REVIEWS

Can anxiety be a predictor of task-oriented cognitive function in individuals over 60 years of age? – a systematic review

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Summary **Background.** Anxiety has been recognized as an important factor in detecting cognitive decline in old age, but research on this topic is sometimes conflicting or inconclusive.
Objectives. The aim of the present study is to provide a review of existing literature on the relationship between anxiety state and task-oriented cognitive functions in order to identify the nature of such a relationship.
Material and methods. All relevant literature published between 2008 and 2020 was searched using four scientific databases (Pubmed, CINAHL, Embase and PsycINFO). The terms in a list of emotion-related and task-related items as search terms in conjunction with "emotion, task, performance and older people" were used to identify relevant research articles from the mentioned electronic databases.
Results. As a result of this review, anxiety is associated with decreased memory and executive function among cognitive functions. While anxiety and depression were negatively associated with cognitive function, anxiety was not a major predictor of cognitive decline in older adults. Although we could not clearly confirm a relationship between anxiety and cognitive functions, these findings provide an interesting possibility of interpretation of the psychological mechanisms in older adults. These results support the conclusion that a relationship with specific human emotions, such as anxiety, might exist for people with declining cognitive functions.
Conclusions. This suggestion could be applied to various environments. Further studies confirming the possibility of predicting anxiety through multi-dimensional analysis of human variations should be promoted.
Key words: aging, anxiety, cognition, emotions, systematic review.

Background

Although anxiety has been recognized as an important factor to detect cognitive decline in later life, research on the topic is sometimes conflicting or inconclusive [1]. It is known that anxiety may arise when a subjective cognitive decline is perceived, as this perception is associated with a higher anxiety score. Additionally, many studies have suggested that anxiety could be considered as a predictor of the progress of dementia [2]. Treating anxiety in later life might in fact prevent or delay the onset of the disease [3]. In general, the prevalence of anxiety disorders in older adults is between 3.2% and 15.3%. Sub-clinical levels of anxiety symptoms range from 15% to 52.3%. The risk of anxiety disorders has increased for females more than for males, as well as for people having a higher level of education, a smaller social network and three or more chronic diseases [4]. This condition could not only negatively affect the risk of disability and mortality but could also be confirmed to be one of the early signs of the onset of neurodegenerative disorders [5, 6].

However, most studies showed some limitations due to inconsistencies in the use of assessment tools, and the results in terms of cognitive aspects, in particular, were inconclusive due to the heterogeneity of the data collected [7–9]. One researcher observed a decline in visual learning and memory in anxious elderly people, some researchers have demonstrated that older adults' cognitive functions are characterized by attentional biases to negative stimuli, and other researchers suggested there might be a decline of executive functions in people who live with anxiety. Therefore, more structured studies would be needed to confirm the available knowledge on the cognitive decline of the aging brain [10, 11].

Compensatory strategies have been developing as a hot topic among scholars for a long time now, and positively compensatory behaviors have been found to be able to provide the possibility of living a healthier life in aging. Using compensatory strategies could be seen as an indicator of problems with physical or mental function. Some researchers asserted that increasing compensatory strategies during daily tasks can be a symptom of pre-clinical disability. It should be confirmed whether they had to change the method or frequency of a specific action during a daily performance, or if the change was a deliberate choice and can therefore be defined as a compensatory strategy in its proper sense [12]. If they had experienced increased risk or had complained about outright difficulties in what they have been doing, then the need to be concerned about their health condition in terms of both physical and mental function is real. Psychological understanding is especially important in the use of compensatory strategies, and some studies investigated the relationship between cognitive and emotional factors, researching whether low self-esteem was associated with specific methods or frequencies in the use of compensatory strategies. Anxiety could be defined by the presence of various affective states, such as uncertainty, worry, concern and tension [12, 13].

To date, several reviews on the relationship between affective state and cognitive function have been conducted, but none of them focused on the association between anxiety state and specific cognitive functions. Some past studies have argued in favor of an association between anxiety and cognition, explaining that anxiety may be an early symptom of neurodegenerative disorders [13–15]. However, the results of previous studies remain inconclusive due to the heterogeneity of the measures of

cognitive ability assessment tools used in literature. Moreover, although the importance of the application of task-oriented detailed evaluation tools other than simple cognitive function evaluation tools was suggested, the correlation with simple cognitive functions was mainly mentioned, and there was no study reviewing the differences in detailed cognitive functions [16, 17]. The relationship between anxiety and cognitive performance is still explained as a curved relationship, mainly suggesting that severe arousal due to anxiety in the elderly narrows attention and leads to a decline in cognitive performance [18, 19].

As such, the antecedents of anxiety symptoms and cognitive decline are unclear, and which cognitive factors are affected also remains unclear. The main concern of this study is the possibility of predicting future cognitive decline through anxiety symptoms. This systematic review of literature was carried out in order to identify an overview of research undertaken on the topic and find out the direction that the studies available seem to have taken. The aim of this review is to survey this literature in order to identify the relationship between anxiety state and task-oriented cognitive functions. In this review, we specifically review and discuss the following:

Experimental conditions used to compare the relationship between anxiety and task-oriented cognitive function.

Common measurements for anxiety and task-oriented cognitive function.

Relationship of the variables involved in anxiety and task-oriented cognitive function.

Plausibility of anxiety state assessment as a method to detect task-oriented cognitive function decline in elder people.

Material and methods

This systematic review is an attempt to survey, summarize and interpret the literature on task-oriented cognitive function decline in aging and its potential. Although this systematic review is not registered, it was designed and developed according to the PRISMA guidelines.

Literature search

All relevant literature was searched using four databases: Pubmed, CINAHL, Embase and PsycINFO. The articles considered were those published between 2008 and 2019. We combined the following search terms: (emotion OR anxiety) AND (cognitive OR cognition) AND (task OR performance) AND older people. Studies involving humans and those written in English were used as limits. The pertinent articles were exported and managed using the RefWorks referencing software program.

Inclusion/exclusion criteria

The following inclusion criteria were used: (1) being an original article, (2) published from 2008 to the present, (3) written in English, (4) aimed at confirming the relationship between anxiety state and task-oriented cognitive functions in older people (over 60 years of age). Articles that were unrelated to the task-oriented cognitive function or to the target population (i.e. older people) were not included in the review. The selection was made by title and abstracts. The eleven remaining articles were read in full and evaluated according to the eligibility criteria.

Assessment of methodological quality

The methodological quality of each study was independently evaluated by two reviewers. The author of each study avoided evaluating the study, and discussions were conducted until a consensus was reached. The methodological quality assessment tool used in this review was the QualSyst tool, which uses a checklist to evaluate an article's methodology and reporting quality (Table 1).
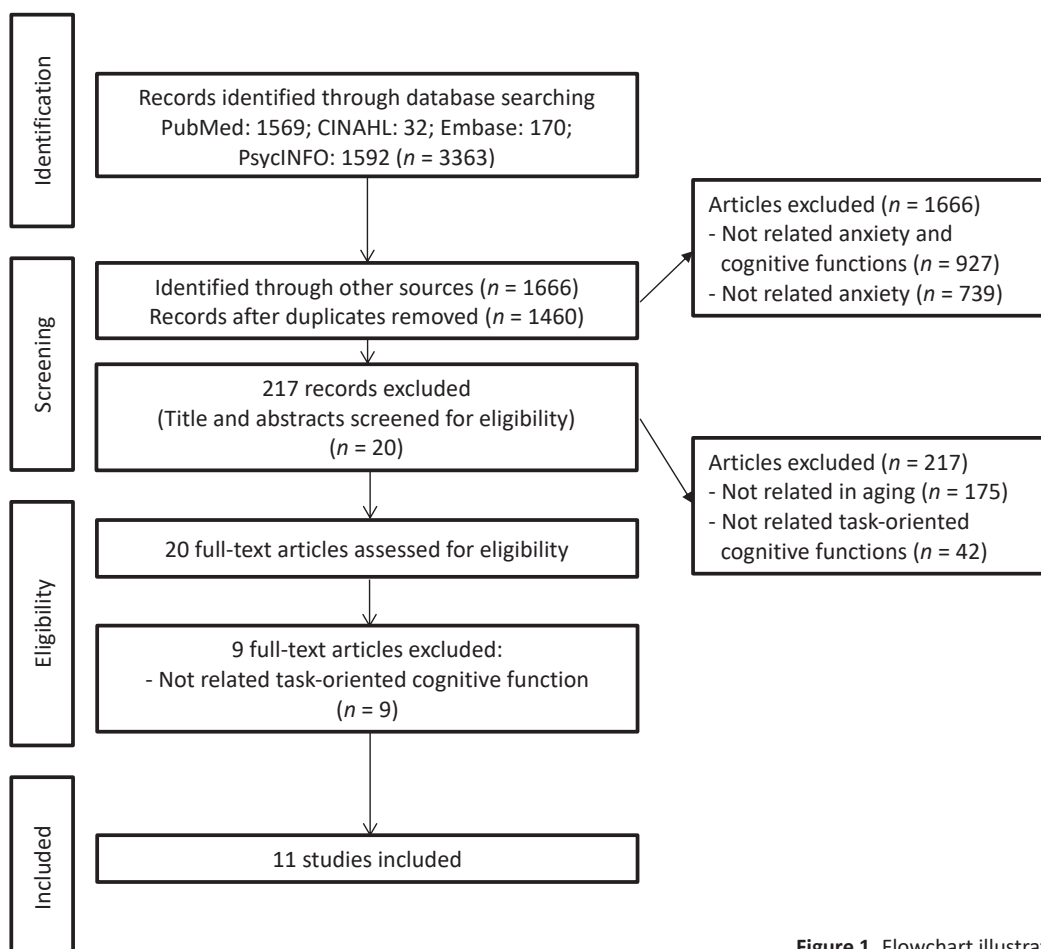

Figure 1. Flowchart illustrating the inclusion process

Data collection and analysis

The citation lists of all the articles were exported and managed with the Refworks referencing software. Two members of the review team independently read all of the research that passed the eligibility criteria. If one reviewer disagreed with the other, it was reconciled by consensus. The reviewers were blind to each other. Posters, books, magazines and articles written in languages other than English were excluded. A flow diagram shows the process of the selection. The findings were presented in tables with a narrative description. The data was systematically categorized and organized using a data charting form developed in Microsoft Excel.

Results

From the eleven articles considered for the analysis, the data was extracted in terms of seven categories that were used to analyze the full-text review, including country, participant, study setting, variables that the authors used to measure the relationship between anxiety and task-oriented cognitive function (Figure 1, Table 2). The literature search yielded an initial total of 3,363 citations, 1,666 of which were identified through other sources, with 1,460 unique titles after the removal of duplicates. After a first screening of the titles and abstracts of these articles, 237 studies were considered eligible for our review, after excluding 217 studies. The full-text articles were reviewed, and eight studies were excluded because they did not focus on the task-oriented cognitive function of older people. We summarized the results and interpreted them according to three lines: experimental condition to isolate the relationship between anxiety and task-oriented cognitive function, common measurements of anxiety and task-oriented cognitive function, relationship between variables in anxiety and task-oriented cognitive function.

Assessment of methodological quality

The quality-assessment results for the included articles are displayed in Table 1. A total of eight papers showed high methodological quality, and three showed moderate methodological quality. The main limitations found were insufficient subject description, insufficient outcome details and key outcome estimates and insufficient control of covariates (Table 1).

Experimental condition to compare anxiety and task-oriented cognitive function

Most studies included in this review were conducted to identify the relationship between anxiety and cognitive-based activities in the elderly. Memory and executive function were the most studied, but some studies also considered fluid intelligence, information-processing speed, compensatory strategies, verbal fluency, conceptual knowledge, inhibition and attention bias as key features in cognitive functions. Only three papers identified effects of pure anxiety on cognitive function [11, 20, 21]. Six papers examined the relationship between a decline of cognitive function in the elderly and symptoms of anxiety and depression [1, 3, 9, 22–24]. Two papers examined the relationship between anxiety and self-efficacy and the cognitive level [25, 26]. The cognitive functions considered in the studies were as follows: seven studies examined memory and/or executive process [3, 10, 21–24, 27]; two studies indicated a linked engagement bias for emotional information [11, 20]; two papers considered compensation strategies or computer use levels [25, 26]. Most of the studies were conducted as cohort type longitudinal studies rather than phenomenological analyses. The states of anxiety were graded, and the cognitive function of each level was compared and analyzed. The participants were divided

Table 1. Standard Quality Assessment of the eligible articles

Study	Design	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Quality^a		
Beaudreau et al. [24]	CS	+	+	+/–	–	N/A	N/A	N/A	+/–	+	–	+/–	–	+/–	+/–	11/22	50.0%	Moderate
Bierman et al. [23]	CT	+	+	+	+	N/A	N/A	N/A	+	+	+	+/–	+	+	+	21/22	95.5%	High
Burgess et al. [20]	CS	+/–	+	+/–	+/–	N/A	N/A	N/A	+/–	+/–	+/–	+/–	–	+/–	+/–	11/22	50.0%	Moderate
Delphin-Combe et al. [21]	CT	+	+	+	+/–	N/A	N/A	N/A	+	+	+	+/–	+/–	+	+/–	18/22	81.8%	High
Fung et al. [10]	CT	+	+	+	+	N/A	N/A	N/A	+	+	+	+/–	+	+	+	21/22	95.5%	High
Herrera et al. [11]	CS	+	+	+	+/–	N/A	N/A	N/A	+/–	+	+	+/–	–	+/–	+/–	15/22	68.2%	Moderate
Higgins et al. [26]	CS	+	+	+	+	N/A	N/A	N/A	+	+	+	+/–	+	+	+	21/22	95.5%	High
Laukka et al. [27]	CT	+	+	+	+	N/A	N/A	N/A	+	+	+	+/–	+	+	+	21/22	95.5%	High
Potvin et al. [22]	CT	+	+	+	+	N/A	N/A	N/A	+	+	+	+/–	+	+	+	21/22	95.5%	High
Wild et al. [25]	CT	+	+	+	+	N/A	N/A	N/A	+	+	+	+	+	+	+	22/22	100.0%	High
Yochim et al. [3]	CS	+	+	+	+	N/A	N/A	N/A	+	+	+	+	+/–	+	+	21/22	95.5%	High

1. Question/objective sufficiently described? 2. Study design evident and appropriate? 3. Method of subject/comparison group selection or source of information/input variables described and appropriate? 4. Subject (and comparison group, if applicable) characteristics sufficiently described? 5. If interventional and random allocation was possible, was it reported? 6. If interventional and blinding of investigators was possible, was it reported? 7. If interventional and blinding of subjects was possible, was it reported? 8. Outcome and (if applicable) exposure measure(s) well defined and robust to measurement/misclassification bias? Means of assessment reported? 9. Sample size appropriate? 10. Analytic methods described/justified and appropriate? 11. Some estimate of variance reported for the main results? 12. Controlled for confounding? 13. Results reported in sufficient detail? 14. Conclusions supported by results? + yes (2), +/– partial (1), – no (0), N/A not applicable (no score), CS – Cross-Sectional, CT – Cohort, ª Quality: low, < 50%; moderate, 50–74%; high, ≥ 75%.

Table 2. Summary of study characteristics and key results from eleven studies

Article citation	Participants	Assessment tools (Task-related cognitive function) * Anxiety evaluation tools	Cognitive function variables	Confounders	Main finding
Beaudreau et al. [24]	• 102 participants • Healthy older adults	• Rey Auditory Verbal Learning Test (RAVLT) • Stroop Color and Word Test (STROOP) • Symbol Digit Modality Test (SDMT) • Controlled Oral Word Association Test (COWAT) ***Beck Anxiety Inventory (BAI)**	• Episodic memory • Inhibition • Processing speed/shifting attention • Word fluency	• Not considered	• Anxiety symptoms 1. Poorer inhibition and slower processing speed/shifting attention 2. Only inhibitory ability was focally related • Coexisting anxiety and depressive symptoms: semantic memory, episodic memory and processing speed/shifting attention ↓
Bierman et al. [23]	• 2351 participants • 62 years or older • Anxiety and cognitive performance scales not considered	• Raven's colored Progressive Matrices (12 sub-items) • Adjusted version of coding task • Modified Dutch version of Auditory Verbal Learning Test (AVLT) ***Hospital Anxiety and Depression Scale-Anxiety (HADS-A)**	• Fluid intelligence: ability to deal with new information • Information-processing speed • Episodic memory	• Socio-demographic variables: age, gender and level of education • Physical health • Depression symptoms (CES-D) • Alcohol consumption • Use of benzodiazepine	• Depends on the severity of worse cognition • Not predictive value of cognitive decline
Burgess et al. [20]	• 64 participants • 32 older adults and 32 younger adults (equal number of males and females)	• Lexical decision task ***State-Trait Anxiety Inventory (STAI-Trait)** ***State-Trait Anxiety Inventory (STAI-State)**	• Attentional bias	• Not considered	• Anxiety linked attentional engagement positive words < negative words • ↓anxious participants: rapid engagement with positive words • ↑anxious participants: faster engagement with negative items
Delphin-Combe et al. [21]	• 149 participants • 65 years of age or older (Cognitive complaint: having at least one positive answer per questionnaire was required)	• Free and Cued Selective Reminding Test (FCSRT) • Battery of mnemonic efficiency of Signoret • Forward Digit Span Task • Backward Digit Span Task • Trail Making Test part A • Digit Symbol Task • Trail Making Test part B • Stroop Test • Category Fluency • DO 80 • Copying of a complex figure (REY) ***Hamilton Anxiety Rating Scale (HARS)**	• Memory 1. Episodic memory 2. Visual recognition memory 3. Visual episodic memory • Executive functions 1. Working memory 2. Processing speed/shifting attention 3. Mental flexibility 4. Inhibition 5. Word fluency • Instrumental functions 1. Language (spontaneous naming ability) 2. Visual spatial abilities	• Not considered	• High level of anxiety, the performance of retrieval and recognition of visual information is lower compared to mild or moderate levels of anxiety • For memory storage processes, the difference is between very low and highly anxious patients • Impacts several stages of verbal memory, notably the processes of storage and retrieval, and visual recognition memory within a population having cognitive complaints
Fung et al. [10]	• 122 participants • Cognitively healthy older adults with anxiety symptoms • Another 122 participants without anxiety symptom (at baseline based on age, gender and education in the same pool)	• Category Verbal Fluency Test (CVFT) • Digit and visual span test • Trail making test (TMT) • Alzheimer's disease assessment scale cognitive scale (ADAS-Cog); word list learning task extracting ***Revised Clinical Interview Schedule (CIS-R)**	• Global cognitive functioning • Fluency and executive function • Attention and working memory • Executive function and speed of proceeding • Episodic memory	• Socio-demographic data; age, gender, education, family history of mental illness, smoking and drinking habits	• Anxiety symptoms 1. Poor performance in delayed recall and TMT 2. Greater decline in episodic memory rather than executive functioning 3. Early preclinical sign of cognitive impairment and probably Alzheimer's disease 4. May predispose older adults to faster neuro-degeneration

Table 2. Summary of study characteristics and key results from eleven studies

Article citation	Participants	Assessment tools (Task-related cognitive function) *Anxiety evaluation tools	Cognitive function variables	Confounders	Main finding
Herrera et al. [11]	• 102 participants (48 with high trait anxiety and 54 with low trait anxiety) • Older adult of 60 years of age	• 72 pictures of different emotional valence (recognition task) • Autobiographical memory; requested to remember an experience in their life *State Trait Anxiety Inventory (STAI-T)	• Autobiographical memory	• Not considered	• Attending 1. Negative > positive or neutral ones 2. With anxiety > without anxiety • Remember positive pictures: with anxiety < without anxiety • People without anxiety tend to remember life experiences more positively
Higgins et al. [26]	• 257 participants • Older adults (average age 67.6 years)	• Task Modification (MOD) scale *Mental Readiness Form-Likert (MRF-L)	• Degree and severity of compensatory strategies on 8 daily tasks	• Not considered	• ↓ SE beliefs and ↑ anxiety levels: higher level of using compensatory strategies • SE and state anxiety may influence
Laukka et al. [27]	• Cohort 1921 sample ≥ 550 participants (1999–2001) • Mean age of 79 years	• Modified version of the Moray House Test No.12 • Raven's Standard Progressive Matrices • Logical Memory subtest of the Wechsler Memory Scale • Letter fluency *Hospital Anxiety and Depression Scale (HADS)	• Mental ability • Non-verbal reasoning ability • Verbal declarative memory • Verbal fluency ability	• Emotional stability	• Anxiety and depression are negatively associated with cognitive performance (working memory and central executive of working memory) • Between-person differences showed to be more important for anxiety, within-person changes appeared more influential for depression
Potvin et al. [22]	• 955 participants • Age 65 years and older	• Isaacs Set Test • Benton's Visual Retention Test (BVRT) • Digit Symbol Coding Test • Verbal Paired Associates test • Similarities test • Forward and Backward Digit Span tasks *State-Trait Anxiety Inventory Y-version (STAI-Y)	• Generally cognitive • Semantic verbal fluency • Short-term visual memory • Speed of information processing and visuomotor coordination • Episodic memory • Conceptual knowledge • Working memory	• Age, education, sex, depressive symptoms, subjective health, subjective cognitive complaints, chronic diseases, functional status, psychotropic drug use and number of medications	• High anxiety level (adjustments for confounding variables): all positive, except for the delayed recall of the verbal paired associates and digit span tasks • State anxiety is not main factor to predict the decline of cognitive function in older adults
Wild et al. [25]	• 162 participants • At least 80 years old at entry and living independently	• Computer Self-Efficacy Survey *Computer Anxiety Survey	• Computer-based tasks such as moving a cursor, using e-mail and making selections from an onscreen menu	• Social-demographic variables: age, education, living alone	• Consistent computer use: reduced levels of anxiety and increased self-confidence in ability to perform computer tasks • Benefit from training and/or experience with computers: cognitively intact participants > participants with MCI • Suggested use of computer to people with MCI
Yochim et al. [3]	• 120 participants • 60 years old and older	• California Verbal Learning Test, second edition (CVLT-II) • Delis-Kaplan Executive Function System (D-KEFS) 1. Trail Making subtest 2. Verbal fluency subtest 3. 20 questions subtest *Geriatric Anxiety Scale (GAS)	• Executive function 1. Number Sequencing/Letter Sequencing/Number-Letter Switching 2. Verbal Fluency; executive and language 3. Abstraction	• Not considered	• Related to decreased performance on semantic clustering ability • Related to lowered performance on several tests of executive functioning (categorization and set-switching) • Suggest that anxiety has a unique relationship with executive functioning, which impacts the ability to learn new information

into groups according to their high or low-level state of anxiety (two groups), or high, moderate and low levels of anxiety (three groups). In some studies, the participants had been recruited by including the depression level in the inclusion criteria. In other studies, anxiety and depression were cross-analyzed, and the degree of influence of each characteristic was compared.

Common measurements of anxiety and task-oriented cognitive function

In this study, the eleven papers were analyzed and evaluated through interviews and task-based evaluation methods rather than physiological measurements related to anxiety, depression and cognitive function. Most studies tested memory and executive function to assess changing cognitive functions in elderly people with symptoms of anxiety. The memory evaluation areas that proved to be more often used were episodic memory and working memory, along with information processing speed, verbal fluency and mental flexibility, which were evaluated as executive functions. Two studies assessed anxiety levels by using the Hospital Anxiety and Depression Scale-Anxiety (HADS-A) [23, 27], three studies used the State-Trait Anxiety Inventory (STAI) [11, 20, 22]. Other studies did not use a validated evaluation tool. Most participants involved in these studies were pre-clinical participants with fewer psychiatric problems.

Relationship between variables in anxiety and task-oriented cognitive function

Recently, many researchers have been concerned with identifying early traits of the cognitive decline of the elderly. Our review confirmed the feasibility of anxiety as a useful variable to look at in order to detect a decline in cognitive function in older adults. According to our review, anxiety might be a marker of decreasing cognitive function in older adults. In fact, in the results, anxiety is often associated with a decline of memory and executive function among the cognitive functions.

Two studies found that anxiety could lead to a reduction in episodic memory. They also demonstrated that a decline in episodic memory can be more severe than in executive function [10, 21]. With regard to executive function, one study reported no decline in terms of working memory, mental flexibility, inhibition and processing speed, except for retrieval capacity in verbal episodic memory [21]. Another study also suggested that even when a decline is not observed in executive function, it could be observed later on and be seen as a natural change over time [9]. These studies could be considered as evidence of a substantial difference between people with cognitive impairment and those with normal cognitive function in terms of episodic memory problems. On the other hand, one study insisted that symptoms of anxiety are related to lower performance of executive function, such as categorization and set-switching.

Symptoms of anxiety seemed to particularly affect the ability to learn new information by using executive skills [3]; moreover, anxiety was associated with emotional preference and attentional engagement. Two studies found that anxious people tend to pay more attention to negative information than positive or neutral information and tend to spend a long time attending to all items [11, 20]. Older adults with anxiety seemed to recognize negative information more easily and to remember more negative than positive aspects of life events. This could be explained by the relationship between anxiety and reduced recognition of positive information. These studies also revealed that people without anxiety tend to remember more positive things in their life, and they even showed a tendency to perceive memories of negative situations with positive emotions. These studies also supported the idea that selective attention is not due to age-related difference and presented the possibility that older adults pay more attention to positive than negative information relative to younger adults [11, 20].

Moreover, anxiety could affect self-efficacy when performing goal-oriented tasks. Two studies found that low self-efficacy and high anxiety were associated with higher levels of use of compensatory strategies and increased self-confidence about the ability to perform computer tasks. These results showed that there might be a possibility to predict cognitive decline measuring performance in goal-oriented tasks at home in older people with mild cognitive impairment. These studies also suggested to continue research in order to find psychological characteristics linked with the use of compensatory strategies [25, 26].

Finally, anxiety and depression were negatively associated with cognitive function, but anxiety was not a major predictor to detect cognitive decline in older adults. Four studies showed that cognitive problems in people with anxiety depend on the severity of anxiety: mild anxiety seems to affect cognitive functioning positively. However, some studies indicated that the coexistence of symptoms of anxiety and depression was associated with deficits in semantic memory, episodic memory and processing speed/shifting attention [22–24, 27]. Although previous studies have referred to the relationship between anxiety, memory and executive functioning, the results are inconsistent or partial. A novel finding also deals with a comparison between the between-person and within-person in changes and differences for anxiety and depression over time. Anxiety symptoms were a more important value in the between-person, and depression symptoms were a more important value in the within-person.

Discussion

The relationship between anxiety level and cognitive decline in the elderly did not emerge consistently from the results of the eleven analyzed papers. Symptom of anxiety seemed to significantly affect the memory and executive functions of the elderly. Memory was especially shown by some as a predictor of cognitive performance level rather than executive function. With regard to memory, episodic and working memory were associated with symptoms of anxiety, and executive functions were related to inhibition, processing speed/shifting attention and categorization [28–30]. High anxiety and low self-efficacy were also considered potential predictors of the cognitive level of the subjects. These studies confirmed the effect of the level of anxiety and self-efficacy on performing goal-oriented tasks. In the results, self-efficacy was an important variable that could be considered along with anxiety. Emotion valence was another important concept to be considered with anxiety. Some studies demonstrated that symptoms of anxiety were associated with emotion valence tendency and attentional bias and confirmed the relationship between anxiety and the emotional information memory of the elderly [31–34]. Some studies emphasized that pure symptoms of anxiety would not be able to predict the decline of cognitive function in older people and that both anxiety and depression should be considered [11, 20, 21]. Some studies also demonstrated that the anxiety variable might have a positive effect on cognitive function [22–24, 27].

Most of the studies were conducted by recruiting a large number of participants, and some studies included a cohort study to track the characteristics in older adults over a period of one to three years. However, most of the participants did not represent typical older adults experiencing cognitive problems. Although people tend to experience a decline in cognitive function that normally changes with age, some people have experienced limitations in their daily life activities due to a cognitive decline some people could be made to simple mistakes while performing tasks [27, 32]. In general, evaluation of cognitive function is conducted through consultation with a practitioner, and it is possible to experience a wide range of score changes according to the emotional state and condition during the evaluation [24]. In addition, there is a limitation since the evalua-

tion is not conducted in real time, and the changes of patients cannot be detected quickly [28]. Anxiety and depression could reach various levels in life, and this has a positive or negative impact on the person's life in the long term. In a previous study, 45% of patients who experienced psychiatric symptoms reported experiencing symptoms of anxiety as well, and it is one of the symptoms that you should consider when you are counseling to solve memory related problems [29, 33].

Although we did not clearly confirm a relationship between anxiety and cognitive functions, these results could anticipate the possibility of interpreting mechanisms and psychological aspects in older adults over time. Our findings here underline the lack of evidence in this area, and we anticipate that this will serve as a catalyst in developing this research field further. This study shares the typical limitations of systematic reviews, given the dearth of rigorous research in this area. These findings should be interpreted with caution. Our review included only anxiety or depression, and the confounding variables of the participants were not considered, which might have biased the results. Furthermore, we should try various study designs that confirm the quality assessments of the articles.

Globally, a new dementia patient occurs every 3 seconds, and policy efforts to reduce the burden of dementia at an international level are continuously being made [35, 36]. In 2017, the World Health Organization (WHO) proposed a national policy action plan to lower the disease burden of dementia patients [36]. In particular, the main direction was to establish a more concise and continuous care path for dementia patients from the perspective of the consumer, away from the perspective of the supplier [37, 38]. The most important problem is that the pathogenesis of dementia can be delayed by diagnosing the condition as soon as possible in the early stages and continuing treatment and management from an early stage. Distinguishing

dementia from other diseases is difficult in the early stage; thus, it is crucial to study and consider various influencing factors for accurate early detection. The increase of error experience and the decrease of cognitive function may lead to lower the self-esteem and stability of patients and could cause earlier manifestation of symptom of dementia. Recently, many researchers have been trying to develop a technology capable of detecting cognitive decline rapidly. In addition, fast development in ICT is increasing the possibility of measuring human emotions [30–33]. In recent years, clinicians increasingly prefer to measure biological parameters to help determine and differentiate a patient's specific risk of developing Alzheimer's disease and other forms of dementia to aid in more accurate patient assessment [39, 40]. Although these areas may include technologies applicable to a limited population, the elderly people of the future are likely to be more interested in these new technologies [41, 42]. In the future, researchers will need to conduct in-depth research on cognitive function evaluation methods that can easily be assessed, as well as measurement variables that can contribute to these technological developments.

Conclusions

The purpose of a systematic review is to confirm the body of previous research and serve as a starting point to summarize research, generate topics and direct future research. We have presented the findings and summarized the evidence of eleven articles on the relationships between anxiety and cognitive function in older adults. These results support the conclusion that a relationship with specific human emotions, such as anxiety, might exist for people with declining cognitive functions. Further studies confirming the possibility of predicting anxiety through multi-dimensional analysis of human variations should be promoted.

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