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The effect of stereotype threat on older people's clinical cognitive outcomes: investigating the moderating role of dementia worry

Megan Fresson, Benoit Dardenne, Marie Geurten and Thierry Meulemans

Psychology and Neurosciences of Cognition Unit, University of Liège, Liège, Belgium

ABSTRACT

Objective: Numerous studies have shown that stereotype threat (ST) reduces older people's cognitive performance, but few have studied its impact on clinical cognitive outcomes. Our study was designed to further examine the impact of ST on the clinical assessment of older subjects' cognitive functioning, as well as the moderating role of fear of Alzheimer's Disease (AD) (or 'dementia worry'). **Method:** Seventy-two neurologically normal (MMSE > 26) participants aged between 59 and 70 completed a set of neuropsychological tasks in either an ST or a positive condition (condition in which negative stereotypes were invalidated). **Results:** Regression-based path analyses showed that only participants who expressed moderate or high fear of AD underperformed on executive tasks in the ST condition compared to their counterparts in the positive condition. Moreover, in the ST condition, participants' performance on executive tasks was more impaired (relative to normative data) than in the positive condition. However, ST had no effect on memory and attention performance. **Discussion:** Our results showed that ST can cause older people to perform at pathological levels on executive tasks. Results highlight the need for clinicians to be cautious when conducting neuropsychological assessments of older people who express high levels of dementia worry.

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Cognitive aging; stereotype threat; dementia worry; neuropsychological assessment

Although stereotypes about aging are well known to impair older adults' cognitive performance, only three studies have investigated the deleterious impact of stereotypes on clinical cognitive outcomes (Barber, Mather, & Gatz, 2015; Haslam et al., 2012; Mazerolle et al., 2016). Haslam et al. (2012) showed, for instance, that negative stereotypes could cause older adults to perform at a pathological level on a screening measure of dementia. In parallel to the scientific literature, the increasing public awareness of dementia (through television, health campaigns, etc.) has been found to trigger a fear of getting dementia in some older adults (Cutler & Hodgson, 1996). This is of prime concern as dementia worry is associated with poorer health outcomes, including cognitive self-assessment (Kessler, Bowen, Baer, Froelich, & Wahl, 2012). However, no study has yet considered dementia worry as a potential moderator of the effect of stereotype threat (ST) on older persons' cognitive performance.

CONTACT Megan Fresson megan.fresson@ulg.ac.be

As a matter of fact, in evaluation situations, performance can decrease as a result of a threat to the social group (the stereotype threat phenomenon) and/or to the individual (e.g. because of past experience of failure; Strickland-Hughes, West, Smith, & Ebner, 2016). As suggested by Régner et al. (2016; see also Shapiro & Neuberg, 2007), both group and individual levels should be considered when studying ST's effect on older adults' cognitive performance. In a population of cognitively intact older persons, ST may negatively affect the cognitive performance only of older persons who are already worried about dementia. Our study was designed to address this question and further examine ST's impact on clinical outcomes.

Stereotype threat

There is considerable scientific evidence showing that ST impairs cognitive performance (Steele & Aronson, 1995). Generally speaking, members of a stigmatized group (e.g. older persons) underperform in a particular domain (e.g. memory) when they are reminded of the stereotype about their group (e.g. 'older persons have poor memory'). There is now ample experimental evidence of this phenomenon in older persons (Chasteen, Bhattacharyya, Horhota, Tam, & Hasher, 2005; Desrichard & Kopetz, 2005; Hess, Auman, Colcombe, & Rahhal, 2003; Hess & Hinson, 2006; Hess, Hinson, & Hodges, 2009; Hess, Hinson, & Statham, 2004; Levy & Leifheit-Limson, 2009; Rahhal, Hasher, & Colcombe, 2001; see Lamont, Swift, & Abrams, 2015; for a review). For example, Rahhal et al. (2001) found that, when test instructions simply emphasized the memory components, older adults underperformed compared to young adults, whereas with memory-neutral instructions there were no differences between older and young adults' performance. Presumably, emphasizing the memory component of a test fits with the stereotype that older people have memory difficulties (Hummert, 1999). Along the same lines, Hess et al. (2003) provided their young and older participants with newspaper articles that either reinforced the negative view of aging and memory (negative condition) or contradicted this negative view (positive condition). They found that, while young participants performed equally well in either experimental condition, older adults' memory performance declined in the negative condition relative to the positive condition, and even compared to a neutral one. Note that, in addition to studies showing the detrimental impact of an 'external' stereotype (i.e. stereotype threat that is experimentally induced by a negative stereotype), another field of study highlights the impact of internalized stereotypes ('self-stereotypes') on health, including cognitive functioning (Levy, 2009).

However, this ST effect is not as unconditional as it might seem. Several studies have shown that some individual, psychosocial, and contextual characteristics can moderate ST's impact on older subjects' memory performance (Andreoletti & Lachman, 2004; Desrichard & Kopetz, 2005; Fernandez-Ballesteros, Bustillos, & Huici, 2015; Hess et al., 2003, 2009; Horton, Baker, Pearce, & Deakin, 2010; Kang & Chasteen, 2009). To name but two examples, Desrichard and Kopetz (2005) provided evidence that a lower level of memory self-efficacy in older people is associated with more harmful effects of ST, and Hess et al. (2003) showed that domain identification (i.e. the value that older people place on cognitive functions) moderates the impact of ST on memory performance (ST has a more negative effect on individuals who value memory most).

Despite the abundant experimental evidence that ST diminishes cognitive performance, too little is known about its impact on clinical neuropsychological outcomes, that is, in clinical diagnosis situations where older people's results are compared to normative data. To our knowledge, only three studies have examined ST's impact on older people's clinical cognitive outcomes. Haslam et al. (2012) manipulated the age-based self-categorization of their participants (60–70 years) by providing information about the participants' age spectrum in the study. Participants in the younger condition were told that the age spectrum was 60–90 and that they were therefore among the younger participants. In the older condition, the alleged age spectrum was 40–70, so the subjects' alleged position was at the older end of the spectrum. The experimenters also manipulated participants' view of cognitive aging (global cognitive decline vs. memory-specific decline). The results revealed poorer performance on a memory task and a global cognitive measure in the older condition than in the younger condition, with the decline in performance being most marked in the memory task for participants who expected a memory-specific decline and most marked in the global cognitive task for participants who expected a more global cognitive decline. Interestingly, 70% of the participants in the older condition who expected a global cognitive decline performed below the cut-off score on the screening measure (the global cognitive test) for dementia. Mazerolle et al. (2016) obtained similar results, with more older persons performing below the cut-off score on global cognitive tests in the ST condition than in the reduced-threat condition. Similarly, Barber et al. (2015) observed that their ST instructions affected the cognitive performance of older people (memory and global cognitive tasks). However, the deleterious effect was not sufficient to induce cognitive performance below the normative data. Finally, in addition to having an adverse effect on memory and global cognitive functioning, ST has also been found to affect another important component of clinical assessments, namely memory complaints (Bouazzaoui et al., 2016)

Taken together, all these results show that stereotype threat could contribute to an overdiagnosis of early dementia or Mild Cognitive Impairment (MCI; the prodromal state of dementia). Régner et al. (2016) also made such an assumption and highlighted the necessity for clinicians who practice with older adults to consider the influence of stereotype. The present study was therefore conducted to further consider the impact of ST on clinical outcomes. Specifically, we aimed to examine the impact of ST on specific cognitive tasks rather than on a global screening task (Barber et al., 2015; Haslam et al., 2012; Mazerolle et al., 2016). As Mazerolle et al. (2016) and Régner et al. (2016) suggested, investigating the effect of ST on specific cognitive tasks (neuropsychological battery) is of primary importance, given that, in clinical practice, neuropsychologists rely more on specific cognitive tasks than on global screening tasks when making their clinical judgments and diagnoses. Specific tasks commonly administered for the cognitive assessment of older persons are considered to be more reliable and indicative of possible dementia than a global screening task (Chen et al., 2000; Mitchell, 2009). It is therefore interesting to examine whether ST can also alter their validity and cause impaired performance on these specific tasks.

Regarding the impact of stereotypes on specific tasks, it has been consistently shown that tasks that rely heavily on executive processes are especially sensitive to the deleterious effect of ST (Schmader, Johns, & Forbes, 2008). Specifically, ST has been found to induce intrusive thoughts that participants try to suppress (e.g. see Schuster, Martiny, & Schmader, 2015). These suppression processes consume executive resources, which consequently become unavailable for completing the tasks. Therefore, ST can induce a decline in performance, especially on executive tasks. However, ST does not impair performance on all cognitive tasks. It preferentially impacts tasks that participants perceive as difficult (e.g. see Schuster et al., 2015).

Dementia worry: a moderator of stereotype threat?

As the worldwide population ages, Alzheimer's disease (AD) and dementia in general are becoming major health problems (Alzheimer's Association's, 2008; Sosa-Ortiz, Acosta-Castillo, & Prince, 2012). Consequently, there is growing media coverage and thus increased public awareness of cognitive aging and related diseases such as dementia and AD. The image conveyed is mostly negative (Peel, 2014): individuals suffering from AD are stereotypically seen as incompetent, as are older people in general (Fiske, Cuddy, Glick, & Xu, 2002; Sadler, Meagor, & Kaye, 2012). The result is that, as shown by the five-nation survey conducted by the Harvard University School of Public Health in collaboration with Alzheimer Europe (2011), AD is second only to cancer as the greatest health fear (see also MetLife Foundation, 2006). This fear of getting dementia or AD was initially referred to as 'anticipatory dementia' (Cutler & Hodgson, 1996) and defined as the fear of some (older) adults that their normal memory problems are indicative of dementia. This phenomenon is now generally referred to as 'dementia worry' (or 'perceived threat of AD') and defined as 'an emotional response to the perceived threat of developing dementia, independent of chronological age and cognitive status' (Kessler et al., 2012, p. 277). A growing number of studies have examined the predictors and correlates of dementia worry. For example, it has been consistently found that dementia worry is higher in middle-aged or older adults who have a (first-degree) relative suffering from AD than in those who do not (Cutler, 2015; Cutler & Brăgaru, 2015; Cutler & Hodgson, 2001). Some studies showed that poorer cognitive self-assessment predicts or is related to greater dementia worry (Cutler & Brăgaru, 2015; Cutler & Hodgson, 1996; but see Werner, 2002). Interestingly, Sun, Gao, and Coon (2015) showed that endorsement of negative stereotypes about AD predicts perceived threat of AD.

Other studies focused on the impact of dementia worry on health. For example, Cutler and Hodgson (2013, 2014) showed that greater dementia worry was associated with poorer psychological well-being (e.g. depression) and physical health outcomes (e.g. number of sick days). Regarding cognitive functioning, Lineweaver, Bondi, Galasko, and Salmon (2014) showed that middle-aged and older adults' memory performance and memory self-assessment were negatively affected if they learned that they had the apolipoprotein E (APOE) ε4 allele risk factor for AD: in that study, participants who knew they had the APOE ε4 allele performed worse on objective memory tasks and memory self-assessment than participants who did not know they carried the allele. Kinzer and Suhr (2016) showed that dementia worry moderated the relationship between actual cognitive impairment and memory concerns. In the group of older adults presenting cognitive impairment, memory concerns did not differ as a function of dementia worry. However, in the group exhibiting no cognitive impairment, those with high dementia worry had more memory concerns than their counterparts with low dementia fear. In fact, the cognitively healthy participants with high dementia worry reported as many memory concerns as the cognitively impaired groups with low and high dementia worry.

Hence, studies conducted on dementia worry highlight the importance of considering the worry that older adults feel about getting dementia. It is important to note that most studies of dementia worry were correlational and therefore did not provide evidence that dementia worry actually induces poorer health outcomes. However, some authors have hypothesized that dementia worry could diminish older persons' cognitive functions and exacerbate their cognitive complaints (Kessler et al., 2012; Kinzer & Suhr, 2016). We therefore hypothesized that dementia worry would moderate the impact of stereotype threat on both cognitive performance and complaints. We expected that the deleterious impact of ST would be greatest for older adults who had more dementia worry. Indeed, the situation of being tested for cognitive functioning under an ST condition is especially relevant for individuals who are very afraid of getting dementia.

Overview of the study

Stereotype threat has been found to diminish older adults' cognitive performance. On one hand, two studies even showed that its impact is sufficient to produce clinically impaired cognitive performance on global screening tests for dementia (Haslam et al., 2012; Mazerolle et al., 2016). Thus, ST could contribute to an incorrect diagnosis of MCI. On the other hand, dementia worry – the fear of getting dementia – has been hypothesized to exacerbate cognitive complaints and diminish cognitive performance (Kessler et al., 2012). However, no study has yet considered the moderating role of dementia worry in ST effects on older people's cognitive performance and cognitive complaints. To do so, before any stereotype activation, we first assessed the fear of AD in a group of older persons. About one week later, participants read either two news articles depicting the negative impact of aging on cognitive functioning (ST condition) or two news articles that nullified the negative stereotype regarding the effect of aging on cognitive functioning. Then, all participants were given neuropsychological tasks that are commonly administered in clinical practice (and have normative data with healthy older adults), as well as a cognitive complaints questionnaire.

We hypothesized that dementia worry would moderate the impact of ST on cognitive performance and cognitive complaints such that, compared to the positive condition, participants in the ST condition would show decreased cognitive performance, but only if they had expressed a high level of dementia worry. Moreover, we expected that the impact of ST would induce a decline in performance on specific cognitive tasks that might even reach the level of clinical impairment on these tasks (Haslam et al., 2012; Mazerolle et al., 2016).

Method

Participants

An a priori power analysis assuming medium effect size (f2 = .15) and using three predictors (see below) at $\alpha = .05$ indicated that n approaching 70 would provide around 75% power (G*Power 3.1.9.2; Faul, Erdfelder, Buchner, & Lang, 2009). We recruited 72 French-speaking participants (37 women) aged between 59 and 70 years old ($M = 64.04$; SD = 2.87). Participants were included in this study if they did not report any current or past neurological or psychiatric conditions (including substance abuse and alcoholism). Furthermore, the participants were neurologically healthy, with MMSE (Folstein, Folstein, & McHugh, 1975) scores ranging from 27 to 30. Participants took part in this study at home and chose the time of day (morning or afternoon) they preferred.

Material

Baseline measures

To ensure that cognitive capacities were equivalent between groups (before stereotype activation), participants were given the National Adult Reading Task (NART; Blair & Spreen, 1989) and the Letter-Number Sequencing subtask of the Wechsler Adult Intelligence Scale

(Wechsler, 2008) at the first session. To ensure equivalence between groups regarding subjective health and anxiety, before stereotype activation we administered the Short-Form Health Survey (Leplège, Ecosse, Verdier, & Perneger, 1998; Ware, Kosinski, Dewey, & Gandek, 2000) and the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1983).

French version of the National Adult Reading Task (Blair & Spreen, 1989). This task, which is indicative of verbal intellectual capacities, requires subjects to read aloud words with irregular spelling (34 items). The number of correct responses was recorded.

Letter-number sequencing subtask of the Wechsler Adult Intelligence Scale – fourth edition (WAIS-IV; Wechsler, 2008). In this 30-item working memory task, participants hear increasingly long sequences of letters and numbers and repeat first the numbers in ascending order, and then the letters in alphabetical order. The number of correct responses was recorded.

Short-Form Health Survey (SF-36; Leplège et al., 1998; Ware et al., 2000). This 36-item scale (Cronbach's α = .93) assesses subjective mental and physical health in clinical and general populations. Participants respond using Likert scales. Higher scores represent better subjective health.

State-Trait Anxiety Inventory (Spielberger et al., 1983). This self-assessment scale assesses state anxiety with 20 items (STAI-YA; Cronbach's α = .92) and trait anxiety with 20 items (STAI-YB; Cronbach's α = .88). Participants respond to statements using a 4-point Likert scale (from 'no' to 'yes'). Higher scores represent higher anxiety levels.

Experimental tasks
As the dependent variable, we chose to specifically assess cognitive areas that are commonly affected with pathological aging: attention, memory, and executive functioning. We selected specific cognitive tasks that are commonly administered to older persons in clinical settings. Participants completed the Coding subtask of the WAIS-IV (Wechsler, 2008) and the Flexibility subtask of the Test of Attentional Performance (TAP; Zimmermann & Fimm, 2010) to target attention. Memory was assessed with the California Verbal Learning Test (CVLT; Delis, Kramer, Kaplan, & Ober, 1987), the Digit Span subtask of the Wechsler Adult Intelligence Scale – third edition (WAIS-III; Wechsler, 1997), and a fluency task (Cardebat, Doyon, Puel, Goulet, & Joanette, 1990; Godefroy & GREFEX, 2008). Finally, to tap into executive functioning, participants were given the Stroop task (Godefroy & GREFEX, 2008; Stroop, 1935), the divided attention subtask of version 2.3 of the TAP (Zimmermann & Fimm, 2010), and the Trail Making Test (Godefroy & GREFEX, 2008; Reitan, 1958).

Attention tasks
Coding subtask of the WAIS-IV (Wechsler, 2008). In this paper-and-pencil task, following a number-symbol code presented at the top of the page, participants write one symbol under each number for 2 min. The number of correct responses was recorded.

Flexibility subtask of the TAP (Zimmermann & Fimm, 2010). In this computerized task, participants continuously alternate between the processing of two kinds of stimuli (letters and numbers), by pressing the button corresponding to the letter, then the button corresponding to the number, and so on. The number of errors was recorded.

Memory tasks

California Verbal Learning Test (Delis et al., 1987). In this well-known verbal episodic memory task, participants learn 16 words belonging to four different semantic categories and recall them after a 20-min delay filled by other tasks. Our variable of interest was the total number of words recalled during the encoding phase.

Digit Span subtask of the WAIS-III (Wechsler, 1997). In this working memory task, participants have to repeat increasingly long sequences of numbers read aloud by the experimenter, either in the same order or in reverse order. The total number of correctly resolved items (in direct and reverse order) was recorded.

Fluency task (Cardebat et al., 1990; Godefroy & GREFEX, 2008). Fluency tasks are known to involve working memory components and strategic searches in long-term memory (Rende, Ramsberger, & Miyake, 2002; Unsworth, Brewer, & Spillers, 2012). In two tasks, participants have to retrieve from memory words belonging to the category of animals (semantic fluency) or beginning with the letter ‘P’ (phonemic fluency), for two min each. The total number of correct responses in the two conditions was recorded.

Executive functions

Stroop task (Godefroy & GREFEX, 2008; Stroop, 1935). This task assesses inhibition capacities by requiring participants to inhibit the automatic reading of colored names of colors, and to name the color in which the word is printed. We recorded the number of errors.

Divided attention subtask of version 2.3 of the TAP (Zimmermann & Fimm, 2010). In this computerized attentional task, participants have to simultaneously process and respond to visual and auditory stimuli. When participants detect any irregularities in an alternation between a high and a low sound or if they see that a continuously changing pattern of crosses temporarily forms a square, they have to press the response button. The total number of errors was recorded.

Trail Making Test (Godefroy & GREFEX, 2008; Reitan, 1958). In this paper-and-pencil task, participants have to connect numbers and letters on a page in ascending and alphabetical orders, alternating between a number and a letter each time. We recorded the number of errors.

Composite cognitive scores

Regarding the matrix of Pearson correlations between task variables and theoretical conceptualizations of cognitive functions, we created three composite cognitive scores by averaging *Z*-scores, in order to reduce the number of dependent variables (and possible type I errors): (a) an ‘attention’ score, composed of the number of errors in the flexibility subtask of the TAP (reversed) and the number of correct responses in the coding subtask of the WAIS-IV ($r = .23$, $p = .048$); (b) a ‘memory’ score composed of the total score on the digit span subtask of the WAIS-IV, the number of correct words in the encoding phase of the CVLT

[($r = .21$, $p = .077$) for the digit span task], and the total number of correct words in the fluency task[1] [($r = .25$, $p = .037$) and ($r = .32$, $p = .007$) for the digit span task score and the encoding phase of the CVLT, respectively]; (c) an 'executive' score composed of the number of errors in the TMT, the number of errors in the divided attention task [($r = .30$, $p = .011$) for the TMT task], and the number of errors in the Stroop task [($r = .36$, $p = .002$) and ($r = .27$, $p = .022$) for the TMT task and the divided attention task, respectively]. All scores were reversed such that the higher the score, the better the performance.

Additional measures

The proposed moderator – dementia worry – was assessed prior to any stereotype activation with the Fear of AD scale (FADS; French, Floyd, Wilkins, & Osato, 2012). Finally, after completing the experimental tasks, participants were given a cognitive complaints questionnaire (to test the hypothesis that ST would lead to more complaints) and a manipulation check questionnaire.

Fear of AD scale (French et al., 2012). This 30-item scale (Cronbach's $\alpha = .93$) assesses older people's fear of being diagnosed with AD (e.g. 'The more I learn about Alzheimer's disease, the more fearful I become of getting it'). Participants respond to each statement using a 5-point Likert scale (from 'never' to 'always'). Higher scores represent greater fear of AD.

Cognitive complaints questionnaire. This 20-item questionnaire (Cronbach's $\alpha = .79$) is composed of negative statements (e.g. 'I am poor at concentrating when somebody talks to me') and positive items (e.g. 'I can manage several tasks at the same time') to which participants respond using a 5-point Likert scale (from 'totally agree' to 'totally disagree'). Higher scores are indicative of more cognitive complaints.

Manipulation check measure. This dichotomous response scale comprises four questions. The first three require participants to choose statements they have read in the news articles. The last question requires participants in the negative condition to circle their age group (young or older), and participants in the positive condition to circle the time of day (morning or afternoon).

Procedure

The study was approved by the Ethics Committee of the University of Liège (Belgium). Regarding recruitment, the study was open to all. Participants were recruited by the snowball technique and through social networks. Potential participants were invited to take part in a study on 'memory and attention capacities.' They were told that, if they agreed to participate, they would complete questionnaires and neuropsychological tasks. During the first session, following signing of the informed consent form, participants completed the FADS (French et al., 2012) and the sociodemographic questionnaire.[2] Then, they were given the SF-36 (Ware et al., 2000), the STAI-YA and STAI-YB (Spielberger et al., 1983), the MMSE (Folstein et al., 1975), the NART (Blair & Spreen, 1989), and the letter-number sequencing subtask of the WAIS-IV (Wechsler, 2008). Because we thought that administration of the FADS could induce dementia worry or age stereotype activation, the questionnaire was administered during the first session to avoid stereotype priming effects during the second session.

During the second session (about one week after the first one), depending on the experimental condition (positive or negative) to which they were randomly assigned, participants received either two positive or two negative news articles about aging and cognitive functions. This material was adapted from Hess et al. (2003). The order of news articles in each condition was counterbalanced across participants. Participants read the articles silently so that the experimenter remained blind to the condition. An example of information reported in the articles used in the negative condition follows: 'The brain deteriorates and some cerebral regions are less active with aging. Consequently, memory, attention, and processing speed deteriorate as well …' An example of information reported in the articles in the positive condition is as follows: 'The brain does not uniformly deteriorate with aging. Some mental capacities, like memory, concentration and processing speed, are relatively well preserved …' In each condition, participants were told that the tests they would undertake were the same as the ones used in the studies they had just read about in the news articles. Then, participants were given two blocks of tests (the order of the blocks was counterbalanced). One task block comprised the digit span subtask of the WAIS-IV (Wechsler, 2008), the CVLT (Delis et al., 1987), the divided attention subtask of the TAP (Zimmermann & Fimm, 2010), the TMT (Reitan, 1958), and the recall phase of the CVLT (Delis et al., 1987). The other block comprised the coding subtask of the WAIS-IV (Wechsler, 2008), the Stroop task (Stroop, 1935), the fluency task (Cardebat et al., 1990), and the flexibility subtask of the TAP (Zimmermann & Fimm, 2010). Finally, participants completed the cognitive self-evaluation questionnaire. In order to ensure that participants understood the content of the articles and were aware of the stereotype, participants responded to the manipulation check at the end of the first block they completed. At the end of the full session, participants were fully debriefed.

Data analyses

We conducted statistical analyses to examine the groups' equivalence regarding demographic data and cognitive and emotional status. We then conducted correlational analyses to examine the relationship between the dependent variables (composite scores and cognitive complaints) and the moderator (fear of AD), the demographic information, and the baseline emotional and cognitive status. Our main analyses were conducted to test for the effect of stereotype threat depending on the level of dementia worry. To test our moderation hypothesis, we used general linear regression-based analyses (Hayes, 2013). The goal of moderation analyses is to determine whether the size or sign of the effect of one variable (stereotype condition) on another (cognitive performance and cognitive complaints) is conditioned by one or more other variables (fear of AD) (see below for a more detailed description). Finally, to examine the clinical significance of performance (comparison to normative data), we conducted a chi-square analysis.

Results

Preliminary analyses

First, all our participants responded correctly (according to their condition) to at least one question of the manipulation check measure and there was no difference between conditions regarding response accuracy ($t(70) = -.98$, $p = .331$). Regarding moderating, baseline and demographic variables (see Table 1), *t*-tests indicated that there was no significant difference between conditions for the FADS, SF-36, STAI-YA, STAI-YB, NART, or letter-number sequencing scores (*ps* > .105). There was, however, a significant difference in age between conditions ($t(70) = -2.61$, $p = .011$), with participants in the positive condition being slightly younger than those in the negative one. There was also a tendency for participants in the positive condition to be better educated than participants in the negative one ($t(70) = 1.86$, $p = .066$). Pearson chi-square tests indicated that there was no gender difference between conditions ($\chi^2(1) = .06$; $p = .814$).

Correlational analyses (see Table 2) showed that, the older the participants were, the worse they performed on the executive tasks. A higher level of education was associated with better performance on each cognitive score and fewer cognitive complaints. The better the performance on the letter-number sequencing task (baseline performance), the higher the education level and the better the performance on the composite attention and memory scores. A higher self-perceived health level on the SF-36 was associated with less anxiety. Finally, a high level of cognitive complaints was associated with worse performance on executive and memory scores. Regarding the proposed moderator, a high level of fear of AD was linked to a lower educational level, a worse subjective health level (SF-36), more anxiety, and worse performance on the executive score. There was, however, no correlation

Table 1. Descriptive statistics for each experimental condition.

	Positive stereotype (*n* = 36)	Negative stereotype (*n* = 36)
Age (years)*	63.19 (2.85)	64.89 (2.66)
Education (years)	15.53 (3.28)	14.28 (2.33)
Gender (% female)	52.78	50.00
FADS	1.98 (.63)	2.03 (.52)
SF-36	132.33 (11.63)	129.33 (15.81)
STAI-YA	28.03 (6.34)	31.28 (10.04)
STAI-YB	35.86 (8.73)	36.97 (6.72)
NART	23.19 (3.78)	23.33 (3.89)
LNS	18.17 (2.14)	18.17 (2.14)

Notes: Education = years of education; FADS = score on the Fear of Alzheimer's Disease Scale; SF-36 = score on the Short-Form Health Survey; STAI-YA = score on the State Form of the State-Trait Anxiety Inventory; STAI-YB = score on the Trait Form of the State-Trait Anxiety Inventory; NART = score on the National Adult Reading Test; LNS = score on the Letter-Number Sequencing task of the WAIS-IV.
*$p < .05$.

Table 2. Pearson correlations.

Measures	1	2	3	4	5	6	7	8	9
1. Age	–								
2. Education	−.03	–							
3. LNS	−.17	.48**	–						
4. SF-36	−.08	.13	.22	–					
5. STAI-YB	−.14	−.26	−.18	−.53**	–				
6. FADS	.05	−.35**	−.14	−.29*	.46**	–			
7. Executive	−.24*	.31*	.10	−.07	−.06	−.29*	–		
8. Attention	−.17	.42**	.46**	.12	−.23	−.18	.37**	–	
9. Memory	−.09	.48**	.58**	−.00	−.05	−.09	.30*	.37**	–
10. Complaints	.16	−.35**	−.14	.06	.07	−.04	−.29*	−.19	−.28*

Notes: Education = years of education; LNS = Letter-number sequencing task of the WAIS-IV; SF-36 = score on the Short-Form Health Survey; STAI-YB = score on the Trait Anxiety Inventory; FADS = score on the Fear of Alzheimer's Disease Scale; Executive = composite executive score; Attention = composite attention score; Memory = composite memory score; Complaints = cognitive complaints questionnaire score. Analyses conducted on 72 participants.
*$p < .05$; **$p < .005$.

between the baseline cognitive measure and the fear of AD. We also examined the gender effect on the FADS; *t*-tests ($t(70) = -3.41$, $p = .001$) indicated higher fear of AD in women than in men ($M = 2.21$, $SD = .56$ for women; $M = 1.78$, $SD = .50$ for men).

Does fear of AD moderate the impact of condition on cognitive performance and cognitive complaints?

Because we were interested in understanding when (i.e. under what conditions) ST diminishes performance and increases cognitive complaints, we carried out moderation analyses. We conducted regression-based path analyses on the three composite cognitive scores and the cognitive complaints score (Hayes, 2013). We tested the conditional direct effects of condition in moderation models, separately for the four dependent variables. The independent and moderating variable were mean-centered before the interactions were computed (Hayes, 2013). Therefore, the *b* coefficient for condition, for instance, indicates the conditional effect of condition when fear of AD was at its mean value. Regarding the independent variable, the negative stereotype condition was contrast-coded −1 while the positive stereotype condition was contrast-coded +1. Due to the differences between conditions regarding age and education, we controlled for these variables in subsequent analyses. We also controlled for gender since we found that fear of AD was higher with women. There was no effect of task block order on cognitive performance ($ps > .236$).

Executive score

There was a significant effect of condition ($b = .18$, SE = .08, $t = 2.26$, $p = .027$, $\eta_p^2 = .07$) on the composite executive score. Participants (who had a mean level of fear of AD) performed worse on executive tasks in the negative condition than their counterparts in the positive condition. The interaction between condition and fear of AD was not significant ($b = .21$, SE = .14, $t = 1.57$, $p = .120$). However, due to our directional hypothesis that the impact would be greatest for participants with high levels of dementia worry, we examined specific contrasts. To do so, we used the pick-a-point approach, which creates two specific values for fear of AD: a low value (mean minus 1 *SD*) and a high value (mean plus 1 *SD*). We nonetheless used a false discovery rate method for multiple testing (Benjamini & Hochberg, 1995). This correction allows for an appropriate trade-off between type I and type II errors. After ordering our three *p* values for low, moderate, and high fear of AD from the smallest to the largest, the Benjamini-Hochberg correction – which controls the expected proportion of type I errors – set our level of significance at .033. On the one hand, these analyses showed that condition had no effect on participants with a low level of fear of AD ($b = .06$, SE = .11, $t = .52$, $p = .606$). On the other hand, and as expected, condition had a significant effect on participants who had a high level of fear of AD ($b = .30$, SE = .11, $t = 2.76$, $p = .008$, $\eta_p^2 = .10$): participants with high levels of fear of AD obtained poorer executive performance in the negative condition ($M = -.41$) than their counterparts in the positive condition ($M = .20$). Apart from a significant effect of the gender covariate ($b = -.18$, SE = .08, $t = -2.25$, $p = .028$), there was no other significant effect on the executive score ($ps > .144$).

Attention score

Apart from a significant effect of education ($b = .11$, SE = .03, $t = 3.30$, $p = .002$), there was no other significant effect on the attention score ($ps > .160$).

Memory score

Apart from a significant effect of education ($b = .12$, SE = .03, $t = 4.09$, $p < .000$), there was no other significant effect on the memory score ($ps > .299$).

Cognitive complaints

Apart from an effect of education ($b = -.06$, SE = .02, $t = -3.05$, $p = .003$), there were no other statistically significant effects ($ps > .121$).

Supplementary analyses

For exploratory purposes, we conducted MANCOVA to test for the effect of condition and the interaction between condition and fear of AD on neuropsychological task scores using the same covariates. With the three executive scores as dependent variables, there was no effect of condition ($p = .166$), but a non-significant trend for an interaction between condition and fear of AD ($F(3, 62) = 2.25$, $p = .091$, $\eta_p^2 = .10$). There was also a trend toward an effect of fear of AD ($F(3, 62) = 2.50$, $p = .067$, $\eta_p^2 = .11$). Univariate analyses indicated a main effect of condition ($F(1, 64) = 4.15$, $p = .046$), fear of AD ($F(1, 64) = 5.40$, $p = .023$), and an interaction between condition and fear of AD ($F(1, 64) = 6.79$, $p = .011$) for the Stroop errors only ($ps > .171$ for the TMT and divided attention scores). Participants made more Stroop errors in the negative condition than in the positive condition (see Table 3). The interaction revealed an effect of fear of AD in the negative condition only ($F(1, 31) = 5.85$, $p = .022$; $p = .516$ for the positive condition): the higher the fear of AD, the more participants made errors ($r = .48$, $p = .003$). The MANCOVAs and the univariate analyses conducted on attention scores and memory scores, as well as the ANCOVA conducted on cognitive complaints indicated no effect of condition, fear of AD, or interaction between condition and fear of AD ($ps > .106$).

Does stereotype threat produce clinically impaired performance?

In our study, we were specifically interested in determining whether the activation of negative stereotypes would lead to cognitive performance below a normative level, which could

Table 3. Means (standard deviations) scores for each neuropsychological test.

Measures	Positive stereotype ($n = 36$)	Negative stereotype ($n = 36$)
Executive		
Stroop (errors)*	1.28 (1.16)	2.31 (2.21)
Divided attention (errors)	3.20 (3.31)	4.69 (5.23)
TMT (errors)	.25 (.60)	.64 (.64)
Memory		
CVLT	50.31 (9.96)	46.75 (11.40)
Fluency	59.56 (14.06)	57.44 (12.19)
Digit span	17.17 (4.00)	17.25 (4.07)
Attention		
Flexibility (errors)	1.94 (3.42)	2.86 (3.67)
Coding	64.83 (12.54)	63.81 (10.82)
Cognitive complaints	2.57 (.40)	2.78 (.43)

Notes: Executive = executive tasks; Stroop (errors) = number of errors in the Stroop task; Divided attention (errors) = number of errors in the divided attention task; TMT (errors) = number of errors in the Trail Making Test; Memory = memory tasks; CVLT = number of correct responses in the encoding phase of the California Verbal Learning Task; Fluency = number of words produced during the phonemic and semantic fluency tasks; digit span = total score on the forward and backward digit span test; flexibility (errors) = number of errors in the flexibility task; coding = number of correct responses during the coding test.
*$p < .05$.

be perceived as indicative of dementia in clinical settings. Since we observed that the negative condition led to a decline in executive cognitive performance, we examined whether the negative condition might lead some participants to perform at 1.65 *SD* below the normative mean[3] (corresponding to performance below the fifth percentile in a normal distribution), which is generally the level that indicates clinically impaired performance (taking age and educational level into account) (Lezak, Howieson, & Loring, 2012). To do so, if participants obtained at least one impaired score for their performance on the Stroop task (Godefroy & GREFEX, 2008), the divided attention subtask of the TAP (Zimmermann & Fimm, 2010), or the TMT (Godefroy & GREFEX, 2008), we classified their performance as impaired (coded −1); if they did not exhibit any clinically relevant performance, they were coded as 0 on this variable (see Suhr & Gunstad, 2002, for similar analyses). The result of a chi-square Pearson test ($\chi^2(1) = 4.60$, $p = .032$) showed that more participants were classified as impaired in the negative condition (28%, $n = 10$) than in the positive condition (8%, $n = 3$).

Discussion

Since the seminal work of Steele and Aronson (1995), numerous studies have shown that older people's cognitive performance is impacted by negative stereotypes regarding cognitive aging (Chasteen et al., 2005; Desrichard & Kopetz, 2005; Hess et al., 2003), but only a few studies have examined whether ST can lead to impaired cognitive performance in clinical assessment (Barber et al., 2015; Haslam et al., 2012; Mazerolle et al., 2016). Indeed, it has been proposed that ST could, in some cases, contribute to false positive diagnoses of MCI (Régner et al., 2016). Our study was designed to further investigate this question by examining the clinical impact of ST on specific cognitive tasks (rather than a general screening test) and by hypothesizing that dementia worry – the fear of getting dementia – would moderate the impact of ST on cognitive performance. Our results showed that older adults' executive performance declined following exposure to ST compared to the positive condition. Our results also suggested that this effect was moderated by dementia worry: although there was no significant interaction between condition and dementia worry, conditional effects indicated a deleterious effect of ST only for the older participants who expressed moderate or high fear of AD. Furthermore, ST induced impaired executive performance, that is, performance that might be considered as indicative of pathological decline in clinical settings. Finally, ST had no effect on attention and memory performance or on cognitive complaints.

Our results are in accordance with several studies showing that dementia worry is associated with poorer indicators of health. Indeed, higher dementia worry has been found to correlate with poorer psychological, physical, and cognitive outcomes (Cutler & Hodgson, 2013, 2014). In Kinzer and Suhr's (2016) study, dementia worry moderated the relationship between older adults' cognitive status and their complaints. Interestingly, these authors showed that a high level of dementia worry led their cognitively intact participants to complain more about their memory. Our results are similar since moderate and high levels of dementia worry made our healthy participants more vulnerable to the activation of the negative stereotype, leading them to underperform on executive tasks.

Along the same lines, Fernandez-Ballesteros et al. (2015) showed that self-perceptions of aging – which are determined by aging stereotypes – moderate the impact of ST: Participants with negative self-perceptions of aging were the most vulnerable to the injurious effect of

ST. Fear of AD has been found to be determined by stereotypes, among other factors (Sun et al., 2015). Consequently, it could constitute fertile ground for triggering deleterious ST effects (like negative self-perceptions of aging). In our study, the older participants with a strong fear of AD may have been vulnerable to ST because our negative stereotype instructions reinforced their negative internalized stereotyped view of cognitive aging (fear of AD). Consequently, ST acted jointly with fear of AD to impair executive performance, presumably because the activation of negative stereotypes echoed the fear of AD the participants felt. Considering the non-significance of the interaction between condition and dementia worry, however, the moderating role of dementia worry should be considered with caution. Future studies should attempt to replicate these results to better establish the impact of this variable under ST.

While we observed a negative conditional effect of ST on the executive score, this was not the case for the memory and attention scores. Several hypotheses can be advanced to explain this finding. First, Haslam et al. (2012) showed that the impact of ST was greater for a cognitive task if the negative instructions focused on the impact of aging on cognitive functioning in general, whereas the impact on a memory task was greater if the instructions focused specifically on memory. Our news articles described the negative impact of aging on cognitive functioning in general; it might be that executive tasks are more related to global cognitive functioning than memory tasks, which could explain why we only observed an impact on the cognitive functioning score (executive), but not on the memory score. Secondly and relatedly, the recent meta-analysis conducted by Lamont et al. (2015) about the impact of ST on older persons' performance showed a greater effect size for cognitive tasks than for memory tasks, which could also explain the lack of ST effect on memory tasks. Third, this meta-analysis also showed a greater effect size for stereotype-based activation (ambiguous stereotype activation) than fact-based activation (instructions that describe scientific data regarding the effect of aging), which is what we used. This factor could also explain why we did not observe an impact of our experimental instructions on memory and attention performance.

In addition, as presented in the introduction to this article, it has been suggested that tasks involving executive processes (Schmader et al., 2008) and tasks subjectively perceived as difficult (e.g. Schuster et al., 2015) might be particularly sensitive to ST effects. This could explain why the attentional tasks that recruit fewer executive processes (like the coding subtask) and the memory tasks were less impacted by the ST. While memory tasks rely partly on executive processes, participants may have found these tasks less difficult than the executive ones. Indeed, in contrast to the executive tasks, there is no time pressure in the CVLT (Delis et al., 1987) or the digit span subtask of the WAIS-III (Wechsler, 1997). As well, while it recruits executive processes, the fluency task could have been perceived as less difficult by our highly educated participants (performance on verbal fluency tasks is known to be greatly influenced by education level; e.g. Godefroy & GREFEX, 2008). Therefore, even if the memory tasks recruit executive processes, they may have been too easy to induce a deleterious threat effect (Schuster et al., 2015).

While the negative stereotype instructions induced more impaired executive performance, they did not increase cognitive complaints. Bouazzaoui et al. (2016) showed that negative stereotyping led their older participants to express more memory complaints and that those complaints (and memory self-efficacy) mediated the debilitating effect of negative stereotypes on objective memory performance. First, unlike Bouazzaoui et al. (2016), we assessed cognitive complaints at the end of the session. It could be that our stereotype activation had vanished or substantially diminished by then. Secondly, Bouazzaoui et al. (2016) activated negative stereotypes in a rather implicit manner, by asking participants to complete a questionnaire on aging ('activation questionnaire') and by emphasizing the memory component of the task (stereotype-based activation). In our study, we explicitly stated that research shows that aging alters cognitive functioning (fact-based activation). Explicit activation of a stereotype has been found in some cases to produce counter-stereotype effects – better performance following activation of a negative stereotype – presumably because participants are motivated to disconfirm the stereotype (Kray, Thompson, & Galinsky, 2001; Nguyen & Ryan, 2008). Our highly explicit instructions may have motivated our participants to deny the negative stereotype. Consequently, they might not have reported more cognitive complaints.

Clinical implications

A more striking result of our study is that negative stereotype instructions led cognitively intact older participants to perform worse on executive tasks. In the negative condition, 10 (out of 36) older participants were classified as clinically impaired on executive performance. More specifically, if participants' performance on at least one of the three executive tasks was impaired, they were classified as globally impaired (see Suhr & Gunstad, 2002). We applied a more conservative threshold than Suhr and Gunstad (2002), who considered performance inferior to 1 *SD* below the mean of the normative data to be pathological. In this study, we set the level of pathological performance at 1.65 *SD* below the mean (Lezak et al., 2012) rather than 1 *SD* (or 1.5 *SD*; Suhr & Gunstad, 2005) in order to avoid exaggerating the ST effects at the clinical level. It is, however, worth remembering that neuropsychologists never make a diagnosis of cognitive decline based on a single measure and without considering other medical data (including neuroimaging data).

Thus, our results suggest that ST might impair the validity of neuropsychological tests. This result is in accordance with those of Haslam et al. (2012) and Mazerolle et al. (2016), who showed that negative stereotypes about aging cause older people to fall below the clinical threshold in screening tests for dementia. The findings of Haslam et al. (2012) and Mazerolle et al. (2016) are nonetheless somewhat tempered by our results since, in our study, ST impacted only executive performance (not memory and attention performance), suggesting that it might not affect all dimensions of cognitive performance during a neuropsychological assessment. It also appears from the present study that older persons are better able to resist stereotype threat than is often depicted in the ST literature. This could shed some light on the debate regarding misrepresentation of the ST effect in the literature (with underreporting of negative findings; see Stoet & Geary, 2012). Studying the specific conditions under which ST has an impact on cognitive performance (Which persons? Which tasks? etc.) is consequently crucial to better understand the ST phenomenon.

Our results add to the literature regarding the impact of ST on clinical outcomes: we showed that ST can impair performance on specific executive functioning tasks, which clinicians generally view as more reliable than global screening tasks like the ones used in the studies by Haslam et al. (2012), Barber et al. (2015), and Mazerolle et al. (2016). Executive impairment is generally considered as an indicator of early-stage dementia (Albert, Moss, Tanzi, & Jones, 2001; Chen et al., 2000). In this respect, it is interesting to note that, in a substantial number of cases, a diagnosis of MCI does not systematically turn into a diagnosis of dementia and that sometimes MCI-diagnosed patients return to a cognitively normal status (Larrieu et al., 2002; Winblad et al., 2004). In this context, our results and those of previous studies (Haslam et al., 2012; Mazerolle et al., 2016) suggest that ST may sometimes lead to a suspicion of early dementia (see Régner et al., 2016; for similar suggestions). However, the contribution of ST to the overdiagnosis of older persons needs to be further examined. In particular, not all executive tasks are necessarily impacted by ST. Future studies should be conducted to determine which kinds of executive tasks are impacted by ST during the clinical assessment of older persons. For example, Lamont et al. (2015) proposed that tasks with no time pressure or tasks that depend on previously acquired knowledge could be less vulnerable to ST. Some studies (e.g. Schuster et al., 2015) showed that difficult tasks are especially sensitive to ST effects. This specific question should be addressed systematically by varying the level of difficulty, the time pressure of tasks, and the involvement of acquired knowledge.

If ST can lead to the incorrect diagnosis of MCI, this can have numerous detrimental effects on an older person. To take just two examples, such a diagnosis could trigger hypervigilance to any evidence of cognitive failure, which could result in both an exaggeration of complaints and a decrease in cognitive functions, in a vicious circle (see Cook & Suhr, 2016). This could also elicit social exclusion and a reduction in the range of activities (Burgener, Buckwalter, Perkhounkova, Liu, Riley, et al., 2015), which is well known to contribute to unsuccessful aging (e.g. Kramer, Erickson, & Colcombe, 2006). Neuropsychologists should therefore be aware of the impact of ST when they assess older people who have high fear of AD. As Scholl and Sabat (2008) mentioned, hospitals and memory clinics are places that naturally activate negative stereotypes about aging, and therefore are particularly likely to trigger ST in the older people. These results are striking and show the need for neuropsychologists to assess not only cognitive functioning but also psychosocial variables in order to make an accurate diagnosis or cognitive assessment.

Our study suggests that one way to take the possible impact of ST into account is to assess fear of AD. In our view, this test should be given at the very beginning of a clinical assessment and should trigger a discussion based on psycho-education principles. In particular, when conducting this kind of psychosocial approach, it is important to avoid stereotype priming effects (and the deleterious impact of stereotypes). One way to do so is to base the dialog on unambiguous facts. Because fear of AD tends to be triggered by false (and often catastrophic) beliefs concerning the disease, the aim of this discussion should be to correct misconceptions. For example, having a first-degree relative with AD increases dementia concerns, due to heightened perceived risk of developing AD oneself (Cutler & Brăgaru, 2015). Presenting figures regarding the 'heredity' of AD – knowing that heredity actually influences AD risk only in very rare cases – is one unambiguous fact that should be presented. As well as decreasing the deleterious impact of stereotype and dementia worry on neuropsychological assessment, one would expect that reduced fear of AD in older people through deconstruction of age-related stereotypes could also contribute to their overall well-being (Cutler & Hodgson, 2013, 2014). In this respect, it has been shown that it is possible to modulate dementia worry (Molden & Maxfield, 2016) and that some interventions can be conducted to eliminate negative stereotypes (e.g. Abrams et al., 2008).

Limitations and future directions

Since we administered the FADS during the first session, it could have implicitly activated the negative stereotype about aging in both conditions (in the second session). The reason why we chose to assess fear of AD before doing the stereotype manipulation was to be sure that the stereotype activation would not impact fear of AD (Molden & Maxfield, 2016). This provides us with assurance that our fear of AD measure represents the true level of fear (not influenced by contextual variables such as stereotype activation). To avoid priming effects of the FADS in both conditions (positive and negative stereotype conditions), there was a one-week delay between the questionnaire administration and the second session. However, we could not rule out with certainty the possibility that the FADS has activated the negative stereotype in the second test situation for both conditions. In future studies, because the dementia worry measures must be administered before the stereotype is activated, maybe presenting the two sessions as separate studies might be a way to diminish the activation of negative age stereotype during the second session in both conditions.

Relatedly, as discussed above, we used fact-based instructions (unambiguously describing results of aging studies) in our negative stereotype threat instructions. This type of instructions has been found to have less impact on older people's cognitive performance than more ambiguous threat or stereotype-based threat (Lamont et al., 2015). Similarly, because participants were aged between 59 and 70 (mean age of 64.04), they could have been less threatened by our instructions due to their low identification with older persons (but see Hess et al., 2009), which could have reduced the effect of our experimental manipulation.

In this study, we did not investigate the processes mediating the ST effect on executive performance. A growing number of studies show promising results with the regulatory fit account of ST (e.g. Grimm, Markman, Maddox, & Baldwin, 2009; Seibt & Förster, 2004), which is based on regulatory focus theory (Higgins, 1997, 1998). According to this account, ST induces a prevention style that focuses attention on the presence or absence of losses. This type of regulation triggers specific cognitive styles and strategies for completing tasks: individuals try to avoid doing badly (i.e. mistake avoidance) rather than aiming to do their best. Whereas this prevention style of regulation improves performance when tasks are based on losses, it causes poorer performance when tasks are based on gains because of the mismatch between the individuals' focus style and the focus of the task (Grimm et al., 2009). This pattern of results has been observed with older persons before. In some studies conducted by Barber and Mather (2013; Barber et al., 2015), ST was indeed found to impair older adults' cognitive performance but only when the task was based on gains (e.g. participants earned points when they responded accurately). When tasks were based on losses (e.g. participants lost points if they responded incorrectly), ST did not have a harmful impact on performance. Regarding our results, if ST diminishes performance by inducing a prevention focus, this could explain why the most worried participants were more vulnerable to the ST effect. Anxiety disorders, and worry in general, have been associated with a prevention style of regulation (e.g. Klenk, Strauman, & Higgins, 2011). Thus, dementia worry may have facilitated the induction of a prevention style, which in turn impacted performance. However, this question should be specifically investigated in future studies.

Stereotype threat (threat to the social group) in this study affected only individuals who already feared pathological cognitive decline. Our results could mean that dementia worry constitutes a self-threat during cognitive assessment. Of course, fear of dementia is certainly not the only, or even the most important, determinant of threat during cognitive assessment. As recommended by Régner et al. (2016), we think that future studies should investigate other vulnerability factors (moderators). Similarly, self-threat can exist without a group threat, and vice versa (Shapiro & Neuberg, 2007). Studying the specific contributions of each kind of threat (depending on older persons' characteristics) constitutes a promising research area in understanding the effect of threat in cognitive assessment contexts. Future studies should also consider factors other than individual ones. For example, over-helping (paternalistic attitudes by the caregiver) has been shown to have a deleterious impact on older persons' performance (Avorn & Langer, 1982).

Finally, future studies should consider the impact of negative stereotypes on the neuropsychological assessment of older people who actually have dementia (Scholl & Sabat, 2008). For example, Burgener, Buckwalter, Perkhounkova, Liu, Riley, et al., (2015) showed that perceived stigma is persistent, at least in the first stages of dementia, and aspects of perceived stigma relating to social rejection and internalized shame are particularly prevalent. Burgener, Buckwalter, Perkhounkova, and Liu (2015) also showed that different dimensions of perceived stigma were associated with several quality of life outcomes (e.g. behavioral symptoms). Hence, there are reasons to believe that stereotypes and ST can also impact the neuropsychological assessment of people with dementia, leading to an exacerbation of cognitive impairments and perceived stigma.

Conclusions

Our study showed that stereotype threat impacts the executive performance of older people and can actually lead to impaired executive performance (compared to normative data). Specifically, only older people who expressed moderate or high fear of AD underperformed on executive tasks. Nevertheless, our results showed that ST had no effect on memory and attention performance or on subjective complaints. Our results have clinical implications for neuropsychologists who practice in the field of aging: they should take the impact of ST into account and consider the psychosocial characteristics that amplify its deleterious effects when they assess the cognitive status of older people.

Geolocation information

This study was conducted with Belgian participants.

Notes

1. It is well known that fluency tasks are multi-determined. Indeed, it is recognized that they recruit memory processes, executive functioning, and vocabulary, among other things. Because fluency tasks recruit memory processes (Rende et al., 2002; Unsworth et al., 2012) and since our fluency measure was correlated with all our memory measures, but with only one of the three executive measures ($r = -.28$, $p = .018$ for the TMT errors; $ps > .132$ for Stroop errors and divided attention errors), we chose to include fluency measures in the composite memory score.
2. The demographic questions included a 'yes or no' question regarding a past medical consultation for memory and attention concerns. If they responded negatively to this question, participants rated on a 7-point Likert scale ranging from 'not at all' to 'totally' to what extent they intended to have a cognitive assessment. These items were administered to assess the intention to undertake a cognitive assessment. Indeed, we wanted to assess not only attitudes (dementia

worry) but also intentions, with the hypothesis that the interaction between condition and dementia (moderation effect) would be even stronger for older persons who already intended to undertake a cognitive assessment. However, because too many participants responded 'not at all,' we could not include this variable in our statistical analyses. Note that controlling for this variable does not change the pattern of results presented below.

3. When referring to the normative mean, we refer to the published normative data on the clinical cognitive tasks we used. Hence, these normative data were collected on other samples of healthy older persons.

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