Schizophrenia Research 210 (2019) 89–93

Contents lists available at ScienceDirect

Schizophrenia Research

journal homepage: www.elsevier.com/locate/schres

# A comparison of different types of prospective memory reminders in schizophrenia

Julie D. Henry [a,*], Phillipa Moore [a], Gill Terrett [b], Peter G. Rendell [b], James G. Scott [c,d]

[a] School of Psychology, University of Queensland, Brisbane, Australia
[b] Australian Catholic University, Melbourne, Australia
[c] The Queensland Centre for Mental Health Research, The University of Queensland Faculty of Medicine, Queensland, Australia
[d] Metro North Mental Health Royal Brisbane and Women's Hospital, Queensland, Australia

ARTICLE INFO

*Article history:*
Received 7 February 2019
Received in revised form 5 June 2019
Accepted 5 June 2019
Available online 18 June 2019

*Keywords:*
Schizophrenia
Prospection
Memory aids
Virtual Week
Functional capacity

ABSTRACT

People with schizophrenia often experience difficulties with prospective memory (PM), but few empirical studies have directly compared the effectiveness of different types of reminders in remediating these difficulties. In the present study, two distinct types of reminders were compared to a standard (no reminder) condition in outpatients with schizophrenia ($n = 30$) and controls ($n = 30$). Using an adapted version of the well-validated laboratory PM measure, Virtual Week, participants were asked to complete three different conditions (counterbalanced), in which they were (i) provided with access to self-initiated reminders, (ii) provided with experimenter-initiated reminders, and (iii) completed a standard (no-reminder) condition. Both groups benefited from the provision of reminders, but self-initiated reminders were the most beneficial, particularly for time-based tasks. These data align with a broader literature that shows PM can be enhanced by the use of reminders. However, it extends this literature in an important way by showing that these benefits are equivalent for people with schizophrenia, and may be greatest where access to reminders is self-initiated. The implications of these data for the development of rehabilitative interventions are discussed.



## 1. Introduction

Prospective memory (PM) refers to the cognitive operations involved in remembering to complete an intended action, such as taking medication, or turning off appliances. PM is of critical importance for everyday functioning and a large literature has now emerged focused on better understanding how capacity for PM is affected in those living with schizophrenia. Based on a recent review, Wang et al. (2017) concluded that, "Findings of studies conducted so far indicate that PM is severely impaired in schizophrenia." (p. 1). PM deficits have been identified in the early, prodromal phase (Frommann et al., 2011), in first-episode schizophrenia (Lui et al., 2015), and have even been suggested to be a key predictor of initial onset (Lui et al., 2011; Zhou et al., 2012). Deficits are also evident in symptomatically remitted patients (Chen et al., 2015), as well as first-degree relatives (Saleem et al., 2017). Because of how early these deficits appear, and because they do not appear to simply reflect a secondary consequence of broader neurocognitive impairment (Henry et al., 2007; Lui et al., 2015), it has been argued that PM should be considered a neuropsychological marker of schizophrenia (Lui et al., 2015).

In line with this view, it is also noteworthy that PM deficits appear to be a relatively consistent clinical feature that emerges regardless of how the PM task is operationalized. Thus, most evidence indicates that schizophrenia is associated with deficits across multiple types of PM (Wang et al., 2017), as well as other aspects of prospection more broadly (Lyons et al., 2016). These deficits in prospective cognition have been indexed using a variety of different, well validated methods of assessment, including self-report, computerized tests and psychometric test batteries (for a review, see Wang et al., 2017).

Of greatest importance is the finding that level of PM impairment is a strong predictor of functional outcomes (Au et al., 2014; Raskin et al., 2014; Twamley et al., 2008). For instance, Raskin et al. (2014) noted that PM played a critical role in medication management skills, identifying PM as a significant predictor of medication adherence, even after controlling for broader neurocognitive impairment (see also, Lam et al., 2013). Moreover, a recent study involving 153 individuals with severe mental illness (SMI) found that poorer PM was associated with greater illness burden (disability benefits, hospitalization history, current functional capacity), and functional disability (Burton et al., 2018).

Compensatory memory strategies provide new ways to accomplish a cognitive task by working around cognitive weaknesses. However, although several programs are currently available which involve teaching compensatory strategies, such as the Thinking Skills for Work Program (which incorporates the use of practical prospective memory

* Corresponding author at: School of Psychology, University of Queensland, St Lucia, QLD 4072, Australia.
*E-mail address:* julie.henry@uq.edu.au (J.D. Henry).

https://doi.org/10.1016/j.schres.2019.06.002
0920-9964/

compensatory strategies to aid daily living, McGurk et al., 2015), these also use other approaches to enhance cognitive function, making it difficult to isolate the most effective aspects of the intervention. Analogously, although several studies have shown that compensatory reminder strategies specifically are effective at improving prospective remembering, they have not compared the *relative* efficacy of different types of reminders (see e.g., Pijnenborg et al., 2010; Velligan et al., 2008; Chen et al., 2016). At present, it therefore remains unclear whether specific types of compensatory strategies are more effective than others for people with schizophrenia, and consequently how best to compensate for schizophrenia-related PM difficulties. This is an important question to address, both to enhance our theoretical understanding of the cognitive mechanisms that support PM function in schizophrenia, but also to inform the refinement of cognitive interventions for clinical practice. The goal of the present study was therefore to provide an empirical assessment of the efficacy of different types of reminders at enhancing PM function in people with schizophrenia.

To address this goal, an adapted version of the well-validated PM task, Virtual Week, was used (Henry et al., 2012). In this paradigm, conditions that incorporated self-initiated and experimenter-initiated cues were compared with performance on a standard (no reminder cue) condition. This contrast is clinically important and interesting because it directly speaks to whether people with schizophrenia experience the greatest benefit when they are provided with reminder cues at fixed, arbitrary times (experimenter-initiated), or when they are instead given the resources to access reminder cues as often as they need, and at times of their own choosing (self-initiated). While t was predicted that the provision of any type of compensatory strategy (reminders) would enhance PM function for people with schizophrenia relative to a no-reminder condition, the key question of interest was whether self-initiated or experimenter-initiated reminders would be associated with the greatest benefits.

## 2. Methods

### 2.1. Participants

Thirty clinical participants that met DSM-V (American Psychiatric Association, 2013) criteria for schizophrenia or schizoaffective disorder were recruited from the Australian Schizophrenia Research Bank, the Royal Brisbane Women's Hospital, and a not-for-profit community mental health organisation. All clinical participants were outpatients, aged over 18, clinically stable, and had never been diagnosed with a neurological condition or treated for a substance use disorder. The majority were receiving atypical antipsychotic medication. The average age of illness onset was 24.4 years ($SD = 6.37$), and duration of illness was 14.5 years ($SD = 10.04$). Severity of illness was measured using the Scale for the Assessment of Positive Symptoms (SAPS; Andreasen, 1984) and the Scale for the Assessment of Negative Symptoms (SANS; Andreasen, 1983). Mean composite scores were 5.0 ($SD = 3.59$) and 8.1 ($SD = 3.17$) respectively, consistent with a relatively mild level of symptom presentation and stable phase of illness.

Thirty non-clinical controls were recruited via advertisements. Controls were assessed for schizotypy proneness using the Schizotypal Personality Questionnaire (SPQ; Raine, 1991). Their mean score of 17.0 out of a possible maximum of 74 ($SD = 11.36$) was consistent with norms regarding paranoid ideas and psychotic experiences among the general population (Badcock and Dragović, 2006). Exclusion criteria included a history of neurological insult or psychiatric disorders.

Background information for the two groups is reported in Table 1. The schizophrenia and control groups did not differ in gender composition (73% males, and 67% males, respectively), $\chi^2(1) = 0.31$, $p = .581$, $\Phi = 0.07$, or in age ($M = 38.7$, $SD = 12.06$ and $M = 42.9$, $SD = 15.68$, respectively), $F(1, 59) = 1.37$, $p = .246$, but did differ in years of education ($M = 12.9$, $SD = 3.48$ and $M = 15.6$, $SD = 3.48$, respectively, $F(1, 59) = 9.13$, $p = .004$).

**Table 1**
Characteristics of the control and clinical participants.

| \Measure | Schizophrenia | | Control | | Inferential statistics | | |
|---|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *F* | *df* | *p* |
| NART | 108.6 | 7.82 | 111.8 | 5.67 | 3290 | 59 | .075 |
| Phonemic fluency | 31.6 | 10.01 | 42.5 | 12.62 | 13.91 | 59 | <.001 |
| Semantic fluency | 16.5 | 4.38 | 20.3 | 4.35 | 11.58 | 59 | .001 |
| SEFCI - delay | 5.1 | 1.50 | 7.1 | 1.95 | 19.58 | 59 | <.001 |
| TMT ratio | 3.0 | 1.57 | 2.7 | 1.75 | 0.45 | 59 | .507 |
| TMT part A | 32.8 | 9.46 | 26.5 | 10.07 | 6.17 | 56 | .016 |

### 2.2. Procedure and measures

All procedures were approved by the Royal Brisbane Women's Hospital and University of Queensland Human Research Ethics Committees. All participants completed the experimental PM measure, clinical assessments, and background measures of cognitive function (counterbalanced). Average testing duration was 3 h, and participants were remunerated $60AUD.

#### 2.2.1. Background cognitive measures

The National Adult Reading Test (NART; Nelson and Willison, 1991) was used to index premorbid intelligence. The Trail Making Test Part A (TMT A) was used as a measure of psychomotor speed, and a ratio score for Part B (TMT B – TMTA/TMTA) as a measure of executive control. Measures of phonemic (FAS) and semantic (animals) fluency were also used to index executive control. Retrospective memory was indexed using the Delayed Recall subtest from the Screening Examination for Cognitive Impairment (Beatty et al., 1995).

#### 2.2.2. Prospective memory

Participants completed a modified version of the well-validated PM task, Virtual Week (see Online Supplemental Information for full details about the measure, and how the original version was adapted for use in the current study). There is considerable evidence for the reliability and validity of VW in many clinical groups, including schizophrenia (Henry et al., 2007; Rendell and Henry, 2009).

Briefly, Virtual Week is a board game that simulates daily life. Participants move a token around the board with the roll of a die and are instructed to make choices regarding daily activities and remember to carry out lifelike activities (PM tasks). In the present study, participants were asked to complete 6 'days' of Virtual Week (i.e. six loops around the board), with each 'day' including ten PM tasks: four regular (i.e., recurring), four irregular (i.e., one-off), and two time-check tasks. For the regular and irregular tasks, half were event-based (i.e., cued by a specific contextual cue) and the other half were time-based (i.e., cued by a specific time on the board). *Time-check* tasks were dependent on participants' monitoring the time of a stop clock visible on the top of the board that was independent to the ongoing activities encountered in Virtual Week.

As noted, in the present study an adapted version of Virtual Week was used which included three different types of reminder condition: (1) experimenter-initiated, whereby one pop-up reminder was displayed on the computer screen with the tasks to be completed that day, (2) self-initiated, whereby the participant could click a 'To Do' list at any point and as many times as desired during the day to view a list of tasks to be completed that day (see Fig. 1), or (3) no reminder, which effectively corresponded to the standard version of VW. Because of their one off nature, reminders were manipulated in relation to the *irregular* PM tasks only. The order of reminders was counterbalanced across participants, with each type of reminder repeating for two consecutive days. After completing each virtual day, participants were asked to identify all the tasks that they had been prompted to complete that day.

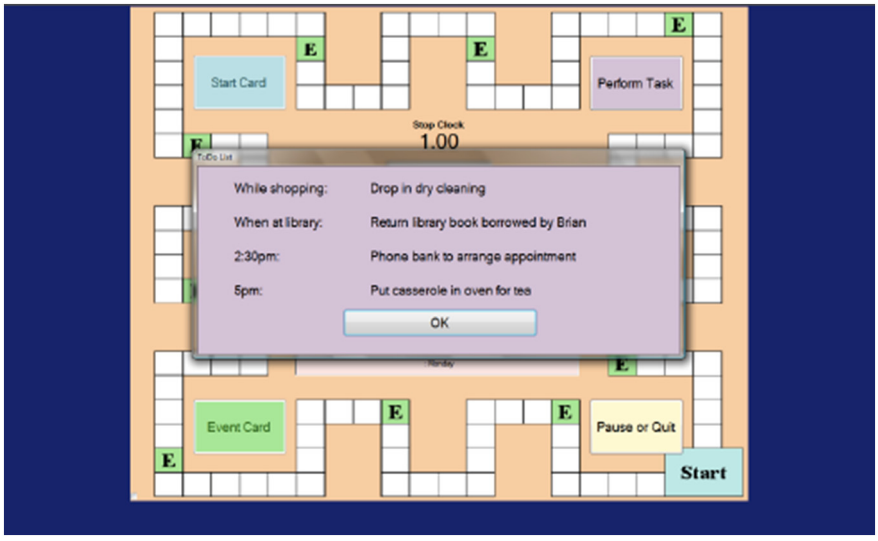


**Fig. 1.** The self-initiated reminder cue, or 'To Do' list that participants were able to access in Virtual Week.

## 3. Results

### 3.1. Background characteristics

As can be seen in Table 1, the two groups did not differ in premorbid intelligence or the TMT ratio score. However, the clinical group exhibited lower scores on both measures of verbal fluency, the TMT Part A, as well as the SEFCI-delay task. These data indicate that although the two groups were matched in terms of premorbid intellectual function, the clinical group performed significantly worse on the measures of retrospective memory, processing speed and one of the executive control tasks.

### 3.2. Regular and time-check task performance

To investigate performance on the PM tasks that were *not* manipulated by reminder conditions (i.e. regular and time-check tasks), a 2 (group; clinical, control) x 3 (PM task; event-based, time-based, time-check) mixed ANOVA was conducted. These data are shown in Fig. 2. Focusing here specifically on effects involving group, it can be seen that group and PM tasks did not interact, $F(2, 116) = 1.96$, $p = .145$, $\eta_p^2 = 0.03$. However, a main effect of group emerged, $F(1, 58) = 8.89$, $p = .004$, $\eta_p^2 = 0.13$, which reflected worse PM performance for the clinical participants ($M = 0.47, SD = 0.10$) relative to controls ($M = 0.67, SD = 0.10$).

### 3.3. The influence of reminder type

The next step in analyses was to test the effectiveness of different reminder types in facilitating PM performance, as indexed by performance on the irregular tasks. The proportion of correct responses on the irregular PM tasks for each of the two groups are shown in Fig. 3. These data were formally analyzed with a mixed $2 \times 3 \times 2$ ANOVA, in which the between-group variable was *group* (clinical, control) and the within-groups variables were *reminder type* (self-initiated, experimenter initiated, no reminder), and *PM cue* (event, time). There were main effects of group, $F(1, 58) = 8.68$, $p = .005$, $\eta_p^2 = 0.13$, PM cue, $F(1, 58) = 15.06$, $p < .001$, $\eta_p^2 = 0.21$, and reminder type $F(2, 116) =$

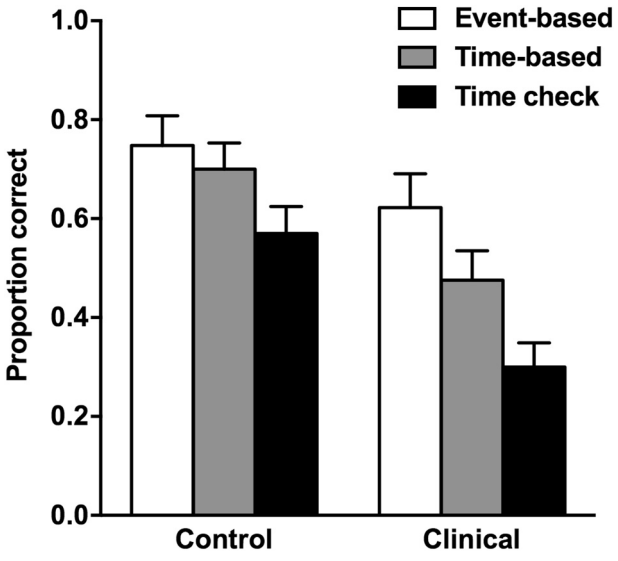


**Fig. 2.** Performance on the regular event-based, regular time-based, and time-check tasks presented separately for the control and clinical groups. Bars represent one standard error of the mean.

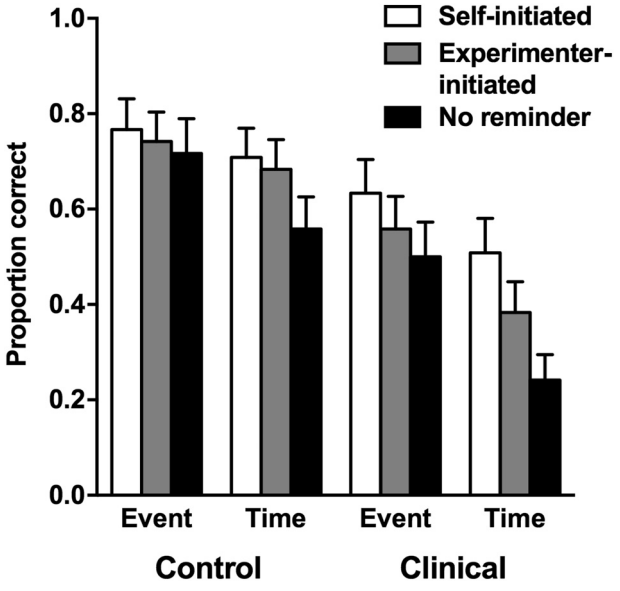


**Fig. 3.** Mean proportion of correct responses for irregular PM tasks completed for control and clinical participants as a function of reminder and PM type (bars represent one standard error of the mean).

17.18, $p < .001$, $\eta_p^2 = 0.23$. The main effect of group reflected poorer performance on the irregular PM tasks for people with schizophrenia ($M = 0.47$, $SD = 0.11$) relative to controls ($M = 0.70$, $SD = 0.11$). The main effect of PM cue reflected better performance when participants received an event-based cue ($M = 0.69$, $SD = 0.35$) as opposed to time-based cues ($M = 0.59$, $SD = 0.33$), regardless of group. The main effect of reminder type reflected highest performance accuracy when reminders were self-initiated ($M = 0.65$, $SD = 0.33$), followed by experimenter-initiated reminders ($M = 0.59$, $SD = 0.32$), and lowest accuracy when there was no reminder ($M = 0.50$, $SD = 0.35$).

No interactions emerged involving group. Thus, group did not interact with reminder type, $F(2, 116) = 2.05$, $p = .134$, $\eta_p^2 = 0.03$, or with PM cue, $F(1, 58) = 1.74$, $p = .192$, $\eta_p^2 = 0.03$; nor was there any three-way interaction between group, reminder type and PM cue, $F(2, 116) = 0.14$, $p = .869$, $\eta_p^2 = 0.002$. The only interaction to emerge did not involve group, and this was between PM cue and reminder type, $F(2, 116) = 3.27$, $p = .041$, $\eta_p^2 = 0.05$. Formal follow up tests of this interaction are also provided as Online Supplemental Information. However, in brief, these data indicate that reminders increase PM performance on both event-based and time-based tasks, but are particularly beneficial for the latter.

### 3.4. Frequency of accessing reminders

Given that the self-initiated reminder condition provided unlimited access to participants' "To Do" list, we then tested whether there were differences in terms of the number of times the two groups accessed the list per virtual day. The results showed that there was no difference between the clinical ($M = 4.07$, $SD = 3.45$) and the control participants ($M = 4.20$, $SD = 2.86$), $t(58) = 0.163$, $p = .871$, $d = 0.04$. Frequency of accessing the 'To Do' list was not related to irregular PM task performance in the control group ($r = -0.07$, $p > .05$), but was positively correlated with performance in the schizophrenia group ($r = 0.38$, $p = .02$).

## 4. Discussion

By conducting the first direct comparison of whether self- and experimenter-initiated reminders differ in their capacity to enhance PM function in people with schizophrenia, the present study is both timely and important. It has long been recognized that "Without an intact prospective memory it is scarcely possible to function independently in an everyday life context" (Cohen, 1996; p. 54) and in the context of SMI specifically, poorer PM has been directly linked to greater illness burden and functional disability (Burton et al., 2018). Moreover, there have been renewed calls for the need to develop compensatory PM strategies, as these are widely acknowledged to be critical to reduce the impact of PM impairment on daily life (Raskin, 2018). Indeed, in a recent review of the schizophrenia literature, Wang et al. (2018) concluded that, "more rehabilitation studies to improve PM performance in these individuals are needed."

The first key result to emerge aligned with most prior literature in showing that, relative to a no reminder condition, provision of reminders is associated with better PM function in people with schizophrenia. Moreover, this effect was comparable in magnitude for both the clinical and control groups. This is an important and interesting finding, because it is not the case that people with schizophrenia benefit from all interventions focused on enhancing PM. For instance, it has been shown that (in contrast to the beneficial effects seen for healthy controls) the provision of emotional stimuli at encoding does not confer any benefit for people with schizophrenia, relative to neutral PM stimuli (Yang et al., 2018).

Moreover, as detailed earlier, there have been very few prior studies focused on the *relative* efficacy of different reminders. Consequently, the most important result to emerge in this study was the finding that self-initiated reminders were more effective in facilitating PM than experimenter-initiated reminders. These data therefore indicate that this self-initiated reminder strategies such as developing and checking 'to do' lists should be prioritized in any rehabilitative program. Moreover, given that the magnitude of this effect was particularly strong for time-based PM tasks, it may be most beneficial to encourage use of self-initiated reminder strategies for everyday tasks that have to be completed at specific times (such as taking medications, or attending appointments).

An important consideration when interpreting these data are that, in contrast to the experimenter-initiated condition which involved reminders being provided at a fixed, arbitrary time, the self-initiated condition allowed participants to determine *when* and *how* frequently reminders were accessed. This meant that self-generated reminders could be initiated at those times when an individual needed memory refreshment the most, allowing an individual to calibrate the reminder interval(s). The current study showed that participants with schizophrenia were just as likely as controls to access the self-initiated reminder, and benefitted equally from this type of reminder. However, in the self-initiated reminder condition there was also greater saturation of the to-be-remembered information, with participants in both groups accessing reminder information on average four times per virtual day. This meant that they were exposed to reminder information approximately four times more frequently than in the experimenter-initiated condition. The greater benefits seen for the self-initiated condition might therefore also reflect greater exposure to the to-be-remembered information.

### 4.1. Clinical implications

The current results have immediate and direct clinical implications. This is because they indicate that it may be more beneficial for mental health care professionals to encourage the use of self-initiated reminders for people with schizophrenia. For instance, instead of (or in addition) to having a text-message service that automatically sends out reminders prior to functionally important target actions, one useful intervention might be to encourage the habit of keeping a diary and self-generating 'To Do' lists. This strategy could be used to improve areas of functioning which challenge people living with schizophrenia including medication adherence and engagement in activities that improve physical health such as brushing of teeth (Tani et al., 2012) and participation in physical activity (Suetani et al., 2016). Because in the present study more frequent use of the 'To Do' list predicted significantly better performance in the clinical group, while no significant relationship was evident for the control group, it would also be a valuable strategy to encourage the habit of frequently referring to any external aid that was self-generated.

### 4.2. Limitations and future directions

The most important limitation of this study was the relatively high functioning of the schizophrenia group. All clinical participants were living independently, medicated and in a stable phase of illness. It therefore remains to be established whether self-initiated reminders show greater benefits in those who are living with more severe positive and negative symptoms of psychosis. In particular, people with schizophrenia who present with prominent negative symptoms such as avolition may be expected to benefit very little from self-initiated reminders. Indeed, consideration of the potentially confounding influence of avolition in people with schizophrenia is now considered critical in many functional domains (Millan et al., 2014). In schizophrenia, motivational deficits have been particularly linked to impaired goal representation (Barch et al., 2016). Reminder interventions that impose minimal demands on self-initiated processing (such as the experimenter-initiated reminder condition used in the present study), while simultaneously linking these reminder cues to rewarding outcomes, might therefore be expected to be particularly beneficial for

people with schizophrenia who present with prominent motivational disturbances.

### 4.3. Conclusion

The present study provides further evidence that individuals with schizophrenia have a consistent and relatively generalized PM deficit. The important novel findings to emerge were that provision of reminders significantly and comparably enhances PM function for clinical and control participants, and that reminders that are self-initiated are particularly beneficial for both groups. Future research is now needed to clarify the underlying mechanisms by which different types of reminders elicit their effects on PM function, as well as to test the predicted clinical implications via interventions that particularly encourage the development of self-initiated reminders. Future studies are also needed that directly assess how the efficacy of different types of reminders varies as a function of specific clinical presentations.

#### Contributors

JDH, GT and PGR designed the study. PM collected and processed the data. PM, JDH and PGR undertook the statistical analyses. JDH prepared the first draft of the manuscript. All other authors subsequently contributed significantly to the interpretation of the findings, reviewed the manuscript, and have approved the final manuscript.

## Funding

This research was supported by the Australian Research Council Discovery Project Grant (DP170101239). JDH was supported by an Australian Research Council Future Fellowship (FT170100096). JGS is supported by a National Health and Medical Research Council Practitioner Fellowship Grant (APP1105807).

#### Declaration of Competing Interest

None.

#### Acknowledgements

We are very grateful to all the participants who volunteered to take part in this study.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.schres.2019.06.002.

## References

American Psychiatric Association, 2013. Diagnostic and Statistical Manual of Mental Disorders.
Andreasen, N.C., 1983. Scale for the Assessment of Negative Symptoms. University of Iowa, Iowa City, IA.
Andreasen, N.C., 1984. Scale for the Assessment of Positive Symptoms. University of Iowa, Iowa City, IA.
Au, R.W., Man, D., Xiang, Y.T., Shum, D., Lee, E., Ungvari, G.S., Tang, W.K., 2014. Prospective memory predicts the level of community living skills in schizophrenia. Psychiatry Res. 219 (1), 86–91.
Badcock, J.C., Dragović, M., 2006. Schizotypal personality in mature adults. Personal. Individ. Differ. 40 (1), 77–85.
Barch, D.M., Pagliaccio, D., Luking, K., 2016. Mechanisms underlying motivational deficits in psychopathology: similarities and differences in depression and schizophrenia. Curr. Top. Behav. Neurosci. 27, 411–449.
Beatty, W.W., Paul, R.H., Wilbanks, S.L., Hames, K.A., Blanco, C.R., Goodkin, D.E., 1995. Identifying multiple sclerosis patients with mild or global cognitive impairment using the Screening Examination for Cognitive Impairment (SEFCI). Neurology 45 (4), 718–723.
Burton, C.Z., Vella, L., Twamley, E.W., 2018. Prospective memory, level of disability, and return to work in severe mental illness. Clin. Neuropsychol. 1–12.
Chen, G., Zhang, L., Ding, W., Zhou, R., Xu, P., Lu, S., ... Cui, H., 2015. Event-related brain potential correlates of prospective memory in symptomatically remitted male patients with schizophrenia. Front. Behav. Neurosci. 9, 262.
Chen, X.J., Liu, L.L., Cui, J.F., Gan, M.Y., Li, C.Q., Neumann, D.L., Chan, R.C., 2016. The effect and mechanisms of implementation intention in improving prospective memory performance in schizophrenia patients. Psychiatry Res. 244, 86–93.
Cohen, 1996. Memory in the real world. Psychology Press, Hove, England.
Frommann, I., Pukrop, R., Brinkmeyer, J., Bechdolf, A., Ruhrmann, S., Berning, J., Wagner, M., 2011. Neuropsychological profiles in different at-risk states of psychosis: executive control impairment in the early—and additional memory dysfunction in the late—prodromal state. Schizophr. Bull. 37 (4), 861–873.
Henry, J.D., Rendell, P.G., Kliegel, M., Altgassen, M., 2007. Prospective memory in schizophrenia: primary or secondary impairment? Schizophr. Res. 95 (1–3), 179–185.
Henry, J.D., Rendell, P.G., Phillips, L.H., Dunlop, L., Kliegel, M., 2012. Prospective memory reminders: a laboratory investigation of initiation source and age effects. Q. J. Exp. Psychol. 65 (7), 1274–1287.
Lam, J.W., Lui, S.S., Wang, Y., Chan, R.C., Cheung, E.F., 2013. Prospective memory predicts medication management ability and correlates with non-adherence to medications in individuals with clinically stable schizophrenia. Schizophr. Res. 147 (2–3), 293–300.
Lui, S.S., Wang, Y., Liu, A.C., Chui, W.W., Gong, Q.Y., Shum, D., Chan, R.C., 2011. Prospective memory in patients with first-onset schizophrenia and their non-psychotic siblings. Neuropsychologia 49 (8), 2217–2224.
Lui, S.S., Wang, Y., Yang, T.X., Liu, A.C., Chui, W.W., Yeung, H.K., Chan, R.C., 2015. Problems in remembering to carry out future actions in first-episode schizophrenia: primary or secondary impairment? J. Psychiatr. Res. 61, 141–149.
Lyons, A.D., Henry, J.D., Rendell, P.G., Robinson, G., Suddendorf, T., 2016. Episodic foresight and schizophrenia. Brit. J. Clin. Psychol. 55 (2), 107–122.
McGurk, S.R., Mueser, K.T., Xie, H., Welsh, J., Kaiser, S., Drake, R.E., McHugo, G.J., 2015. Cognitive enhancement treatment for people with mental illness who do not respond to supported employment: a randomized controlled trial. Am. J. Psychiatry 172 (9), 852–861.
Millan, M.J., Fone, K., Steckler, T., Horan, W.P., 2014. Negative symptoms of schizophrenia: clinical characteristics, pathophysiological substrates, experimental models and prospects for improved treatment. Eur. Neuropsychopharmacol. 24 (5), 645–692.
Nelson, H.E., Willison, J., 1991. National Adult Reading Test. 2nd edition. NFER-Nelson.
Pijnenborg, G.H.M., Withaar, F.K., Brouwer, W.H., Timmerman, M.E., van den Bosch, R.J., Evans, J.J., 2010. The efficacy of SMS text messages to compensate for the effects of cognitive impairments in schizophrenia. Brit. J. Clin. Psychol. 49 (2), 259–274.
Raine, A., 1991. The SPQ: a scale for the assessment of schizotypal personality based on DSM-III-R criteria. Schizophr. Bull. 17 (4), 555–564.
Raskin, S.A., 2018. Prospective memory in clinical populations. Clin. Neuropsychol. 32 (5), 741–747.
Raskin, S.A., Maye, J., Rogers, A., Correll, D., Zamroziewicz, M., Kurtz, M., 2014. Prospective memory in schizophrenia: relationship to medication management skills, neurocognition, and symptoms in individuals with schizophrenia. Neuropsychology 28 (3), 359–365.
Rendell, P.G., Henry, J.D., 2009. A review of virtual week for prospective memory assessment: clinical implications. Brain Imp. 10 (1), 14–22.
Saleem, S., Kumar, D., Venkatasubramanian, G., 2017. Prospective memory in first-degree relatives of patients with schizophrenia. Clin. Neuropsychol. 32 (5), 1–9.
Suetani, S., Waterreus, A., Morgan, V., Foley, D.L., Galletly, C., McGrath, J.J., 2016. Correlates of physical activity in people living with psychotic illness. Acta Psychiatr. Scand. 134 (2), 129–137.
Tani, H., Uchida, H., Suzuki, T., Shibuya, Y., Shimanuki, H., ... Mimura, M., 2012. Dental conditions in inpatients with schizophrenia: a large-scale multi-site survey. BMC Oral Health 12, 32.
Twamley, E.W., Woods, S.P., Zurhellen, C.H., Vertinski, M., Narvaez, J.M., Mausbach, B.T., Jeste, D.V., 2008. Neuropsychological substrates and everyday functioning implications of prospective memory impairment in schizophrenia. Schizophr. Res. 106 (1), 42–49.
Velligan, D.I., Diamond, P.M, Mintz, J., Maples, N., Li, X., Zeber, J., ... Miller, A.L., 2008. Use of individually tailored environmental supports to improve medication adherence and outcomes in schizophrenia. Schizophr. Bull. 34 (3), 483–493.
Wang, Y., Chan, R.C.K., Shum, D.H.K., 2017. Schizophrenia and prospective memory impairments: a review. Clin. Neuropsychol. 1–22.
Wang, Y., Chan, R.C.K., Shum, D.H.K., 2018. Schizophrenia and prospective memory impairments: a review. Clin. Neuropsychol. 32 (5), 836–857.
Yang, T.X., Cui, X.L., Wang, Y., Huang, J., Lui, S.S.Y., Zhang, R.T., Chan, R.C.K., 2018. Effect of emotional cues on prospective memory performance in patients with schizophrenia and major depressive disorder. Schizophr. Res. 201 (11), 145–150.
Zhou, F.C., Xiang, Y.T., Wang, C.Y., Dickerson, F., Au, R.W., Zhou, J.J., Ungvari, G.S., 2012. Characteristics and clinical correlates of prospective memory performance in first-episode schizophrenia. Schizophr. Res. 135 (1–3), 34–39.