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Everyday false memories in older persons with depressive disorder

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ABSTRACT

Generally we tend to think that memory in daily living is complete and accurate in healthy persons. However, current memory research has revealed inconspicuous memory faults. Rarely omissions and distortions of memory are researched with tasks resembling everyday life. We investigated healthy older control subjects (HC) and patients with depressive disorder (DD). Cognitive function was assessed with a comprehensive neuropsychological test battery and mood with the Montgomery-Asberg Depression Scale (MADRS). We assessed everyday veridical and distorted memories on showing participants original news and commercials. In most aspects of attention, executive functions, and memory, patients with DD performed worse than HC. Regarding memory content on viewing news or commercials the difference between patients with DD and HC was more pronounced for false memory content than for veridical memory content. Linear regression analysis showed the extent of false memory content being associated with mental flexibility as assessed with the Trail Making Test and mood as assessed with the MADRS for both information obtained on viewing news and commercials. Increase of false memories impedes overall accuracy of memory more than decrease of veridical memories in older persons with depressive disorder. Diminished executive functions and depressive mood partly explain these memory distortions.

1. Introduction

A slight decline of memory performance with aging is observed in situations demanding high levels of attention and controlled processing (Buckner, 2004). Healthy older subjects do not report decline of memory in everyday life although a slight memory decline is observed on objective assessment. Patients with depressive disorder (DD), however, frequently complain about memory impairment (O'Boyle et al., 1990; Fischer, 1996) sometimes culminating in a syndrome formerly named “depressive pseudodementia” (Nussbaum, 1994; Zapotoczky, 1998). Self-perceived cognitive dysfunction in patients with DD is associated with severity of depressive mood rather than objective cognitive dysfunction (Lovera et al., 2006).

Different profiles of cognitive impairment have been reported for young persons with depressive disorder. One cluster of patients has predominantly memory deficits, another cluster has impaired mental flexibility, and yet another cluster has impaired attention and memory (Hermens et al., 2011). Data on similar profiles in older persons with DD are missing. Cognitive deficits in depressed patients may partly result from motivational shortcomings (Scheurich et al., 2008) and contextual factors not necessarily caused by the depressive syndrome per se (Lee et al., 2009). However, it is unlikely that cognitive deficits in depressive disorder are solely explained by these non-cognitive factors.

Impairment of memory and other cognitive functions in depressive disorder just recently have come under more scrutiny (Porter et al., 2003; Lee et al., 2012; Lim et al., 2013; Papakostas, 2014). Executive function, which also acts as a mediator between neuropsychological domains and daily functioning (O’Bryant et al., 2011) was reported to be a core area of cognitive dysfunction in depression (Sheline et al., 2006). Impaired executive functions bring about memory deficits in patients with depressive disorder (Fossati et al., 2002) and affect memory processes at encoding, learning phase and retrieval (Elderkin-Thompson et al., 2007; Taconnat et al., 2010). Deficits in executive functions in patients with depressive disorder were interpreted as being suggestive of functional impairment of the frontal lobes (Elderkin-Thompson et al., 2011). Moreover, patients with DD have been reported to have smaller hippocampal volumes or diminished hippocampal recruitment (Bremner et al., 2000) (Sheline et al., 1996; Steffens et al., 2000; Gron et al., 2002; Janssen et al., 2004). Impaired hippocampal function was reported to be one further cause for inferior memory performance in patients with depressive disorder (Young et al., 2011; Turner et al., 2012).

Investigation of memory impairment has focused overwhelmingly on memory omissions, i.e. false negatives. Memory omissions result from a failure to recall or recognize information, which subjects have been exposed to in everyday life or under laboratory conditions. Errors

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of omission make memory incomplete. Beyond incompleteness of memory other imperfections of memory such as errors of commission have been described (Schacter, 1999). Errors of commission distort memory content.

Distortions of memory are a by-product of normal memory processes (Schacter, 1999) and have been loosely described as a failure to distinguish between perceived and internally generated information (Johnson and Raye, 1998). Previous research has broadly categorised them as inability to separate information from pre-existing general beliefs (bias), an unconscious fusion of information sources (misattribution), or errors due to external suggestions (suggestibility) (Schacter, 1999). Theoretical frameworks used to explain false memories suggest the influence of gist at encoding (Kim and Cabeza, 2007; Brainerd et al., 2008) and retroactive interference at consolidation (Wright and Loftus, 1998). The Source Monitoring Framework posits that false memories are formed at retrieval due to impaired monitoring process, when external information is misattributed to the actual experience on grounds of vividness or familiarity (Johnson et al., 1993; Mitchell and Johnson, 2009). According to this theory external stimuli activate not only the specific memory trace but also comparable and context related traces, and the executive system fails to discriminate between the two sources (McDonough and Gallo, 2008; Straube, 2012).

Viewed from a neurobiological perspective, memory distortions can further be explained by brain lesions, e.g. damage to the medial temporal or frontal lobe. The prior impairs distinction of veridical from false memory content (Cabeza et al., 2001) (Cabeza 2001 #21953) on from typical or comparable events (Chan and McDermott, 2007). The processes mediated by the medial temporal and frontal lobe work synergistically (Budson et al., 2002). Healthy older persons, who perform high on frontal lobe tests, have similar number of correct and false recognitions as younger persons in list learning paradigms (Beinhoff et al., 2008).

The most widely used approach to investigate false memories in young and elderly subjects is the Deese, Roediger and McDermott task (Jacoby, 1999; Hester et al., 2004). This test assesses false memories on learning and recall of semantic similarities of word lists. However, it has been discussed whether a list learning paradigm indeed has ecological validity and can accurately reflect memory distortions in everyday life situations (Freyd and Gleaves, 1996; Pezdek and Lam, 2007; Koriat et al., 2011). Nevertheless, such laboratory experiments have high internal validity and have laid grounds to understanding of the basic processes that also play their role in more complex ecologically relevant materials (Wade et al., 2007). Whereas the selection of paradigms and theories of false memories is broad, the paradigms assessing false memories in patients with depressive disorder focus on analysing learning and recall in by experimentally manipulating the emotional salience of the stimuli (Moritz et al., 2008; Joormann et al., 2009; Yeh and Hua, 2009; Howe and Malone, 2011; Bookbinder and Brainerd, 2016).

Given the abundance of context information, distortions of memory content are almost inevitable in everyday life among (Kopelman, 1999). The presence of false memories has been demonstrated in paradigms with relevance to everyday life such as memory for domestic catastrophes (Budson et al., 2004) or other political events (Frenda et al., 2013), memory for graphic illustrations of everyday scenes (Miller and Gazzaniga, 1998) or autobiographical events (Fernandes et al., 2008; McDonough and Gallo, 2013; Devitt et al., 2016), or eyewitness recollections (Loftus et al., 1978; Dodson and Krueger, 2006; Dodson et al., 2015; Aizpurua et al., 2011; Memon et al., 2003). None of these studies, however, assessed false memories in older patients with depressive disorder.

It was the goal of the present study to assess false memories in everyday task in older patients with depressive disorder. We hypothesized that basal cognitive impairments associated with depressive disorder, e.g. impairment of executive function, explain the extent of false memories even in complex everyday tasks. To investigate this, memory distortions were assessed with a task occurring in day-to-day life of most adults – learning and recalling information from news videos and commercials.

2. Methods

The present study was designed as an open-label, non-randomized, cross-sectional, mono-centric study. The study received approval of the ethics committee of Ulm University (233/15) and was done in accordance with the ethical standards of the University of Ulm and the guidelines outlined in the declaration of Helsinki. All persons gave their informed consent prior to their participation in the study.

2.1. Participants

The study sample comprised 23 healthy older controls (HC; 11 males, 12 females) and 24 older patients with DD (12 males, 12 females). There is no universally accepted definition of old age. We have defined “older adults” as being at least 60 years old. Sixteen and 18 of DD and HC, respectively, had at least 10 years of schooling. Four DD patients and 2 HC received at least 13 years of schooling, with the remaining 2 DD and 5 HC having a university degree with over 13 years of schooling. There was no education difference between the groups ($\chi(2) = 2.050$, $p = .359$). Healthy controls were volunteers recruited by local advertisements to take part in a study on memory and aging. Patients with DD were recruited from the Old Age Psychiatry Department of Ulm University. Patients received a comprehensive workup including analysis of medical history, neurological and psychiatric clinical findings and assessment of laboratory parameters. Neurodegenerative disorders, mental retardation, addictive behavior and other comorbid psychiatric disorders were ruled out; the Mini Mental State Examination score needed to be > 24. However, patients with DD on average had 5.2 ± 4.5 (mean ± SD) typical geriatric diagnoses such as hypertension, diabetes mellitus, and musculo-skeletal conditions in addition to the depressive disorder and on average were treated for these conditions with 7.5 ± 4.6 (mean ± SD) drugs. All patients met criteria of mild, moderate, or severe depressive episode according to the 10th version of the international statistical classification of diseases and related health problems (ICD-10) which was supported by self-report, third-parties report and MADRS (objective-report, Table 1). Considering the frequency of comorbid conditions in old age and often insufficient documentation for determining the number of depressive episodes we diagnosed the depressive mood state phenotypically without either organic exclusions or diagnostic hierarchy rules (Kessler et al.) such that the group comprised patients with both first time ever (n = 12) and recurrent depressive episode (n = 12).

Demographic variables are presented in Table 1.

2.2. Neuropsychological assessments

2.2.1. Clinical scales

2.2.1.1. Mini-Mental Status Examination (MMSE) (Folstein et al., 1975). The MMSE is a widely used instrument to give on overview

Table 1
Demographic variables of healthy controls (HC; n = 23) and patients with depressive disorder (DD; n = 24).

	HC		DD			
	Mean	SD	Mean	SD	*t*	*p*
Age	69.74	6.46	69.33	5.75	0.228	0.821
MADRS	2.57	2.57	23.42	9.92	− 9.953	< 0.001
MMSE	29.70	0.64	28.67	1.58	2.953	< 0.001

Legend: HC = healthy controls; MADRS = Montgomery and Asberg Depression-Rating-Scale; DD = depressive disorder; MMSE = Mini Mental State Examination.