue testing to item A45 or until the subject has missed three consecutive items

TONI-3 conversion from raw score to IQ

Raw	IQ
0	60
1	61
2	62
3	63
4	64
5	*65*
6	66
7	67
8	68
9	*69*
10	*70*
11	72
12	73
13	75
14	76
15	*77*
16	79
17	80
18	81
19	83
20	*83*
21	84
22	85
23	88
24	90
25	*92*
26	93
27	94
28	95
29	97
30	*98*
31	100
32	102
33	104
34	106
35	*108*
36	110
37	112
38	113
39	115
40	*119*
41	125
42	130
43	135
44	140
45	145

APPENDIX VII: Chinese version of the Cambridge Prospective Memory Test (C-CAMPROMPT) – Overview



APPENDIX VIII: Chinese version of the Cambridge Prospective Memory Test (C-CAMPROMPT) – Scoring sheet

Case No:	Rating Date:	Interviewer:	1

【1】

12. 觀察患者直至他完成問題卡第 14 條 — 有關香港大嶼山 (萬里長城) 的問題 患者應將書本 (地圖) 交給測試員。

區段	分數 (✓)	
• 答完第 14 條並自發地將書本 (地圖) 給予測試員	A=6	
• 做錯任務，要測試員提示是另一項任務	B=4	
• 提示後依然錯；要測試員提示「你應該是給我書本 (地圖)」	C=2	
• 到第 15 條，要測試員提示有一項任務	D=4	
• 提示後做錯任務；要測試員提示是另一項任務	E=2	
• 提示後依然錯；要測試員提示「你應該是給我書本 (地圖)」	F=1	
• 經「提示有一項任務」後猶豫；測試員確定是有一項任務	G=1	
• 經「提示有一項任務」後仍然說：「記不起」	H=0	

【2】

13. 當計時器顯示剩餘 9 分鐘 時，患者應轉換另一任務 (筆)。

區段	分數 (✓)	
• 自發地轉換另一任務 (筆)	A=6	
• 做錯任務，要測試員提示是另一項任務	B=4	
• 提示後依然錯；要測試員提示「你應該轉換另一任務 (筆)」	C=2	
• 剩餘 8 分鐘時仍未作出反應，要測試員提示有一項任務	D=4	
• 提示後做錯任務；要測試員提示是另一項任務	E=2	
• 提示後依然錯；要測試員提示「你應該轉換另一任務 (筆)」	F=1	
• 經「提示有一項任務」後猶豫；測試員確定是有一項任務	G=1	
• 經「提示有一項任務」後仍然說：「記不起」	H=0	

【3】

14. 當計時器顯示剩餘 7 分鐘 時，患者須提示你去拿鎖匙 (杯子)。

區段	分數 (✓)	
• 自發地提示你去拿 鎖匙 (杯子)	A=6	
• 做錯任務，要測試員提示是另一項任務	B=4	
• 提示後依然錯；要測試員提示「你應該提示我去拿鎖匙 (杯子)」	C=2	
• 未有反應，在剩餘 6 分鐘時測試員提示有一項任務	D=4	
• 提示後做錯任務；要測試員提示是另一項任務	E=2	
• 提示後依然錯；要測試員提示「你應該提示我去拿鎖匙 (杯子)」	F=1	
• 經「提示有一項任務」後猶豫；測試員確定是有一項任務	G=1	
• 經「提示有一項任務」後仍然說：「記不起」	H=0	

C-CAMPROMPT scoring sheet (page 2)

【4】

15. 當計時器顯示剩餘 5 分鐘 時，測試員說：「現在還剩餘 5 分鐘。」

患者此時應將信息交給你。

區塊	分數（✓）	
• 自發地將信息交給你	A=6	
• 做錯任務，要測試員提示是另一項任務	B=4	
• 提示後依然錯；要測試員提示「你應該將信息交給我」	C=2	
• 15 秒內未有反應，測試員提示有一項任務	D=4	
• 提示後做錯任務；要測試員提示是另一些任務	E=2	
• 提示後依然錯；要測試員提示「你應該將信息交給我」	F=1	
• 經「提示有一項任務」後想像；測試員確定是有一項任務	G=1	
• 經「提示有一項任務」後仍然說：「記不起」	H=0	

【5】

16. 當計時器顯示 0 分鐘及響起時，患者此時應告訴你有關 5 樣物件及它們所放置的地方。

區塊	分數（✓）	
• 自發地自發地告訴你有關物件及它們所放置的地方	A=6	
• 做錯任務，要測試員提示是另一項任務	B=4	
• 提示後依然錯；要測試員提示「你應該告訴我在測驗開始時我所隱藏的物件及它們所放置的地方」	C=2	
• 15 秒內未有反應，測試員提示有一項任務	D=4	
• 提示後做錯任務；要測試員提示是另一些任務	E=2	
• 提示後依然錯；要測試員提示「你應該告訴我在測驗開始時我所隱藏的物件及它們所放置的地方」	F=1	
• 經「提示有一項任務」後想像；測試員確定是有一項任務	G=1	
• 經「提示有一項任務」後仍然說：「記不起」	H=0	

【5b】 患者須告訴你有關 5 樣物件及它們所放置的地方。如果患者未能告訴你那些物件是甚麼及隱藏的地方，測試員便說：「你是否記得起那些物件是甚麼及它們所隱藏的地方？」

如有需要，可逐一提示每一樣物件（例如，說：*「我隱藏了甚麼？」*，*「我隱藏了甚麼東西？」*）及每一個隱藏地點（說：*「我放了在甚麼地方？」*）。
記錄患者之反應及有否使用提示。

雖然 20 分鐘已過，但測試仍未完成，所以測試者應與患者繼續保持對話，直至完成最後一個任務。

C-CAMPROMPT scoring sheet (page 3)

【6】

17. **當完成測試後 5 分鐘**，患者應提示你打電話到車房查詢車子是否準備好 (打電話到接待處查詢另一位病人是否已來到)。

區段	分數 (✓)	
• 自發地提示你打電話到車房（接待處）	A=6	
• 做錯任務，需測試員提示是另一項任務	B=4	
• 提示後依然錯；需測試員提示「你應該提示我打電話到車房（接待處）」	C=2	
• 1 分鐘內 (即完成測試後 6 分鐘) 仍未有反應，測試員提示有一項任務	D=4	
• 提示後做錯任務：需測試員提示是另一些任務	E=2	
• 提示後依然錯；需測試員提示「你應該提示我打電話到車房（接待處）」	F=1	
• 經「提示有一項任務」後醒覺；測試員確定是有一項任務	G=1	
• 經「提示有一項任務」後仍然說：「記不起」	H=0	

分數總結

		Time	Event	Score conversion
(12)	書本 / 地圖		☐	Score A = 6
(13)	轉換任務 / 車	☐		Score B = 4
(14)	車鎖匙 / 杯子	☐		Score C = 2
(15)	交信息		☐	Score D = 4
(16)	物件及位置		☐	Score E = 2
(17)	打電話到車房 / 接待處	☐		Score F = 1
	Total time-based	☐		Score G = 1
	Total event-based		☐	Score H = 0
	Overall total score	☐		

APPENDIX IX: Chinese version of the Functional Needs Assessment (CFNA)

機能需要評估中文版 評分紀錄表	Case No _____
病房：_____ 日期：_____	机构编号：_____ 负责评估人员：_____

評分準則 ：5 = 能完成所有要求　　0 = 未能完成任何一項要求

	項目	次項目					備註	主項目評分
		a.	b.	c.	d.	e.		
1/	使用廁所技巧							
2/	洗澡技巧							
3/	個人衛生							
4/	穿衣技巧							
5/	進食技巧							
6/	住處料理							
7/	完成簡單任務的技巧							
							自我照顧主項目總分	/175
8/	身體活動能力							
9/	明白能力							
10/	表達能力							
11/	空間和地方的認知							
12/	時間認知							
13/	個人資料							
14/	數字概念和簡單運算							
15/	安全意識和預防危險的能力							
16/	使用廚房的技能							
17/	預備食物							
18/	洗衣技巧							
19/	在社區中的活動能力							
20/	理財							
21/	購物							
22/	參與治療							
23/	職前所需技巧							
24/	社交禮儀							
25/	計劃和作決定							
26/	參加休閒活動							
							社區生活主項目總分	/475
							評估總分 ＝自我照顧主項目總分＋社區生活主項目總分	/650

APPENDIX X: Consent form for subjects

香港中文大學醫學院

威爾斯親王醫院及沙田醫院

精神病患者及精神分裂症患者的前瞻性記憶力(對特定事情的事前的記憶力)及其在日常生活技能中的重要性之研究

（接受調查同意）

本人 _____ 現居 _____
（姓名及香港身份證號碼） （地址）

_____

同意參與以上之研究，而此研究之性質、目的及檢查程序已經由 _____ 先生／女士詳細解釋。本研究之目的是比較精神病患者、精神分裂症患者及沒有精神病人士的前瞻性記憶力及其與日常生活技能的關係。大約有 180 位人士會參與此項研究。本人的個人資料如姓名，年齡，性別，身份証號碼，地址，電話號碼等會被記錄，這些資料等會保密及只用於此項研究。本人明白參與此項研究能幫助了解前瞻性記憶力問題及其治療。本人完全明白到等會接受一次過約三小時的評估：當中包括精神科醫生面談、心理測驗、記憶力測試及日常生活能力評測。本人明白此研究純屬自願性質，本人不參與此研究等不會對本人的治療有任何影響。本人亦了解到本人可以隨時通知有關人仕退出此項研究。如本人對此項研究有任何疑問，可聯絡香港醫院管理局沙田醫院職業治療師歐永昌先生，電話：26357556。

病人簽名： _____

病人姓名： _____

研究人員姓名： _____

研究人員簽名： _____

見證人姓名： _____

見證人簽名： _____

日期： _____

APPENDIX XI: Ethics approval of the research protocol (for 2008/2009)

Faculty Of Medicine
The Chinese University Of Hong Kong

Hospital Authority
New Territories East Cluster

Joint The Chinese University of Hong Kong – New Territories East Cluster Clinical Research Ethics Committee

Flat 8C, Block B, Staff Quarters, Prince of Wales Hospital, Shatin, HK.
Tel: (852) 2632 2978 Fax: (852) 2646 6035 Website: http://www.crec.cuhk.edu.hk

To: Mr. Wing Cheong, AU
Student (Doctor of Philosophy in Medical Science)
The Chinese University of Hong Kong

Ethics Approval of Research Protocol

CREC Ref. No.:	CRE-2008.21*
Date of Approval:	02 July 2008*
Date of Amendment Approval:	19 December 2008
Study Title:	Prospective Memory and its Functional Significance in Chinese Patients with Schizophrenia and Bipolar Affective Disorder
Investigator(s):	Wing Cheong AU, Edwin LEE, Gabor UNGVARI, David SHUM, David MAN, Y.T. Xiang and Wai Kwong TANG
Academic Supervisor:	Prof. Wai Kwong TANG
Site Supervisor(s):	Prof. Wai Kwong TANG

I write to inform you that ethics approval has been given for you to conduct the captioned study in accordance with the following documents submitted:

- Research Proposal
- Informed Consent Form in Chinese Version

  Amendment(s) dated 05 December 2008
- Revised Hong Kong Verbal Learning Test (HKVLT) – Story Telling Episode

This ethics approval* will be valid for 12 months. Application for further renewal can be made by submitting the Ethics Renewal and Research Progress Report Form to the CREC (Download the electronic form template from the http://www.crec.cuhk.edu.hk/eng/current_forms/Renewal%20Form.doc). You are kindly requested to report to the Committee upon completion of the project.

The Joint CUHK-NTEC Clinical Research Ethics Committee is organized and operates according to ICH-GCP and the applicable laws and regulations.

Miss Winkie Tsui
CREC Officer
Joint CUHK-NTEC
Clinical Research Ethics Committee

WL/ct

Ethics approval

(for 2009/2010)

香港中文大學醫學院
Faculty Of Medicine
The Chinese University Of Hong Kong

醫院管理局
Hospital Authority
New Territories East Cluster

Joint The Chinese University of Hong Kong – New Territories East Cluster
Clinical Research Ethics Committee
香港中文大學—新界東聯合醫院 臨床研究倫理 聯合委員會

Flat 3C, Block B, Staff Quarters, Prince of Wales Hospital, Shatin, HK
Tel : (852) 2632 3058 / 2144 5926 Fax : (852) 2646 6653 Website : http://www.cuhk.edu.hk

To: Mr. Wing Cheong AU
Student, Doctor of Philosophy in Medical Science
The Chinese University of Hong Kong

Renewal of Ethics Approval

Ethics Ref. No.:	**CRE-2005.247**
Date of Renewal Approval:	**02 July 2009***
Study Title:	**Prospective Memory and its Functional Significance in Chinese Patients with *Schizophrenia* and Bipolar Affective Disorder**
Investigator(s):	**Wing Cheong AU, Edwin LUI, Gabor UNGVARI, David SHI M, David MAN, Y.L. Xiang and Wai Kwong TANG**
Academic Supervisor:	**Prof. Wai Kwong TANG**
Site Supervisor(s):	**Prof. Wai Kwong TANG**

Reference is made to the ethics application of the captioned study in accordance with the approval letter dated 14 January 2009. I am pleased to inform you that ethics approval for renewal of the said study was granted on 02 July 2009.

This ethics approval will be valid for 12 months starting from the date of renewal. Application for further renewal can be made by submitting the Ethics Renewal and Research Progress Report Form to the CREC. Download the electronic form template from the URL: http://www.cuhk.edu.hk/ or http://medicine.cuhk.edu.hk/. You are kindly requested to report to the Committee upon completion of the project.

The Joint CUHK-NTEC Clinical Research Ethics Committee is constituted and operates according to Part 6A of the applicable laws and regulations.

Miss Winkie Lui
CREC Office
Joint CUHK-NTEC
Clinical Research Ethics Committee

WL/cc

Ethics approval

(for 2010/2011)

香港中文大學醫學院
Faculty of Medicine
The Chinese University of Hong Kong

醫院管理局
新界東醫院聯網
Hospital Authority
New Territories East Cluster

Joint Chinese University of Hong Kong-New Territories East Cluster
Clinical Research Ethics Committee

[illegible]

To: Mr Wing Cheong AI
Student (Doctor of Philosophy in Medical Science)
The Chinese University of Hong Kong

Renewal of Ethics Approval

CREC Ref. No.:	**CRE-2008.247**
Date of Renewal Approval:	**02 July 2010***
Study Title:	**Prospective Memory and Its Functional Significance in Chinese Patients with Schizophrenia and Bipolar Affective Disorder**
Investigator(s):	**Wing Cheong AI, Edwin LEE, Gabor UNGVARI, David SHUM, David MAN, Y.T. Xiang and Wai Kwong TANG**
Academic Supervisor(s):	**Prof. Wai Kwong TANG**
Site Supervisor(s):	**Prof. Wai Kwong TANG**

I write to inform you that ethics approval has been renewed for the captioned study in accordance with the approval letter dated 01 June 2009.

This ethics approval* will be valid for 12 months starting from the date of renewal. Application for further renewal can be made by submitting the Ethics Renewal and Research Progress Report Form to the CREC (Download the electronic form template from the http://www.crec.cuhk.edu.hk or http://[illegible]). You are kindly requested to report to the Committee upon completion of the project.

The Joint CUHK-NTEC Clinical Research Ethics Committee is organized and operates according to ICH-GCP and the applicable laws and regulations.

Miss Wai Kai Lin
CREC Officer
Joint CUHK-NTEC
Clinical Research Ethics Committee

WLAs