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## Clinical utility of the Multiple Errands Test in schizophrenia: A preliminary assessment



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### ABSTRACT

Schizophrenia (SZ) is a chronic, severe disease, which results in misperception of reality, major social withdrawal, and cognitive disturbances. One type of cognitive disturbance, known as executive dysfunction, is widely considered as a primary determinant of functional outcome. However, classic neuropsychological measures of executive functioning (EF) poorly represent patients' functional outcome, and thus seem inappropriate for evaluating the real-world functional impact of diseases such as SZ. We hypothesized that the Multiple Errands Test (MET), an ecological assessment of executive function would show greater ability to measure everyday adaptive functioning SZ, compared to conventional EF assessment methods. 100 clinically stable SZ patients were administered the MET, Wisconsin Card Sorting Test – 64 and a paper version of MET. Correlation analyses were performed between each EF measure and functional outcome, as measured by the Social Autonomy Scale (SAS). After adjusting for age, education, IQ and illness duration, SAS was significantly predicted by MET global score. No other EF measure correlated with SAS. Results from this study suggest that MET offers a valuable prediction of daily life functional outcome in this large sample of SZ patients. Therefore, it could be used as a complementary measure to improve the identification of executive dysfunctions prior to psychosocial interventions.

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### 1. Introduction

Schizophrenia (SZ) is a chronic, severe disease, and the third most disabling disorder of the central nervous system worldwide. The global cost of SZ is estimated at 23.7 million disability-adjusted life years (DALYs) (Collins et al., 2011). SZ begins in early adulthood and is characterised by positive symptoms (e.g., delusions, hallucinations), negative symptoms (e.g., anhedonia, flat affect), thought disorders, motor behaviour abnormalities and cognitive impairment (CI). Symptoms such as these can result in misperception of reality and social withdrawal. CI is now widely considered a core deficit of this disorder (Elvevag and Goldberg, 2000) and a primary determinant of functional deficits. Indeed, CI largely contributes to functional outcome (e.g., professional insertion, community functioning, acquiring new skills, and managing every-day activities; Green and Harvey, 2014). As a

consequence, in Europe, 80% of SZ patients are unemployed, and most of them are single (Thornicroft et al., 2004). For these reasons, research on CI and its determinants is currently considered a priority (Furiak et al., 2014). Among cognitive domains, executive function is one of the most impaired areas studied in SZ (Minzenberg et al., 2009).

The term "executive function" (EF) refers to a large set of processes necessary for adapting to novel contexts and situations where routine and automatic actions are not sufficient (Eslinger and Damasio, 1985; Shallice, 1982). The EFs are therefore essential for autonomous, creative, and socially adaptive behaviours. Correlations exist between EF and ability to solve interpersonal problems (Green et al., 2000), vocational functioning, daily life activities management (Kessler et al., 2007; Penadés et al., 2010) and quality of life (Tolman and Kurtz, 2012). These higher-order cognitive processes play a major role in one's adaptation to their environment; thus, detailed assessment of an individual's cognitive deficits and subsequent functional impact seems primordial as part of holistic rehabilitative care.

The exploration of EF is complicated by several theoretical

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issues; specifically, complex and multifactorial EF concepts (such as involving planning, decision making, mental flexibility, the use of feedback and adaptation) are hard to operationalize. As a result, these concepts are difficult to measure appropriately and thus determine their real-world functional impact.

The Wisconsin Card Sorting Test (WCST) is one of the most widely used tools designed to measure EF. WCST is based on card sorting paradigm and involves a network of frontal and nonfrontal brain regions (Stuss et al., 2000). Performance on such tests is unlikely to reflect real life abilities (i.e., poor “generalizability”); it is not known what kind of real life situations require the cognitive constructs measured by WCST (Burgess et al., 2006). Although patients with SZ consistently show impaired performance on this task, no differences in WCST performance between patients with SZ and patients with depression have been documented.

Shallice and Burgess (1991), the EF assessment pioneers, demonstrated that most neuropsychological tests failed to fully apprehend EF impairments because of their highly structured material and very clear instructions, EF is unlikely to be captured by classic psychometric “paper and pencil” assessments that do not allow for dynamic interactions between the patient and the context. Indeed, EF assessment requires, by definition, poorly structured and complex situations, where unknown and unexpected events may appear and where different cognitive components must be coordinated (Kimberg and Farah, 1993).

The term “ecology” is defined as the relationship between an individual, their activity, and the environment (Christiansen et al., 2005). Ecological assessment of cognitive function incorporates the effect that environmental context that may have on an individual and the way one uses their cognitive, emotional and motor abilities in everyday life conditions (Seene, 2008).

Progressively, ecological approaches of EF assessment have gained much interest (Channon and Crawford, 1999; Chevignard et al., 2000; Gioia and Iaquith, 2004; Josman et al., 2009; Norris and Tate, 2000). These novel tasks take into account the relationship between an individual and their physical and social environments.

Shallice and Burgess (1991) have developed the Multiple Errands Test (MET) for patients with brain damage. The MET assesses day-to-day abilities, such as planning, adaptation, problem solving and mental flexibility in real life settings by incorporating contextual (i.e., social, perceptive) influences. Completing EF assessments outside of the typical laboratory setting may help identify subtle EF impairment that may not systematically be expressed in standard care conditions, and may consequently improve future care solutions. The MET is based on the Supervisory Attentional System (SAS) model of executive functioning and attention control, which specifies how thought and action schemas become activated or suppressed for routine and non-routine circumstances (Norman and Shallice, 1986).

The MET measures real-world EF by requiring participant to confront unpredictable situations and interpersonal interactions while planning and problem solving. Patients are asked to accomplish several tasks of varying complexity in an unknown commercial district. A number of rules must be respected and thus an action plan, strategy formulation, time and space management are required with very little assistance.

Most studies utilizing the MET have been conducted with patients with acquired brain damage (see Table 1 for a synthetic review of main MET studies). Le Thiec et al. (1999) offered an extensive protocol with the initial scoring system (in terms of inefficiencies, rule breaks, interpretation failures and task execution failures). Simplified versions of the MET have been suggested as more suitable in hospital settings (Alderman et al., 2003; Dawson et al., 2009; Knight et al., 2002). Only one case-study exists in SZ research (Duvigneau et al., 2010), thus it is difficult to

**Table 1**  
Principal adaptations of MET and diseases of interest.

Study	Clinical sample (n)	
Shallice and Burgess (1991)	TBI* (3)	Pilot study (MET)
Le Thiec et al. (1999)	TBI (12)	MET
McGeorge et al. (2001)	CA (9)	Virtual Multiple Errands Test (VMET)
Knight et al. (2002)	TBI (12), CA (5), TBI+CA (3)	Hospital version (MET-HV)
Alderman et al. (2003)	TBI (39), CA (9), TS (2)	Simplified version (MET-SV)
Dawson et al. (2009)	CA (14), TBI (13)	Baycrest MET (BMET)
Duvigneau et al. (2010)	SZ (1)	MET+extended qualitative scoring
Cuberos-Urbano et al. (2013)	TBI (30)	Hospital version (MET-HV)
Morrison et al. (2013)	MCA (25)	Revised version (MET-R)
Wicky et al. (2013)	TBI (unknown)	MET-PRO

\* TBI: Traumatic brain injury, CA: Cerebrovascular Accident, TS: Surgery for cerebral tumors, SZ: schizophrenia, MCA: Mild Cerebrovascular Accident.

draw conclusions about the MET's clinical utility in this patient population. Despite the frequency of EF impairment psychotic patients, no other study has investigated the utility of the MET in this population.

The current study is the first to utilize the MET in a large sample of participants with SZ. We hypothesized that the MET would have a better predictive ability of everyday adaptive functioning in patients with SZ compared to other conventional methods of EF assessment. To test this hypothesis, we examined whether MET scores were more strongly correlated to global functioning than scores on other traditional tests.

## 2. Methods

### 2.1. Participants

The current sample consisted of 100 participants with a diagnosis of SZ or schizoaffective disorder, according to DSM-5 criteria (see Table 2). All patients were interviewed by two different psychiatrists to confirm diagnosis. All participants were recruited from a university-affiliated hospital (Cognitive and Social Rehabilitation Centre, Psychiatry Department, Hôpitaux Universitaires Henri Mondor, AP-HP), and were in either full or partial remission, as determined by the remission criteria of Andreasen (Andreasen et al., 2014). Exclusion criteria consisted of: a history of neurological or somatic disorders with sensori-motor impact, toxic or alcohol abuse in the 6 months prior to participation, electroconvulsive therapy in the 12 months prior to participation, or any recent affective episode. All participants were fluent in French and had no untreated perceptive disorders that may affect understanding of oral and written questions.

**Table 2**  
Social and demographic characteristics of the sample.

	Patients
N	100
<b>Diagnostic category</b>	
Schizophrenia	75
Schizoaffective disorder	25
Duration of the illness (years), mean (SD)	7.7 (6.1)
Sex, % Male	81
Age, mean (SD)	30.9 (9.4)
Handedness, % Right handed	93
<b>Education level</b>	
Education class 1	19
Education class 2	39
Education class 3	42

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