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► **To cite this version:**

Isabelle Régner, Pascal Huguet. Age-based stereotype threat effects: From the laboratory to the clinical setting. Cortex, 2024, 10.1016/j.cortex.2024.12.006 . hal-04860156

HAL Id: hal-04860156

<https://hal.science/hal-04860156v1>

Submitted on 31 Dec 2024

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Age-based stereotype threat effects : From the laboratory to the clinical setting

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Régner, I., & Huguet, P. Age-based stereotype threat effects : From the laboratory to the
clinical setting. CORTEX, <https://doi.org/10.1016/j.cortex.2024.12.006>

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Age-Based Stereotype Threat (ABST) adversely affects older adults' memory performance by inducing anxiety and interfering thoughts related to negative stereotypes about aging and memory decline. While well-documented in laboratory settings, the relevance of ABST in real-life clinical contexts remains underexplored. This narrative review examines the effects of ABST and its implications for cognitive aging, emphasizing the importance of addressing ABST in clinical settings. We review key laboratory findings and the limited studies that simulate clinical environments, highlighting their methodological limitations. The review underscores the need for further research involving actual patients, tested within real clinical setting and using appropriate interventions to reduce ABST. Proactive interventions such as educational debriefing and expressive writing, are promising methods adapted to clinical settings. By enhancing our understanding and mitigation of ABST in clinical practice, we can improve the accuracy and reliability of neuropsychological assessments, leading to better diagnostic outcomes for older adults.

Key Words: Aging stereotypes; Neuropsychological Testing; Age-Based Stereotype Threat; Clinical setting

Age-Based Stereotype Threat Effects: From the Laboratory to the Clinical Setting

1. Introduction

The culturally pervasive belief that older adults inevitably experience memory decline and diseases such as Alzheimer's Disease (AD) is a widespread stereotype. Although cognitive decline can occur in some individuals, 'normal' aging does not equate to severe deteriorating memory, and mild cognitive impairment (MCI) is not a typical aspect of aging (Clarys et al., 2009; Hultsch et al., 1998; Petersen et al., 1992; Alzheimer's Association, 2012). Chasteen et al. (2012) emphasize that negative attitudes toward aging are not only widespread but also institutionalized, affecting older adults' self-perception (Levy, 2003). This self-stereotyping can lead to a belief that memory decline is unavoidable and that memory difficulties are due to personal deficiencies rather than situational factors (Lachman, 1990; Blank, 1982; Lachman & McArthur, 1986).

One significant consequence of these stereotypes is the heightened vulnerability of older adults to stereotype threat (ST) effects on memory performance. Stereotype threat, a phenomenon where individuals underperform in areas where their group is negatively stereotyped, has been extensively studied since the seminal publication of Steele and Aronson in 1995, across various domains and groups. ST research has demonstrated that when negative stereotypes are made relevant, either explicitly or implicitly, individuals from stigmatized groups typically perform below their actual abilities due to an extra pressure that interferes with their cognitive functioning (e.g., Pennington et al., 2016; Spencer et al., 2016; Schmader et al., 2008).

For older adults, negative aging stereotypes have been shown to contribute significantly to the differences in memory task performance compared to younger adults

(Chasteen et al., 2012). While acknowledging that aging can be associated with cognitive decline, ST studies indicate that negative aging stereotypes can artificially inflate these age-related differences. The effects of age-based stereotype threat (ABST) are now well-established in the laboratory setting (e.g., Armstrong et al., 2017; Barber, 2020; Lamont et al., 2015; Swift et al., 2021), demonstrating that the conditions under which memory tests are conducted can induce ABST, leading older adults to underperform relative to their true abilities and potentially resulting in an overestimation of cognitive aging.

The significance of these findings has prompted researchers to explore their implications in clinical settings, particularly concerning the diagnosis of cognitive and neurodegenerative diseases. Preliminary studies, conducted on neuropsychological tests typically used in the clinical setting, suggest that ABST effects should be considered in clinical assessments to ensure accurate diagnosis. However, these studies have primarily involved healthy older adults still tested within laboratory environments and employed ABST reduction interventions that are, for most of them, incompatible with clinical settings. This indicates a need for further research to address ABST effects in real-world clinical contexts.

This narrative review provides a comprehensive examination of the effects of ABST and their implications for cognitive aging. We begin with an overview of ABST laboratory studies, which offer valuable insights on methodological requirements to test such effects and set the stage for exploring ABST's relevance in clinical contexts. The review then shifts focus to the limited number of studies conducted with some of the neuropsychological tests that are used in clinical settings, highlighting their methodological limitations and underscoring the pressing need for rigorous research involving actual patients undergoing initial diagnostics. The present review goes further previous ones (e.g., Barber et al., 2020; Morand et al., 2020) by integrating both laboratory and clinical perspectives. Specifically, we provide a critical methodological analysis of studies simulating clinical contexts, emphasize the constraints that

clinical settings impose on the interventions available to mitigate ABST effects, and outline actionable recommendations for practitioners. By bridging the gap between experimental findings and clinical applications, we aim to provide a more nuanced understanding of ABST and propose strategies to enhance practitioner awareness and diagnostic precision in clinical contexts.

2. ABST laboratory studies among healthy older adults

2.1 Requirements for testing ABST in the laboratory setting

This section focuses on ABST effects as they have been exclusively investigated in laboratory studies with healthy older adults. These studies provide critical insights into the mechanisms of ABST and establish foundational principles for its investigation. However, it is important to note that existing evidence comes from controlled lab settings, and the outlined requirements reflect this context. Later in this manuscript, we will discuss how these principles can be adapted or applied to the clinical context, among true patients undergoing neuropsychological testing.

To effectively study ABST effects among older adults in the lab, three key requirements must be met. The first requirement involves creating a high-pressure and sufficiently challenging testing environment. This refers to a context where older adults understand they are being evaluated on their cognitive abilities in a formal assessment, rather than engaging in a casual activity like a game or training exercise. Additionally, the tasks must be appropriately difficult to challenge their abilities. Stereotype threat (ST) effects are unlikely to emerge if the testing situation lacks this evaluative pressure or if the task is perceived as too easy to pose a meaningful challenge (Spencer et al., 2016; Steele, 1997). It is this combination of evaluative pressure and task difficulty that creates the conditions necessary for stereotype threat to manifest.

Secondly, researchers must compare older adults' memory performance in at least two testing conditions: a Threat condition, where the negative stereotype is activated and made relevant, and a Reduced-Threat condition, where the influence of the stereotype or the threat it induces is minimized (Mazerolle et al., 2020; Spencer et al., 2016; Steele & Davies, 2003). As reviewed by Lamont (2015; see also Armstrong et al., 2017; Mazerolle et al., 2021), the Threat condition in ABST studies can rely on both blatant (explicit) and subtle (implicit) interventions to activate negative aging stereotypes. Blatant interventions overtly highlight age differences in cognitive performance, such as by using straightforward statements about age-related cognitive decline (e.g., Bouazzaoui et al., 2016; O'Brien & Hummert, 2006; Rossi-Arnaud et al., 2018) or presenting fabricated news articles about aging's negative effects on memory (e.g., Barber & Mather, 2013; Fresson et al., 2017; Hess et al., 2003; Hess & Hinson, 2006). In contrast, subtle interventions hint at stereotypes without explicitly mentioning them, for example by emphasizing the memory component of the test (e.g., Desrichard & Köpetz, 2005), noting the presence of younger participants in the study without mentioning age differences (e.g., Mazerolle et al., 2012, 2015, 2024), or using priming techniques (Levy, 1996; Stein, Blanchard-Fields, & Hertzog, 2002). In sum, both blatant and subtle interventions have been used in lab settings to represent the Threat condition. To test ABST effects, at least one Threat condition must be compared to a Reduced-Threat condition.

The Reduced-Threat condition requires particular attention. Such a condition is specifically designed to eliminate or reduce the influence of negative aging stereotypes. Achieving this requires proactive interventions from researchers to create a "safe" environment where individuals can perform without the cognitive and emotional burden imposed by stereotype threat (Steele & Davies, 2003). In laboratory settings, common interventions to establish a Reduced-Threat condition include refuting aging differences (e.g., Mazerolle et al., 2012, 2015, 2024), providing positive information about aging and memory

preservation (e.g., Hess et al., 2003; Hess & Hinson, 2006), or de-emphasizing the memory component of the test (Bouazzaoui et al., 2016; Desrichard & Köpetz, 2005; Febriani & Sanitioso, 2021). Ensuring that the study includes a Reduced-Threat condition to effectively neutralizes or reduce the influence of negative aging stereotypes is crucial, as this sets the necessary precondition for a valid test of ABST's effects (Mazerolle et al., 2020, 2021).

For these reasons, a “no-intervention” condition—such as simply presenting a memory test as a memory test—cannot be considered a Reduced-Threat condition. This default testing situation, often referred to as the control (or neutral) condition, does nothing to counteract negative aging stereotypes or alleviate the resulting pressure. Instead, it is likely to function as a subtle threat condition, as the evaluative nature of the task and contextual cues implicitly activate stereotype-related pressures. As Steele and Davies (2003) pointed out, this misunderstanding can lead to compare two Threat conditions (blatant and subtle), and miss the inclusion of a genuine Reduced-Threat condition. In other words, a no-intervention condition inherently involves some level of stereotype activation and cannot be equated with a Reduced-Threat condition, as it fails to neutralize or reduce the influence of negative aging stereotypes. As we will see later in the present review, this point is especially critical to understand in the clinical context, where routine testing situations must be recognized as inherently threatening by default due to their evaluative nature (i.e., clinical diagnosis of age-related diseases).

Thirdly, Mazerolle et al. (2021) emphasize the importance of considering the framing of memory tests in terms of gains versus losses to interpret the results in an informed manner. Under the Threat condition, older adults tend to adopt a prevention focus, making them particularly vigilant against errors (Seibt & Förster, 2004). Gain-focused tests, which reward correct responses, induce a promotion focus that mismatches with the prevention focus induced by the Threat condition. This typically increases cognitive load and leads to impaired

memory performance compared to the Reduced-threat condition (e.g., Barber & Mather, 2013b; Thomas & Dubois, 2011; Smith et al., 2017), which are the classic signs of ST effects. Conversely, tests framed towards losses, emphasizing caution and error avoidance, reinforce the prevention focus already induced by the Threat condition. This congruence of focuses can lead to better recall performance or reduced memory distortion compared to the Reduced-threat condition (e.g., Barber & Mather, 2013b; Wong & Gallo, 2016), an outcome that, at first glance, may seem contrary to ABST effects, which typically are performance impairments. Understanding the framing of the memory test is thus crucial for accurately interpreting the results (see Baber, 2017 for a detailed explanation of the regulatory focus model of ABST).

In sum, a rigorous test of ABST effects in healthy older adults requires creating a challenging and evaluative environment, carefully implementing a genuine Reduced-Threat condition, and considering the framing of memory tests to ensure accurate interpretation of how stereotype threat influences memory performance.

2.2. Established Laboratory Findings on ABST

More than sixty laboratory studies have demonstrated that older adults significantly underperform in the Threat condition relative to the Reduced-threat condition on various memory tests (for reviews see Armstrong et al. 2017; Barber, 2020; Barber & Liu, 2020). These tests include episodic memory tasks such as free recall, cued recall, and recognition-based recall (e.g., Hess et al., 2003; Hess et al., 2009a, 2009b; Mazerolle et al., 2015), working memory tests (e.g., Barber & Mather, 2013; Mazerolle et al., 2012; Swift et al., 2013; for a review, see Piroelle et al., 2022), and prospective memory tests (Tsang et al., 2024; Zuber et al., 2019). When younger adults are included in the studies for comparison, reducing the stereotype threat often narrows or even eliminates the performance gap between

older and younger participants (e.g., Desrichard & Köpetz, 2005, Study 2; Hess et al., 2003, 2004; Mazerolle et al., 2012). Furthermore, ABST is not confined to Western cultures; it also affects older adults' memory performance in Eastern countries, including Indonesia (Febriani et al., 2021) and East Asian Chinese culture (Tan & Barber, 2020). These findings highlight the significant influence of aging stereotypes and strengthen the conclusion that ABST artificially inflates age differences in memory tasks.

The magnitude of ABST effects can depend on several individual moderating factors, including chronological age, age-group identification, age-based self-categorization, essentialist beliefs about aging, and memory self-efficacy (Armstrong et al., 2017; Hess & Hinson, 2006; Kang & Chasteen, 2009; Haslam et al., 2012; Barber & Mather, 2013; Lamont et al., 2015; Schlemmer & Desrichard, 2017). For example, ABST effects are more likely to be observed in "young-old" adults (60 to 70 years of age) compared to "old-old" adults (above 70), possibly because the younger subgroup finds their new categorization as older adults more salient and self-threatening (Hess et al., 2009). Additionally, young-old adults are more susceptible to ABST when they are highly educated (Hess et al., 2009), have high stigma consciousness or perceived stereotype threat (Chasteen et al., 2005; Hess et al., 2009; Kang & Chasteen, 2009), have a low memory self-efficacy (Schlemmer & Desrichard, 2017), and when they place a high value on memory ability (Hess et al., 2003). Age group identification also plays a crucial role, with older adults who strongly identify with their age group performing worse than those who do not (Kang & Chasteen, 2009). Similarly, contextual factors such as examiner characteristics can amplify the salience of age-related stereotypes. For instance, Desrichard et al. (2023) analyzed data from large-scale surveys in which older adults were tested at home on cognitive tasks by examiners of varying ages. Their findings revealed that participants performed better when tested by older examiners, suggesting that younger examiners may exacerbate stereotype threat by making age-related stereotypes more

salient. These results underscore how subtle contextual cues in evaluative settings can heighten the effects of ABST, even outside traditional laboratory environments, thereby influencing older adults' cognitive performance.

Given all these findings, there is little doubt today that ABST may contribute to age-related differences in memory tasks (for recent reviews, see Barber, 2020; Barber & Liu, 2020). While some debate remains regarding the underlying mechanisms—whether they involve executive resource depletion or a mismatch in regulatory focus (Barber, 2017; see Piroelle et al., 2022 for an attempt to solve the debate)—the primary evidence supporting the effects of ABST among healthy older adults tested in the lab is robust. This is supported by two meta-analytic reviews, which found significant small-to-medium effects of ABST on older adults' cognitive performances ($d = 0.36$; Lamont et al., 2015) and both on episodic and working memory performance ($d = 0.25$ and $d = 0.37$, respectively; Armstrong et al., 2017). Both meta-analyses observed significantly larger effect sizes of ABST when subtle interventions were used to activate negative aging stereotypes, particularly in working memory tasks ($d = 0.52$ in Lamont et al., 2015; $d = 0.96$ in Armstrong et al., 2017) rather than blatant interventions ($d = 0.09$ in Lamont et al., 2015; $d = 0.06$ in Armstrong et al., 2017). According to the authors, subtle interventions likely generate uncertainty about the presence of a threat, thereby increasing distracting thoughts and consuming the cognitive resources necessary for successful performance on challenging tasks (Schmader et al., 2008). However, this pattern does not hold as clearly for episodic memory tasks. Armstrong et al. (2017) found that blatant stereotype threat manipulations produced a small but significant effect size ($d = 0.257$), while subtle manipulations did not yield significant effects, which is in line with Lamont et al. (2015)'s suggestion that the effect of blatant and subtle ABST inductions might differ in tasks that are less reliant on working memory abilities. The authors cautioned,

however, that only three studies used subtle manipulations for episodic memory, making it difficult to draw firm conclusions about their differential impact in this domain.

Given the robustness of ABST findings and the observation that subtle cues in evaluative settings—which are prevalent in clinical environments—can induce ST and significantly impact healthy older adults’ memory performance, researchers have increasingly emphasized the importance of investigating the effects of ABST within clinical contexts (e.g., Barber, 2020; Haslam et al., 2012; Morand et al., 2020; Régner et al., 2016; Scholl & Sabat, 2008).

3. Toward ABST studies in the clinical setting

Beyond the scientific interest in determining whether ABST, a phenomenon well-documented in laboratory settings, can be observed in real-world clinical environments, there is a pressing societal concern. With life expectancy increasing and Alzheimer's disease receiving heightened media attention, more people are growing anxious about memory decline. This anxiety has fueled a surge in demand for neuropsychological testing, which is used to assess memory and cognitive functions and distinguish between normal aging and pathological cognitive declines. The rising awareness of aging and cognitive health, coupled with the inherent stress of undergoing neuropsychological tests in a clinical setting, creates an ideal context for ABST effects. Therefore, it is crucial to investigate whether these effects manifest in clinical settings, as they can significantly influence patient performance and the diagnosis of mild cognitive impairment (MCI), which may or may not progress to Alzheimer's disease. Indeed, the progression of MCI is known to be heterogeneous; while some patients remain stable, others may revert to normal cognitive functioning (e.g., Edmonds et al., 2015; Petersen et al., 2013; Sachdev et al., 2013). This variability underscores

the importance of examining potential biases, including the impact of ABST effects on patients' performance during diagnostic testing in real clinical settings.

3.1. Evidence from existing studies simulating clinical settings

To the best of our knowledge, no published study has directly examined ABST effects among real patients within a clinical setting during routine neuropsychological assessments. Instead, researchers have primarily used proxies, such as employing neuropsychological tests typically used in clinical settings or recreating aspects of these environments (e.g., the 'white coat effect'). We identified only seven published studies where a Threat condition was compared to a Reduced-Threat condition (see Table 1).

Among the seven studies, six aimed to approximate the clinical assessment experience by using neuropsychological tests that are typically employed in clinical settings (Haslam et al., 2012; Barber et al., 2015; Fresson et al., 2017; Mazerolle et al., 2017; Follenfant & Atzeni, 2020; Caughie et al., 2023). The aim was thus to investigate whether the performance of older adults on these standardized test batteries could be influenced by ABST effects. These studies leveraged various widely recognized neuropsychological assessments, such as the Wechsler Memory Scale, the Addenbrooke's Cognitive Examination, and others, which are standard tools in diagnosing cognitive impairments and monitoring mental health in older adults. Conversely, one study by Schlemmer and Desrichard (2017) attempted to replicate a medical office environment complete with neuropsychological décor and an experimenter dressed as a neuropsychologist. However, unlike the other studies, this one used laboratory-based memory tests rather than typical clinical neuropsychological tests.

The seven studies reviewed all involved healthy older adults who volunteered to participate, being recruited through various methods and networks (e.g., community services, research volunteer lists, social networks, snowball sampling, advertisements in local

newspapers). The sample sizes varied significantly, ranging from as few as 27 participants in the smallest study (Schlemmer & Desrichard, 2017) to 80 participants in the largest (Barber et al., 2015; Mazerolle et al., 2017). Only the study by Follenfant and Atzeni (2020) included younger adults alongside older adults, providing a comparative analysis across both age groups. Testing locations varied, with five studies conducted entirely in laboratory settings (Haslam et al., 2012; Barber et al., 2015; Schlemmer & Desrichard, 2017; Follenfant & Atzeni, 2020; Caughie et al., 2023), one exclusively at participants' homes (Fresson et al., 2017), and one study conducted testing either at participants' homes or on the premises of local community associations (Mazerolle et al., 2017).

Most of the reviewed studies (four out of seven) employed subtle interventions to activate ABST (Haslam et al., 2012; Schlemmer & Desrichard, 2017; Mazerolle et al., 2017; Follenfant & Atzeni, 2020). In the Threat condition, Haslam et al. (2012) subtly invoked age-related concerns by informing participants that they were at the older end of an age spectrum (40 to 70 years) and asking them to state their age. The study was framed for all participants (including those in the reduced-threat condition) as investigating how people of different ages performed on ability tests, without mentioning any specific expectations. Schlemmer and Desrichard (2017) created a simulated clinical environment by having the experimenter wear a white coat and decorating the room with neuropsychological posters and a 'Neuropsychological Laboratory' sign, suggesting a clinical evaluation setting. Mazerolle et al. (2017) told participants they would perform a memory task and mentioned that both younger and older adults were participating, subtly implying an age comparison. Follenfant and Atzeni (2020) informed all their participants that they would receive a memory test. Their Threat condition added no further information (no-intervention control condition), implying a default assumption of ABST without additional activation. As will be seen below, Follenfant and

Atzeni (2020) actively intervened to reduce this “threat in the air” (Steele, 1997) in the Reduced-threat condition.

In contrast, the three other studies used blatant interventions to induce the Threat condition (Barber et al., 2015; Fresson et al., 2017; Caughie et al., 2023). Barber et al. (2015) had participants read fictitious news articles stating that cognitive decline begins early and accelerates after age 60, explicitly highlighting age-related cognitive decline. Fresson et al. (2017) presented articles describing brain deterioration with aging and associated declines in memory, attention, and processing speed. Similarly, Caughie et al. (2023) used excerpts from a pseudo-journal on aging containing stereotypes about cognitive decline and inevitable progression toward Alzheimer’s disease.

As noted in our previous section, effectively reducing ABST requires proactive interventions from researchers to ensure that a threat is not present, even at an implicit level. Among the seven studies, three reduced ABST by refuting aging stereotypes (Barber et al., 2015; Fresson et al., 2017; Mazerolle et al., 2017). Follenfant and Atzeni (2020) proposed two other interventions to reduce ABST: individuation of the self and self-handicapping. The individuation intervention aimed to alleviate the burden of social identity by focusing on individual traits, while the self-handicapping intervention aimed to shift the perceived cause of potential poor performance away from age-related factors. Haslam et al. (2012) employed a subtler approach, informing participants in the reduced-threat condition that they were at the younger end of an age spectrum (60 to 90 years). Since the study was framed for all participants as investigating how people of different ages performed on ability tests without mentioning specific expectations, this instruction was expected to minimize age-related stereotypes. Schlemmer and Desrichard (2017) reduced the threat of the medical context by conducting tests in a neutral 'University Research' environment, with the experimenter dressed normally and presented as a psychology student. While this intervention reduces the

salience of a clinical evaluation setting, it does not directly refute age-related stereotypes that are still salient in the lab context where participants were told their memory would be assessed. A similar concern emerges for Caughie et al. (2023), who did not implement any specific reduced-threat condition. Indeed, participants in their so-called 'control' condition received 'neutral' instructions unrelated to age or cognitive decline. However, as the neuropsychological test batteries were presented as such, without any measures to counteract stereotype-related pressures, this condition is unlikely to have effectively reduced ABST.

Most of the reviewed studies found significant ABST effects, with the majority reporting that threat conditions impaired older adults' performance compared to reduced-threat conditions (Haslam et al., 2012; Barber et al., 2015; Fresson et al., 2017; Mazerolle et al., 2017; Schlemmer & Desrichard, 2017; Follenfant & Atzeni, 2020). Notably, in two of the six studies conducted using real neuropsychological tests, ABST not only led to poorer test scores but also resulted in a significant increase in the number of participants meeting diagnostic criteria for predementia (Haslam et al., 2012; Mazerolle et al., 2017). In Follenfant and Atzeni's study, only the individuation intervention improved memory performance in older adults. Schlemmer and Desrichard (2017) found mixed evidence as no main effect emerged, but there was an interaction between the ABST conditions and memory self-efficacy: those with low memory-efficacy benefited from the reduced-threat environment, while those with higher self-efficacy were boosted by the simulated medical environment. In contrast to the six other studies, Caughie et al. (2023) did not show any significant differences between the Threat and Reduced-threat conditions, likely due to the lack of intervention to reduce ABST, suggesting that the threat was still implicitly present. These two last studies should be interpreted with caution for two reasons: their very small sample sizes and the absence of an intervention to reduce ABST from the testing environment.

3.2. Issues raised by these studies

These seven studies provide valuable insights into testing ABST in proxies to the clinical setting, supporting the likelihood of ABST occurring in clinical environments. However, these studies have several limitations that prevent firm extrapolation to true clinical settings. Firstly, all studies were conducted among healthy older adults rather than patients arriving at hospitals for initial screenings. This introduces a selection bias, as the participants were not representative of the broader patient population seeking medical evaluation for cognitive concerns. Older adults who volunteer for stereotype threat lab studies are often more active, healthier, and potentially have higher levels of cognitive functioning than those who visit hospitals for screening. For instance, participants in studies by Haslam et al. (2012), Barber et al. (2015), Mazerolle et al. (2017), or Follenfant and Atzeni (2020) were recruited from community services, "University of the Third Age," research volunteer lists, and social networks, likely including individuals with greater access to resources, social support, and cognitive stimulation. This skews the participant pool towards individuals who may have better cognitive health compared to the general population of older adults seeking medical assessment for Alzheimer's disease.

Related to this, participants in research studies on stereotype threat may be more motivated and aware of their cognitive abilities and performance due to their active participation in cognitive research. In contrast, older adults attending hospitals for Alzheimer's screening may have varying levels of motivation, awareness, and insight into their cognitive health. This discrepancy can lead to different responses and behaviors during neuropsychological assessments. Furthermore, participants in these studies were generally healthy older adults without significant medical comorbidities or cognitive impairments, while patients attending hospitals for Alzheimer's screening may present with a range of health conditions, including chronic diseases, which can influence their performance and responses during assessments.

Secondly, none of the studies were conducted within actual clinical settings, which means they cannot fully capture the heightened stress and pressure experienced by patients in real clinical environments. The lab settings or simulated medical offices used in these studies, such as in Schlemmer and Desrichard (2017), cannot replicate the anxiety inherently generated by hospitals, which is likely to add load and pressure, exacerbating ABST effects (Scholl & Sabat, 2008). This difference is significant because real clinical settings involve various stressors that cannot be easily simulated in a lab environment.

Finally, there are issues with the methods used to activate and reduce ABST in these studies when exploring ABST in real-life clinical settings. The interventions designed to induce ABST, such as reading fictitious news articles about cognitive decline (Barber et al., 2015; Fresson et al., 2017) or emphasizing the presence of younger adults (Mazerolle et al., 2017), make no sense in a clinical setting. The primary challenge within the clinical setting is not how to activate ABST, as the clinical assessment context itself likely triggers age-related stereotypes and the related fear of severe cognitive decline. The key issue is rather finding ways to reduce ABST without disrupting the assessment process, which remains a significant hurdle. As earlier emphasized, ensuring that the Reduced-Threat condition effectively neutralizes or reduces the influence of negative aging stereotypes is crucial for a valid test of ABST's effects (Mazerolle et al., 2020, 2021), even in the clinical setting. The problem is that most strategies that have proved efficient to reduce ABST in the lab —such as those reviewed by Parker et al. (2022), including reframing tasks or shifting focus away from age-related comparisons— would be at odds in the real-life clinical setting. Refuting aging differences, emphasizing memory preservation with age, or de-emphasizing the memory component of the tests are incompatible with diagnostic goals and lack credibility in the clinical context where pathological aging decline is routine. Likewise, individuation interventions aimed at

alleviating the burden of social identity for patients before neuropsychological testing seem less appropriate in a clinical setting.

3. Moving Forward: Addressing ABST in Clinical Settings

The findings from previous lab studies and the few studies that attempted to test ABST in proxies to clinical settings provide a valuable foundation. These findings clearly pave the way and strongly suggest that ABST likely exists in clinical settings. In such settings, where memory and cognitive assessments are central to diagnosis, environmental factors may inadvertently amplify ABST. As Ben-David et al. (2018) highlight, sensory impairments common among older adults— such as difficulty clearly hearing oral instructions, reading written test materials, or discerning visual stimuli—can increase anxiety and cognitive strain, which may heighten sensitivity to stereotype threat during neuropsychological testing. While these limitations are not the primary focus, their interaction with stereotype-related pressures underscores the complexity of mitigating ABST in hospital-based neuropsychological testing. The primary challenge within the clinical context is not how to activate the threat, as the environment itself inherently triggers high pressure and negative age-related stereotypes. Instead, the focus should now shift to developing and testing interventions that can effectively reduce ABST without disrupting the assessment process. Future research should move into actual clinical settings with real patients, implementing interventions tailored specifically to these environments. By doing so, we can better understand and mitigate the impact of ABST on diagnostic outcomes, ultimately improving the accuracy and reliability of neuropsychological assessments in clinical practice.

3.1. What do practitioners know about ABST?

To effectively address ABST in clinical settings, it is essential to consider what health practitioners currently know about ABST and its potential impact on cognitive assessments.

To our knowledge, only one study (Parker et al., 2023) has investigated health practitioners' understanding of the impact of ABST on older adults' cognitive test performance and their perceptions of its impact in clinical practice. This study involved 129 health practitioners (86% female; mean age = 39.75 years, SD = 11.50), who had experience conducting cognitive assessments with older adults (e.g. psychologists, neuropsychologists, geriatricians, psychiatrists). First, practitioners' ability to recognize ABST was tested through a hypothetical scenario without explicitly mentioning ABST or aging stereotypes, assessing their implicit awareness. After this, they received specific information about ABST and were asked to reassess their perceptions of its impact on cognitive performance in general and in their clinical practices.

Findings indicated that health practitioners rated ABST factors (e.g., attending a memory clinic, being told that their memory would be evaluated) in the assessment scenario as less detrimental to performance compared to external (e.g., being seated in an uncomfortable chair, air conditioning too cold) and internal (e.g., feeling doubtful about the need for assessment, family worries) factors. According to Parker et al. (2023), this suggests a potential underestimation of ABST's influence on cognitive test outcomes. Although there was some improvement in recognizing the influence of ABST in practice following the educational intervention, the overall perception of ABST's impact remained somewhat limited compared to the recognition of the other factors. This result suggests that while awareness of ABST can be increased through education, its perceived impact in clinical practice may still be underappreciated.

Similarly, from the patients' perspective, older adults themselves are aware of potential ageist judgments in clinical settings, which can exacerbate feelings of vulnerability. Phibbs and Hooker (2018) found that these perceptions are frequently linked to prior experiences of age discrimination and negative self-perceptions about aging. While not

specific to ageism, Abdou et al. (2016) also highlighted that stereotype threat in healthcare settings is a concern for many older adults, further emphasizing the need for practitioners to address these biases. This bidirectional nature of ABST—practitioners' underestimation of its impact and patients' heightened awareness of age-related biases—strengthens the case for addressing stereotype threat in clinical contexts to ensure more accurate and equitable assessments.

Practitioners must recognize not only the subtle influence of stereotype threat on cognitive assessments but also that patients themselves can be acutely aware of ageist stereotypes in clinical settings, which may exacerbate their vulnerability. Enhancing practitioners' understanding of ABST is essential for improving the validity of cognitive assessments for older adults (Parker et al., 2023). May be a first step to make practitioners more sensitive to the need for training is to demonstrate the existence of ABST effect within the clinical setting. By providing concrete evidence of ABST's impact in real clinical environments, practitioners can better appreciate the importance of addressing this issue.

3.2. Moving forward: Clinically compatible reduced-threat interventions

Most interventions used in laboratory settings to reduce ABST cannot be directly applied in clinical environments. As previously outlined, strategies such as providing articles refuting negative aging stereotypes or delivering age-fair instructions are either not credible or inappropriate during routine neuropsychological assessments. The challenge lies in identifying interventions that align with the constraints of clinical diagnostic settings, including the nature of the testing, time limitations, and the need to maintain credibility and diagnostic rigor. At least two promising approaches to reduce ABST in real-life clinical settings can be proposed. The first approach is an educational intervention designed to address the stress generated by negative aging stereotypes, especially in the context of memory assessment (Mazerolle et al., 2017, 2020). This involves explaining the stereotype threat

phenomenon in simple terms. Mazerolle et al. (2017) found that this educational debriefing successfully neutralized ABST among healthy older adults during short neuropsychological testing.

Applying this method to a real clinical setting presents a double challenge: adapting the content to patients in hospitals and ensuring standardized instruction regardless of the practitioners administering the tests. In a pre-registered protocol, Gauthier et al. (2019) developed a video to standardize and optimize the effectiveness of these instructions. The video features a gender-matched patient during an interview at a memory clinic, depicting typical steps in an MCI/AD diagnosis. The patient meets with a neurologist and a neuropsychologist, who explain: *"In our societies, we are all exposed in the media to sensational and often fearful information about AD that inevitably induces a lot of stress. This stress can lead people to experience difficulties during the testing, which can impair performances. The tests themselves can be stressful. It is, thus, normal to make some mistakes due to stress, but these mistakes are not necessarily signs of AD."* (Gauthier et al., 2019, p. 4). This approach ensures that all patients receive the same information, delivered in a consistent manner, potentially alleviating anxiety related to stereotype threat, and without disturbing traditional practices.

Another potential intervention is expressive writing. This involves having patients write about their thoughts and feelings regarding the testing situation and their concerns about aging and potential disease. Expressive writing has been shown to help individuals process and manage their emotions, which can reduce anxiety and improve performance in stressful situations (Frattaroli et al., 2011; Ramirez & Beilock, 2011). By writing about their worries, patients can free up working memory capacity, reducing intrusive thoughts and allowing better focus on the tasks at hand. This method has already proved successful in reducing stereotype threat in math among women (Ramirez & Beilock, 2011), demonstrating its

potential to alleviate anxiety generated by strong negative stereotypes and enhance performance. This could be particularly useful for reducing ABST anxiety during MCI diagnosis, as it allows patients to confront and alleviate their anxieties in a controlled manner. Expressive writing seems particularly compatible with patients who come to the hospital for an initial screening, rather than those with advanced stages of AD or other diseases. It is essential that patients have the writing capabilities to engage in this intervention effectively.

Both methods share the specificity of directly addressing the testing situation, the fear of Alzheimer's Disease, and the anxiety surrounding the diagnosis. These proactive interventions are crucial for neutralizing ABST effects within the inherently anxiety-inducing clinical setting. Furthermore, it is important that both methods be implemented just before taking the tests to maximize their effectiveness. Of course, further research is needed to rigorously test the efficacy of these methods during neuropsychological testing in hospital settings among actual patients. Additionally, creating a supportive testing environment is crucial. Clinicians should use neutral language, provide positive reinforcement, and avoid references that might strengthen the fear of the diagnosis or diseases like Alzheimer's disease, at least when testing for the prodromal stage of AD. Educating clinicians about the effects of stereotype threat and training them to recognize and mitigate these effects during assessments is also essential (Parker et al., 2023).

Conclusion

The evidence from laboratory studies and the few attempts to simulate clinical settings suggest that ABST likely impacts older adults' cognitive performance in clinical environments. The findings from these studies pave the way for further investigation into ABST within real clinical settings. However, existing studies have limitations that prevent firm extrapolation to true clinical settings, such as the selection bias towards healthier and more cognitively aware volunteers, the inability to fully replicate the anxiety-inducing

atmosphere of hospitals, and the inappropriateness of most interventions designed to reduce ABST. Addressing ABST in clinical settings requires developing and testing interventions that can effectively reduce ABST in this real-life clinical context without disrupting the assessment process. Proactive interventions, such as educational debriefing and expressive writing, show promise in neutralizing ABST effects. These methods address the testing situation directly, alleviating anxiety related to negative aging stereotypes, Alzheimer's Disease, and the fear of diagnosis. Implementing these interventions just before testing and ensuring a supportive testing environment are probably key steps in mitigating ABST effects.

While this paper focuses on the impact of ABST in neuropsychological testing, it is important to recognize that stereotype threat may influence a broader range of clinical evaluations. For example, ABST has been shown to affect physical performance measures such as walking speed, balance, and motor control, which are commonly assessed in geriatric settings (Barber et al., 2020; Borel et al., 2024). Barber et al. (2020) demonstrated that ABST impaired walking performance in older adults, particularly for tasks with high difficulty levels, and that the effect was stronger among individuals who perceived themselves as having limited personal resources to meet task demands. Similarly, Borel et al. (2024) reported that ABST significantly disrupted dynamic balance in older adults, a key component of fall risk assessments. Psychosocial evaluations of mental health, including assessments of depression and anxiety, may also be impacted if older adults fear being judged through the lens of negative stereotypes about emotional resilience, which have been linked to a decreased will-to-live and further moderated by self-perceptions of aging and medical conditions (Levy et al., 1999; Gvili & Bodner, 2021). These findings underscore the need for future research to investigate how ABST affects a wider array of tasks in clinical settings, ultimately ensuring more accurate and equitable assessments across multiple domains.

This review goes beyond previous work by providing a critical methodological analysis of studies that simulate clinical settings and highlighting the constraints that real-life contexts impose on interventions. Unlike prior reviews, we explicitly connect laboratory-based findings with clinical applications, offering actionable recommendations for practitioners. Creating a consistent and supportive testing atmosphere and training clinicians to recognize and counteract stereotype threat are essential components of this effort. Although ABST effects may be smaller in clinical settings compared to laboratory environments (Barber, 2020), this does not diminish the necessity of investigating and addressing them. By bridging the gap between experimental findings and real-world clinical practice, this review offers a roadmap for advancing research and practice in a way that previous works have not. Enhancing our understanding and mitigation of ABST in clinical practice can improve the accuracy and reliability of neuropsychological assessments, ultimately leading to better diagnostic outcomes for older adults.

CRedit authorship contribution statement

Isabelle Régner: Conceptualization, Methodology, Writing – Original Draft, Writing – Reviewing and Editing. **Pascal Huguet:** Conceptualization, Writing – Review & Editing.

Funding

This work was supported by the French National Research Agency (ANR-16-CE36-0005-01).

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used Chat GPT in order to correct and improve the English. After using this tool/service, the authors reviewed and edited the content as needed and takes full responsibility for the content of the publication.

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Table 1. Summary of the studies examining ABST effects in a proxy environment of clinical setting

Studies	Participants	Participants recruitment and testing location	Threat and Reduced-threat interventions	Memory tests	Main results
Haslam et al. (2012)	N = 68 OA (48.5% women) Mean age: 65.1 years old (SD = 3.1) 12 years of education	Recruitment Method: Local community services and snowball sampling among service recipients' networks. Testing location: lab	In all conditions, participants were told that purpose of the study was to investigate how people of different ages performed on ability tests. Then the experimenter varied age-based self-categorization: - Threat condition here called "Older condition": Participants informed that the age spectrum was 40 to 70 years and they were at the older end. They were also asked to state their age. - Reduced-threat condition here called "Younger condition": participants were told the age spectrum ranged from 60 to 90 years and that they were at the younger end of this.	The logical memory component of the Wechsler Memory Scale-Third Edition; The Addenbrooke's Cognitive Examination-Revised (ACE-R)	70% of healthy older adults who were led to self-categorized as older (vs. younger) and expected widespread (vs. specific) cognitive decline scored below the cutoff of the ACE-R, compared with an average of 14% in the other condition.
Barber et al. (2015)	N = 80 OA (53.7% women) Mean age : 69.54 years old (SD = 5.33; range = 61-80) 17.77 years of education	Recruitment Method: Research volunteer list compiled from university alumni letters, newspaper and online advertisements, and flyers at senior centers and public places. There were compensated \$15 per hr. Testing location: lab	There were two sets of instructions, one before the first test session, and another before the second one. First session instructions: - Threat condition: participants read a fictitious news article about research confirming age-related memory decline. The experimenter stated the study aimed to confirm that "memory inevitably declines with age." - Reduced-threat condition: participants read a fictitious news article about the preservation of memory and improved language abilities with age. The experimenter stated the study aimed to confirm improvements in verbal abilities and memory for words with age. Second session instructions: - Threat condition: Articles indicated that cognitive decline begins at age 45, accelerates after 60, and affects intelligence, reasoning, decision making, and verbal abilities. The experimenter stated that the participant was at the older end of the age-spectrum being tested. - Reduced-threat condition: the article stated minimal cognitive declines before age 85 and general preservation of intelligence, reasoning, and verbal abilities. The experimenter stated that the participant	The Word List Memory Test from the Consortium to Establish a Registry on Alzheimer's Disease (CERAD); The Addenbrooke's Cognitive Examination-Revised (ACE-R) The Mini Mental State Examination (MMSE).	ABST impaired older participants' ACE-R score, yet it did not change the proportion of participants meeting diagnostic criteria for predementia.

			was at the younger end of the age-spectrum being tested.		
Fresson et al. (2017)	N = 72 OA (51.4% women) Mean age : 64.04 years old (SD=2.87; range 59 – 70)	Recruitment Method: snowball technique and social networks. Testing location: at home.	-Threat condition: two articles describing that “the brain deteriorates and some cerebral regions are less active with aging. Consequently, memory, attention, and processing speed deteriorate as well”. -Reduced-threat condition: two articles describing that “the brain does not uniformly deteriorate with aging. Some mental capacities, like memory, concentration and processing speed, are relatively well preserved »	Coding subtask of the WAIS-IV; the Flexibility subtask of the Test of Attentional Performance; the California Verbal Learning Test; the Digit Span subtask of the Wechsler Adult Intelligence Scale; a fluency task; the Stroop task; the divided attention subtask of version 2.3 of the TAP; the Trail Making Test	Participants with moderate or high dementia worry underperformed on executive tasks in the Threat condition compared to the Reduced-threat condition. ABST had no effect on memory and attention performance.
Mazerolle et al. (2017)	N = 80 OA Mean age : 75 years old (SD = 8.31, range: 60 – 93) 7.82 years of education	Recruitment Method: Local community associations for a study on emotions' impact on cognitive tasks. No mention of memory or age during recruitment. Testing location: either at home or on the premises of local community associations by a trained graduate student in neuropsychological testing.	The ABST manipulation was induced before the first test : -Threat condition: the experimenter told participants that they would perform a memory task and that both younger and older adults were taking part in the study. -Reduced-threat condition: participants received the same instructions and were also told that there is typically no age difference on this task (i.e., the task is age-fair). Before the second test, a reduced-threat condition was induced for all participants (regardless of the condition under which they performed the first test): they were told that the second test was under construction and were taught about ST (the debriefing instruction) to decrease related evaluative pressure.	Short cognitive test measures: the Mini-Mental State Examination (MMSE) ; the Montreal Cognitive Assessment (MoCA). Each participant took both the MMSE and the MoCA in a counterbalanced order.	ABST significantly impaired older adults' performance on both tests, leading to an increase in the number of older adults meeting screening criteria for MCI. The debriefing instruction about ST before the second test neutralized ABST for all participants.
Schlemmer & Desrichard (2017)	N = 27 OA (63% women) Mean age : 70.42 years old (SD = 3.10, range = 64-74) All high school graduates	Recruitment Method: subject pools, senior centers, and conferences. Testing location: lab	-Threat condition: participants took the test in a “neuropsychological examination” room where the experimenter wore a white coat on top of her clothes and presented herself as a neuropsychology student who will assess participants' memory. To increase the simulation of a medical office, there were neuropsychological posters on the walls, a “Neuropsychological laboratory” sign on the door, and a pile of “patient records” and a clinical neuropsychology textbook on the desk.	A story-recall task; A word-span task.	Testing in a simulated medical setting within the lab can negatively impact memory performance in older adults with low memory self-efficacy scores, while potentially enhancing performance in those with higher memory self-efficacy.

Follenfant et Atzeni (2020)	<p>N = 40 OA Mean age : 67.03 years old (SD = 5.39)</p> <p>N = 45 YA Mean age : 23.21 years old (SD = 3.56)</p>	<p>Recruitment Method: Older participants were partly recruited from the University of the Third Age and partly from contacts at local social or leisure clubs.</p> <p>Testing location: lab</p>	<p>-Reduced-threat condition: participants took the tests in the “University Research” environment, where the experimenter was dressed normally and presented herself as a psychology student who will assess participants’ memory. The room was neutral with no decoration.</p> <p>All participants were told that they would receive a memory test.</p> <p>-Threat condition: no-intervention.</p> <p>-Two reduced-threat conditions: 1) individuation of the self to alleviate the burden of social identity, 2) self-handicapping to externalize the attribution of the performance</p>	A two-phase cued-recall test with 48 items (RI-48).	Among the two Reduced-threat interventions, only the individuation intervention improved memory performance in older adults compared to the no-intervention condition.
Caughie et al. (2023)	<p>N = 43 OA (67% women) Mean age : 75 years old (range 67-89) 17.65 years of education</p>	<p>Recruitment Method: a newspaper advertisement in a local Missoula, MT newspaper.</p> <p>Testing location: a designated assessment room within the Clinical Psychology Center on the University of Montana campus (lab).</p>	<p>-Threat condition: an excerpt from a pseudo-journal on cognitive decline and the inevitable progress toward Alzheimer. Participants had to answer True/False questions about what they had read in order to enhance their attendance to the stereotypes presented.</p> <p>-Reduced-threat condition, here called “neutral instructions”: an excerpt from a pseudo-journal article on ornithology and similarly required participants to answer True/False questions about what they had read.</p>	The Weschler Adult Intelligence Scale (WAIS), the Trail Making Test (TMT), the California Verbal Learning Test (CVLT), DKEFS Stroop, Trail Making Test, WAIS-IV Digit Span and Coding subtests, and the California Verbal Learning Test	No significant differences were observed between the Threat condition and the Reduced-threat condition on the neuropsychological performance measures.
