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The role of cognitive self-report measure type in predicting cognitive decline among older adults: A systematic review

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Abstract

Many types of items are used to measure self-reported cognition, resulting in heterogeneity across studies. Certain cognitive self-report measure types may be more predictive of future decline. Therefore, the purpose of this systematic review was to compare whether specific types of cognitive self-report measures better predict risk for cognitive decline over time when measures are directly compared within the same study. The PRISMA criteria guided the review. Eligibility criteria included: longitudinal studies, outcome of cognitive decline, at least two different cognitive self-report measures, and no cognitive impairment at baseline. Nineteen studies were included in the final review. A narrative synthesis of results was completed, resulting in three thematic groups of comparisons across self-reported measure types. Self-reported memory decline with worry and peer perceptions of memory were associated with the highest risk for cognitive decline. Future longitudinal investigations of self-reported cognitive problems should focus on using measures that may be most sensitive to predicting cognitive decline risk.

Keywords

self-reported cognitive problems; cognitive decline; cognitive self-report measures; older adults; systematic review

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Declaration of Conflicting Interests
The authors declare that there are no conflicts of interest.

Introduction

Many older adults without cognitive impairment report problems with memory or thinking – global prevalence rates range from 11% to 47%.[1–3] The perception of cognitive problems can detrimentally impact many aspects of an older adult's life and is associated with greater reports of affective symptoms,[4] decreased participation in leisure activities,[5,6] lower quality of life,[7] functional decline,[3] and greater risk for falling.[8] Further, cognitively intact older adults who report such problems may have two to four times the risk of future dementia, including Alzheimer's (AD) and mild cognitive impairment (MCI), compared to those who do not report cognitive problems.[9–11] Despite this association, people may report cognitive problems for a variety of reasons unrelated to early indicators of dementia. For example, older adults may report problems when they experience age-related changes or worry about dementia. Therefore, although self-reported cognitive problems may have reasonable sensitivity for identifying older adults at risk for cognitive impairment, their specificity as an indicator is low. That is, self-reports of cognitive problems are present in a substantial subsample of older adults without cognitive impairment, but they are not necessarily indicative of future cognitive decline.

Previous systematic reviews and meta-analyses examining links between self-reported cognition and objective cognition have reported mixed cross-sectional evidence but rather consistent longitudinal findings. In their review of cross-sectional studies, Burmester et al[12] found that self-reported cognitive problems were associated with lower objective cognitive performance in most studies, but some did not show a relationship. These mixed results may be impacted by factors such as depressive symptoms or personality traits, both known to influence reports of cognitive problems.[13,14] For example, accounting for depressive symptoms may reduce or eliminate the cross-sectional association between self-reported and objective cognition.[12,15] However, in their meta-analysis, Burmester et al[12] found that study characteristics were notably heterogeneous, including differences in the measures used to operationalize self-reported cognition (i.e., single-item, composite measures, memory only, cognition only), which may have also contributed to differences in study findings. Their meta-analysis suggests the potential importance of the characteristics of problem severity: reports of more severe problems were associated with lower cognitive performance ($r = -.13$).

In contrast to mixed cross-sectional findings, evidence supporting associations between self-reported cognitive problems and cognitive decline over time is much more consistent.[9–11] In their systematic review of prospective and retrospective community-based cohort studies, Mendonca et al[16] found that self-reported cognitive problems were related to risk for MCI or dementia in the majority of studies (8/9) that excluded participants with cognitive impairment at baseline. Similarly, in a meta-analysis of prospective cohort studies, Mitchell et al[10] examined risk of MCI and dementia over time in people with self-reported cognitive problems. They found that the cumulative conversion proportion from self-reported cognitive problems to MCI was 24.5% (11 studies, 4.1 years mean follow-up) and to dementia was 11.0% (28 studies, 4.8 years mean follow-up) while in those without self-reported cognitive problems the cumulative conversion proportion to dementia was 4.6% (14 studies, 4 years mean follow-up). All analyses had high heterogeneity in

the conversion proportion, however, and subgroup analyses did not examine the effect of key covariates like depression.[10] In addition, these reviews of longitudinal evidence did not examine the specific type of cognitive self-report measures employed (e.g., comparisons to peers, cognitive complaints with worry). The challenges of examining and synthesizing evidence across studies given the differences in cognitive self-report measures is a limitation in all systematic reviews to date.

Improving the utility of self-reported cognitive problems to indicate an at-risk state for cognitive decline relies, in part, on better understanding how measurement approaches relate cognitive outcomes over time. There is no measurement standard for self-reported cognition, and no consensus among the scientific community regarding optimal measures for predicting cognitive decline risk.[17] Research linking cognitive self-report with cognitive decline has been conducted with a wide variety of measures; a review by Rabin et al[18] found that 34 different cognitive self-report measures and 640 different items were used across 19 preclinical AD studies. This heterogeneity in measurement approaches hinders our ability to draw general conclusions across existing studies as certain aspects of the experience of cognitive problems may better discriminate individuals at risk for cognitive decline. Individual studies have found that certain aspects of self-reported cognition, such as reporting problems that are accompanied by worry or impact on daily function, are stronger indicators of cognitive decline risk than other characteristics of self-reports.[19–22] To better characterize the relationship between self-reported cognition and future cognitive decline among older adults, the purpose of this systematic review is to comprehensively appraise and synthesize the evidence using a narrative synthesis approach to examine how certain types or characteristics of cognitive self-report measures may differentially predict (i.e. the ability of one measure to better predict the outcome over another measure) cognitive decline over time. This will be accomplished by comparing studies that used two or more measures of self-reported cognition within the study. This approach was used to help avoid introducing between-study heterogeneity (e.g., methods, settings, covariates, etc.) when comparing the items on cognitive outcomes. This work builds on previous reviews and fills a gap in the literature where comparisons between studies haven’t been able to manage confounding variables when comparing across studies.

Methods

This systematic review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria.[23] The PRISMA checklist has been completed. In accordance with PRISMA, the protocol was developed *a priori* and registered with the International Prospective Register of Systematic Reviews PROSPERO database (registration number: CRD42018116507) and can be accessed at http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42018116507. Critical appraisal of the evidence was conducted using the Quality in Prognosis Studies (QUIPS) tool.[24,25] Narrative synthesis methods were employed across all studies to synthesize results.

Eligibility Criteria

To be eligible for inclusion, studies had to be peer-reviewed and report on longitudinal results with at least one wave of data collected after baseline. Additional inclusion criteria were: (1) outcome(s) included a measure of cognition or a diagnosis of cognitive impairment [e.g., MCI, AD, dementia]; (2) use of at least two different measures or items of self-reported cognition to predict cognitive decline; and (3) participants or a subsample of participants with no objective cognitive impairment at baseline. Articles were limited to reports on studies that used two or more measures of self-reported cognition **within** the study. Studies were excluded if they were: (1) not available in English; (2) experimental or quasi-experimental; (3) reviews; (4) qualitative; (5) non-empirical; (6) reported on cognitive decline outcomes related to a specific condition other than AD or dementia [e.g., heart failure, diabetes, multiple sclerosis], frontotemporal dementia, or Parkinson's dementia; or (7) informant-based cognitive self-report measures only. Informant-based reports were excluded *a priori* because we wanted to focus on the person who has cognitive problems with their own self-assessment. This is in line with other literature published on self-report measures.[18] No restrictions were made regarding date of publication as we aimed to review the complete body of currently available research that met our criteria.

Search Strategy

Systematic literature searches were conducted by searching the PubMed, CINAHL, and PsycINFO databases from inception until August 13, 2019. The search strategy consisted of three components – predictor variable terms (i.e., those related to self-reported cognition), terms that link the independent variable to the outcome terms (e.g., develop, risk, predicts), and outcome terms (i.e., those related to cognitive decline; Table 1) listed in the title, abstract, or text. Limits placed upon the search were English language and peer reviewed. Each term within one of the three components was serially placed in the search box. If there was overlap when adding a new search term where no new studies were found (i.e., term *a* and term *b* both resulted in the same number of studies) then only one of the search terms was used in the final search. The search terms for all three components were combined for the final search in each database (see Supplemental Table 1 for the final Boolean strings). Additionally, once the final studies from the search were identified, we then hand searched their reference lists and conducted a reverse citation check in Google Scholar to further identify potentially relevant studies.

Study Selection

One author (RKW) initially reviewed all titles and eliminated those that definitively did not fit the criteria. Then the remaining studies were split among all authors to review the abstracts for eligibility. All abstracts were then reviewed by a second author. After abstract review was completed, the studies were split among every author so that the full text of the studies could be evaluated to determine eligibility for inclusion in the systematic review. All studies were reviewed by at least two authors independently so that consensus could be made about what to include and any discrepancies could be resolved. The two reviewers discussed any discrepancies and if they could not come to an agreement, then a third

reviewer made the final decision. The outcomes of the study selection process are presented in the results section and Figure 1.

Data Extraction

All authors extracted relevant data from the final studies based on a predetermined matrix in an Excel spreadsheet. The extracted data were then reviewed and confirmed by a second author. The data extracted were: citation; purpose; sample (size, participant characteristics, age range/mean, etc.) and subsamples (if applicable); study setting; geographic location(s); name of cohort study; design (number of follow-up points, frequency of follow-up); comparator groups (i.e., did not self-report cognitive problems throughout the study duration); cognitive self-report measures/items; outcome measure(s); method used to determine no cognitive impairment at baseline; results relevant to the systematic review purpose; covariates; important covariate outcomes analyzed separately; strengths/limitations; and any notes related to the study.

Narrative Synthesis

We initially attempted a meta-analysis of the data but instead completed a narrative synthesis due to significant heterogeneity in the meta-analysis.[26] The narrative synthesis was guided by Joanna Briggs Institute's (JBI) recommendations for conducting systematic reviews of association.[26] JBI constructed these guidelines because few recommendations for conducting systematic reviews of association exist. Current recommendations for systematic reviews are based on PICO (population, intervention, comparator, and outcomes) which does not apply to systematic reviews of association. Rather the JBI approach focuses on population, exposure of interest, and outcome.[26] The narrative synthesis included textual descriptions of individual studies. Textual descriptions are summaries of individual studies based on predetermined factors (e.g., setting, participants, intervention).[26] In the current systematic review, these factors included study characteristics (e.g., number of participants, setting, length of study), cognitive self-report measures, and outcomes. The principal summary measures were hazard ratios and odds ratios.

The matrix (as described above) facilitated aggregation of study information so that themes across study characteristics and results could be determined by examining similarities and differences across studies and within and across subgroups. First, the studies were categorized into major thematic groups based on whether the cognitive self-report measures were examining reports of decline, current cognitive performance, or had measures of both decline and current cognitive performance. The three groups were then further split into sub-categories based on the characterization of cognitive self-report items (e.g., peer comparison, memory, executive function). While the problem of heterogeneity within cognitive self-report items extends to many different aspects of the items (e.g., characterization of item content, type of response options, number of items in the measure, referents in ability and change, etc.),[18] we focused our themes on item content to avoid conceptual overlap (e.g., memory and general cognition together). We did report on the other important aspects of the self-report item within the results section and in Table 2. Finally, all results are reported using the final model adjusted for covariates (if applicable).

Risk of Bias

The potential risk of bias for each study was assessed using the QUIPS tool.[24,25] A prognostic tool was selected for this systematic review because it is used to evaluate risk of bias in studies that examine the ability of a factor (i.e., cognitive self-report) to predict the risk of an outcome (i.e., cognitive decline). The QUIPS is an instrument used to determine validity and risk of bias in prognostic studies through the evaluation of six domains: study participation; study attrition; measurement of prognostic factor; outcome measurement; study covariates; and statistical analysis and reporting. Within each domain there are multiple items specified to determine the potential for bias (e.g., "definition of the prognostic factor" is included in the Prognostic Factor Measurement domain). The items are then scored related to adequacy and quality of reporting with the following response options: yes (i.e., reporting is adequate), partial (i.e., reporting is partially adequate), or no (i.e., reporting is not adequate). Each domain is then rated for potential risk of bias as either low, moderate, or high, with detailed notes entered to help with adjudication of ratings. The QUIPS does not provide a final score but rather allows for an assessment of a study's risk of bias by domain.[25] Every study in the systematic review was independently assessed with the QUIPS by two authors. The interrater reliability (IRR) was then calculated for approximately one-third of the studies in the review, selected at random, by examining the intraclass correlation coefficient[27] in SAS v. 9.4. According to McHugh,[28] IRR 0 to .20 has minimal level of agreement, IRR .60 to .79 has moderate level of agreement, and IRR .80 and higher has strong to almost perfect level of agreement.

After the first round of QUIPS ratings, the IRR was low in two domains (Prognostic Factor Measurement and Study Covariates). Therefore, we further refined our QUIPS rating system by establishing and implementing scoring criteria as recommended by Hayden et al.[25] Our modifications to the QUIPS included instructions on what to do if an article refers to another paper for details related to the study. Raters were instructed to look at the original paper if they were unable to make a determination from the details in the paper being reviewed. We refined two of the items within the Prognostic Factor Measurement domain. For the "valid and reliable measurement of the prognostic factor item" we modified it to read, "there is congruence between the prognostic factor conceptual definition and how the prognostic factor was operationalized." The "method used for missing data" was modified to read, "missing data at follow-up points was reported. If yes, treatment of data was handled appropriately." The Study Covariates domain also had a "method used for missing data" item that we also replaced with the modified wording. Finally, all wording within the Study Covariates domain was changed from confounding/confounders to covariates. The refined QUIPS tool was then applied to the final studies in this review. Each study was rated by two study authors (NLH and JM) and all ratings differences were resolved through discussion.

Results

Study Selection

A total of 4,319 studies were identified from initial searches: 624 from CINAHL; 1,996 from PsycINFO; and 1,699 from PubMed. After duplicate studies were removed, 3,210 remained for title review. Details related to full search and elimination of articles are in

Figure 1. Thirteen studies from the database searches were included in the review along with six additional studies which were added after conducting forward and backward citation searches. This resulted in a total of 19 studies in the final review.

Study Characteristics

All studies reviewed (Table 2) were published between 1997 and 2019 with the majority (n = 13; 68%) in 2015 or later. Study samples were from nine different countries, which includes one study that sampled in more than one country: Germany (n = 5); Australia (n = 5); United States (n = 3, includes one site in Puerto Rico); Sweden (n = 3); and Austria, Canada, France, and Japan each had one site. Further, some used data from the same cohort studies which included: German Study on Aging, Cognition, and Dementia (AgeCoDe) in Primary Care Patients Study (n = 5); Betula Prospective Cohort Study (n =2); Sydney Memory and Ageing Study (n = 2). All samples were drawn from community settings with the exception of two studies. One included both a memory clinic and a community-based sample; however, the memory clinic sample was not used in our review because it was not included in the analysis that was relevant to the purpose of the current review. The other study used a residential care and a community-based sample. The baseline sample sizes of the included studies ranged from 209 to 13,974. Length of study follow-up ranged from three to 17 years. All but three of the studies reported the mean or median age of their samples. These ranged from 62.52 to 81.1 years old, and most (n = 13) with a mean or median age of 70 years or older. Baseline gender was reported in most of the studies. One study did not report gender and in three studies, baseline gender was unable to be determined by the information provided. In all but two of the studies, the majority of participants were women. The percentage of women ranged from 0 – 75.7%. Only one of the studies included a sub-analysis stratified by gender.[29] Most of the studies reported on education level (n = 17). Some of the studies reported years of education which ranged from 7.9 – 15 years (n = 9). Only one study analyzed their sample by low versus high education level.[30]

Risk of Bias

Final ratings for the QUIPS risk of bias assessment are displayed in Table 3. Each study is rated in the six domains for a total of 114 ratings across the 19 studies. The IRR for the six studies chosen at random for IRR analysis were: κ = 1, κ = .75, κ = 0, κ = 1, κ = 1, and κ = .07. The QUIPS domains for the majority of studies had risk of bias ratings that were low (82/114, 72%) to moderate (25/120, 22%). Seven of the studies had high risk of bias ratings in one domain (7/114, 6%) – six in the study attrition domain[21,29,31–34] and one in the study covariates domain.[35] None of the studies had more than one domain rated as high risk of bias.

The Role of Cognitive Self-Report Measure Type in Predicting Cognitive Decline

The studies reviewed included within-study comparisons of a variety of cognitive self-report measures resulting in three thematic groups: (a) Reports of Decline, (b) Reports of Current Cognitive Performance, and (c) Reports of Decline vs. Current Cognitive Performance. All three thematic groups had sub-groupings. Many of the sub-groupings will reflect a

difference between global cognition and memory. Global cognition includes several domains of cognition whereas memory is a single domain of cognition.

Studies in the Reports of Decline thematic group had within-study comparisons of at least two measures of self-reported decline related to global cognition or memory. Measures of decline include those that ask participants if aspects of their cognition (e.g., memory, global cognition) have become worse when compared to a previous timepoint (e.g., last year, five years ago). Studies in the Reports of Current Cognitive Performance group had within-study comparisons of two self-reported measures of status of their current cognition (e.g., items asking about any global cognitive or memory problems). Finally, studies in the Reports of Decline vs. Current Cognitive Performance included those that had within-study comparisons of at least one measure of self-reported cognitive or memory decline and at least one measure of self-reported current cognitive or memory performance. One of the studies[36] was assigned to two different groups as it used more than two types of cognitive self-report measures that were applicable to this review. Table 4 provides details related to the measures used by each study organized by the three thematic groupings. Both established measures[37–44] and investigator derived measures were used.

Reports of Decline—Twelve studies compared reports of global cognitive and/or memory decline. This thematic group involved five sub-groupings: (a) Worry vs. No Worry in Global Cognitive Decline; (b) Worry vs. No Worry in Memory Decline; (c) Memory Decline vs. Global Cognitive Decline; (d) Memory Decline vs. Executive Function Decline; and (e) Daily Function Affected vs. Not Affected in Memory Decline.

Worry vs. No Worry in Global Cognitive Decline.: Only one study examined the predictive role of global cognitive decline and worry related to the decline.[34] The presence of decline was categorized as consistent versus inconsistent and the outcome investigated was risk for developing MCI. Consistent global cognitive decline with or without worry was associated with risk for MCI. Nonetheless, global cognitive decline without worry was slightly more predictive of MCI (HR 2.17 CI [1.51–3.13]) when compared to those who were worried (HR 1.79 CI [1.24–2.58]).[34]

Worry vs. No Worry in Memory Decline.: Six studies examined the predictive role of items related to perceived decline in memory and associated worry.[20,22,29,32,45,46] Of note, five of these studies sampled from the same longitudinal cohort (AgeCoDe) and participants may be represented in more than one study as time periods overlapped across some studies. However, two of the studies examined outcomes in unique ways. Heser et al[29] included a gender stratified sample, the results of which are displayed in Table 2. Wolfsgruber et al[22] categorized those with self-reported memory problems as: (a) inconsistent decline if they only reported worsening memory at one of two timepoints [baseline or follow-up one]; (b) consistent decline with or without inconsistent worries if there was decline at baseline and follow-up one and they either did not have worry or were inconsistent in their reporting of worries; or (c) consistent decline with worries if they had worries at both timepoints [baseline and follow-up one]. Not all of these studies examined the same outcomes. Two examined AD,[22,45] three investigated the risk for AD as well as other types of dementia,[20,29,46] and one examined risk for developing MCI.[32]

Both self-reported memory decline with and without worry were associated with an increased risk for dementia or AD in all of the studies using the AgeCoDe cohort; however, worry about decline was associated with a greater risk for decline than self-reported memory decline alone. Wolfsgruber et al[22] found that consistent self-reported memory decline with or without worry, but not inconsistent self-reported memory decline, predicted AD. Furthermore, they found that when worry about memory decline was consistent (present at all waves), it was more predictive of AD (HR 3.72 CI [2.13–6.50]) than when inconsistent (HR 2.03 CI [1.30–3.15]).[22] Some differences across studies were found based on the outcomes investigated (dementia vs. AD). Jessen et al[20] found that both measures of self-reported memory decline (with or without worry) predicted dementia and AD, the risk of AD was approximately twice that of any dementia. Conversely, Koppara et al[46] and Heser et al[29] did not find a difference in risk between AD or any dementia. Overall, having self-reported memory decline with worry about that decline was associated with approximately twice the risk of cognitive decline across studies in comparison to self-reported memory decline without worry.

Snitz et al[32] did not find an association between self-reported memory decline without worry and risk for MCI but did find an increased risk in those who had worry related to the decline (HR 1.66 CI [1.24–2.24]).

Memory Decline vs. Global Cognitive Decline.: Three studies examined the role of memory decline compared to global cognitive decline in predicting cognitive decline.[31,35,47] The outcomes investigated were dementia,[31,35,47] cognitive decline,[35] and MCI.[31] Both Brodaty et al[47] and Slavin et al[31] sampled from the Sydney Memory and Ageing Study. However, they used entirely different measures for self-reported cognition and Slavin et al[31] had the additional outcome of MCI.

In the Brodaty et al[47] study, self-reported global cognitive decline was associated with risk for dementia but only for those participants categorized as having severe decline at baseline (OR 2.2 CI [0.9–5.0]). Self-reported memory decline at baseline was not associated with risk for dementia. In the Jorm et al[35] study, self-reported global cognitive decline and self-reported memory decline were not associated with future dementia or cognitive decline. Similarly, in the Slavin et al[31] study self-reported global cognitive decline and self-reported memory decline were not associated with conversion to MCI or dementia.

Most of the studies examining the ability of self-reported global cognitive decline vs. self-reported memory decline in predicting cognitive decline (67%) had nonsignificant findings for both types of self-reported decline. Brodaty et al[47] showed a significant finding for self-reported cognitive decline and risk for dementia but that was only for the participants who were designated as having severe self-reported decline at baseline.

Memory Decline vs. Executive Function Decline.: One study compared the role of self-reported memory decline with self-reported executive function decline for the risk cognitive decline.[48] The data were grouped into self-reported memory decline and self-reported executive function decline domains.[48] The executive function decline was further broken

into three subdomains: concentration, making decisions, and taking initiative. The outcome was risk for dementia.

Using the full sample (this analysis was repeated in a small subsample of participants who also underwent computed tomography) when comparing for analysis, self-reported memory decline (HR 1.9 CI [1.3–2.7]) and self-reported executive function decline that included all subdomains (HR 1.6 CI [1.2–2.3]) were associated with a similar risk for dementia.[48] When the subdomains of executive function were included in the analysis, only a decline in concentration was associated with a risk for dementia (HR 1.9 CI [1.2–3.1]).

Daily Function Affected vs. Not Affected in Memory Decline.: One study investigated memory decline and memory decline that affects daily function in predicting cognitive decline.[21] The outcomes were MCI, mild cognitive disorder, Clinical Dementia Rating (CDR) scale impairment, and cognitive decline. Sargent-Cox et al[21] found that self-reported memory decline that affected daily functioning was associated with an increased risk for MCI (OR 3.54 CI [1.19 – 10.48]) but not for any of the other outcomes. Self-reported memory decline was associated with a decreased risk for impairment on the CDR scale (OR 0.22 CI [0.05 – 0.92]).

Reports of Current Cognitive Performance—Five studies compared reports of current cognitive performance. There were five sub-groupings: (a) Memory vs. Global Cognition, (b) Memory vs. Peer Comparisons, (c) Memory vs. Peer Perceptions, (d) Global Cognition vs. Peer Perceptions, and (e) Daily Function Affected vs. Not Affected in Current Memory Performance.

Memory vs. Global Cognition.: Only one study examined the role of memory problems compared with global cognitive problems in predicting risk for cognitive decline.[33] The outcome measured was cognitive decline. Sohrabi et al[33] found that neither self-reported global cognitive problems nor self-reported memory problems were associated with cognitive decline.

Memory vs. Peer Comparisons.: Abner et al[49] only used male participants examine risk for dementia and found that both self-reported memory problems and self-reported memory problems in comparison with peers were associated with risk for dementia. However, self-reported memory problems in comparison with peers (HR 6.01 CI [3.68–9.74]) was much more predictive of dementia than self-reported memory decline (HR 1.87 CI [1.47–2.38]). Table 2 displays a sub-analysis of Black participants only.

Memory vs. Peer Perceptions.: Rönnlund et al[36] compared the role of self-reported memory problems with peer perceptions of their memory problems in predicting cognitive decline. Peer perceptions refers to how others perceive a person’s memory problems. Participants were categorized into never (reference group), rarely, sometimes, and often groups for analysis. The outcomes were dementia and AD.[36] Two different samples were examined.[36] The full sample was used for the first analysis. For an additional analysis, a sample was used that only included the participants who did not have “near onset dementia” (i.e., five years or more until dementia diagnosis). This was done so that participants who

developed dementia earlier in relation to study baseline did not bias the results. Table 2 displays the results of the participants who did not have near onset dementia.

For the full sample, self-reported memory problems were associated with similar risks for dementia (HR 1.18 CI [1.04–1.34]) and AD (HR 1.22 CI [1.04–1.43]).[36] However, once the item measuring peer perceptions of memory problems was added to the model, self-reported memory problems were no longer predictive of either outcome. In this analysis with all items, only peer perceptions of memory problems was associated with dementia and AD. The degree of predictability varied by how often the problems were reported. For example, those who indicated rare peer perceptions of memory problems had a lower risk for dementia (HR 1.65 CI [1.11–2.45]) than those who indicated sometimes (HR 2.04 CI [1.38–3.00]) or often (2.98 CI [1.60–5.54]). When examining AD as an outcome, those who indicated rarely (HR 1.78 CI [1.07–2.97]) or sometimes (HR 2.06 CI [1.24–3.42]) for peer perceptions of memory problems had a lower risk than those who reported often (HR 3.86 CI [1.79–8.35]).

Overall, self-reported memory problems were not associated with risk for dementia or AD when compared to peer perceptions of memory problems. Those who indicated more frequent peer perceptions of memory problems were generally at a greater risk for cognitive decline over time than those with less frequent reports.

Global Cognition vs. Peer Perceptions.: The role of self-reported cognitive problems (one global cognition and one memory specific) and self-reported memory problems in predicting cognitive problems were examined in a single study with risk for dementia as an outcom.[50] Similar risks for dementia were found when comparing self-reported cognitive problems (HR 2.11 CI [1.88–2.37]), self-reported memory problems (HR 2.15 CI [1.84–2.51]), and self-reports of how others perceive their memory problems (HR 2.32 CI [2.06–2.60]).[50] Additive effects for dementia risk were found when participants reported one (HR 1.89 CI [1.65–2.15]), two (HR 3.01 CI [2.59–3.50]), or three (HR 6.20 CI [4.87–7.90]) types of self-reported difficulties with cognition.

Daily Function Affected vs. Not Affected in Current Memory Performance.: One study examined the role of self-reported memory problems and self-reported memory problems that affect daily function in predicting cognitive decline.[30] The sample was separated into low or high education levels. Low education levels applied to participants who did not receive an elementary school diploma. High education level applied to those who obtained an elementary school diploma or higher (i.e., attended/graduated from secondary school). The outcome measured was dementia.

Chary et al[30] used two separate analyses to examine participants in a three-year window and a ten-year window. In the three-year window analysis for the high education level participants, difficulty in retaining or remembering new information (OR 2.5 CI (1.74–3.59]), difficulty in retrieving or remembering old memories (OR 1.32 CI [0.51–3.41]), and difficulty finding words (OR 1.46 CI [1.02–2.09]) were all associated with risk for dementia. Self-reported memory problems that affected daily function were also associated with risk for dementia (OR 1.35 CI [0.94–1.94]). For the ten-year window analysis with

the high education level participants, difficulty in retaining or remembering new information (OR 1.47 CI [1.12–1.93]) and difficulty finding words (OR 1.18 CI [0.91–1.53]) were al associated with risk for dementia. Difficulty in retrieving or remembering old memories was not significantly associated with dementia. Self-reported memory problems that affected daily function was associated with risk for dementia (OR 1.47 CI [1.13–1.91]). For the participants in the low education level group, neither self-reported memory problems not self-reported memory problems that affected daily function were associated with dementia at any timeframe.

Reports of Decline vs. Current Cognitive Performance—Three studies compared reports of decline vs. current cognitive performance. This thematic group included three sub-groupings: (a) Memory Decline vs. Current Memory Performance, (b) Memory Decline vs. Peer Perceptions, and (c) Memory Decline vs. Peer Comparisons. The Rönnlund et al[51] study is reported in both sub-groupings b and c because they have measures within their study that are applicable to both groups. Of note is that two studies[36,51] sampled from the same longitudinal cohort study (Betula Prospective Cohort Study) so there is the potential for overlap among the participants. However, while there is one cognitive self-report item that is used in both studies, one of the studies[36] has one additional self-report measure that is not used in the other study[51] and the other study has two additional self-report measures that aren't overlapping.

Memory Decline vs. Current Memory Performance.: Only one study examined memory decline compared to memory problems.[52] The outcome measured in the study was AD.[52] Self-reported memory decline was predictive of AD.[52] Self-reported memory problems also predicted risk for AD. However, self-reported memory problems were associated with almost twice the risk for AD (OR 3.00 CI [1.07–5.37]) in comparison to self-reported memory decline (OR 1.68 CI [1.34–2.10]).

Memory Decline vs. Peer Perceptions.: Rönnlund et al[51] examined the role of self-reported memory decline and peer perceptions of their memory problems in predicting cognitive decline. The outcomes were dementia and AD. Analyses were done with a full sample and a sample without "near onset dementia" as described in the previous section. The near onset dementia analyses are displayed in Table 2.

In the analysis with the full sample both self-reported memory decline and peer perceptions of their memory problems were predictive of dementia and AD.[51] Self-reported memory decline had similar risks for dementia (worse HR 1.48 CI [1.19–1.85]; much worse HR 1.66 CI [1.06–2.60]) and AD (worse HR 1.51 CI [1.12–2.03]; much worse HR 1.94 CI [1.09–3.44]) regardless of whether the self-reported memory decline was indicated as being worse or much worse. Peer perceptions of their memory problems also had similar risks for dementia (rarely HR 1.38 CI [1.05–1.80]; occasionally HR 1.50 CI [1.15–1.96]) and AD (rarely HR 1.56 CI [1.08–2.23]; occasionally HR 1.91 CI [1.34–2.72]) in those who indicated peer perceptions of their memory problems as being rarely or occasionally. A much greater risk for dementia (HR 4.04 CI [2.54–6.45]) and AD (HR 5.92 CI [3.17–11.07]) was found in those with peer perceptions of their memory problems who indicated that this was often or usually.

Memory Decline vs. Peer Comparisons.: Rönnlund et al[51] examined self-reported memory decline with self-reported memory problems in comparison with peers.. The outcomes were dementia and AD. As reported earlier, for the full sample, self-reported memory decline in the Rönnlund et al[51] study was associated with risk for dementia (worse HR 1.48 CI [1.19–1.85]; much worse HR 1.66 CI [1.06–2.60]) and AD (worse HR 1.51 CI [1.12–2.03]; much worse HR 1.94 CI [1.09–3.44]). Participants who reported their memory as worse or much worse than their peers, had an increased risk for both dementia (HR 1.92 CI [0.86–1.40]) and AD (HR 2.54 CI [1.72–3.74]). The results for the participants who did not have near onset dementia are displayed in Table 2.

Depressive Symptoms

Most of the studies included depressive symptoms as a covariate and adjusted for this variable in their full models. Supplemental Table 2 provides an examination of depressive symptoms by study as they relate to the relevant results of the current systematic review.

Discussion

The purpose of this systematic review was to determine whether certain characteristics of cognitive self-report measures better predict the development of cognitive decline when measures are directly compared within the same study. Therefore, we examined studies that used at least two different cognitive self-report measures as simultaneous predictors of cognitive decline over time. Nineteen studies were identified for inclusion in the review. We identified three major categories of comparisons in the extant literature: Reports of Decline, Reports of Current Cognitive Performance, and Reports of Decline vs. Current Cognitive Performance. Further, several aspects of measurement types within such comparisons may be particularly important for cognitive decline risk: cognitive domain affected (i.e., global cognition, memory, executive function), worry related to the decline/performance, impact on daily function, peer perceptions, and peer comparisons. Across studies, risk of bias was low to moderate, indicating that there was adequate reporting and the studies were of moderate to high quality. Only a few of the studies had a high risk of bias on at least one QUIPS domain, most of which related to attrition, indicating that these data were either not collected or were not reported.

Self-reported memory decline with worry was found to have a higher likelihood of dementia and AD than self-reported memory decline without worry. This suggests that worry may be more indicative of severity of the underlying self-reported memory decline. Indeed, people often have an increased awareness of memory problems in the absence of objectively identified memory decline very early in the AD process,[53] which could contribute to increased worry. Wolfsgruber et al[22] also found that having *consistent* worries conveyed a greater risk of AD when compared to those with consistent self-reported memory decline but who were not consistently worried about the decline at the follow-up points. This finding further confirms that reports of ongoing worries related to perceived memory problems may be a critical aspect of assessment to better identify those who are at higher risk for cognitive decline.[54] Additionally, having worries related to cognition may increase feelings of anxiety, which is a risk factor for cognitive impairment.[55]

In contrast to the studies that examined self-reported memory decline and worry, van Harten et al[34] found the composite measure of self-reported global cognitive decline to be more predictive of cognitive decline in comparison to the measure of worry related to the decline. The composite cognitive self-report measure in the van Harten et al[34] study measured both memory decline and non-memory cognitive decline, the heterogeneity of which may have contributed to this discrepancy.[18] Furthermore, van Harten et al[34] used MCI as an outcome instead of AD or dementia. This difference may be because not all who have MCI go on to develop dementia/AD and those with MCI often revert to normal cognition[56] as found in a recent study where only 12% of those with MCI progressed to dementia over a five-year period.[57]

While not a finding related to measure type, through our narrative synthesis, we also determined that composite measures (i.e., more than one item within measure) of memory self-report and cognitive self-report were inconsistently associated with risk for cognitive decline. In fact, only 46% (6/13) of the composite measures used in the studies included in this systematic review were significantly associated with the outcomes. In one case where the composite measure was predictive of AD, the single-item measure was associated with almost twice the risk of the composite.[52] Many of the items within the composite measures in this systematic review assessed different types of memory and cognition. The lack of significant results may be due to heterogeneity of the items in that different domains of self-reported cognition were assessed within a composite measure. Perhaps categorizing participants by severity of self-reported memory/cognitive problems for analysis may be helpful in parsing out those most of at risk for decline when using composite measures of cognitive self-report. For example, Brodaty et al[47] only categorized by severity for one of their composite measures and only those in the severe category were at risk for dementia. The composite measure that was not analyzed by level of severity of self-reported decline did not have significant results.[47] Categorizing those within certain cutoffs may help to see who is at most risk. This provides support for the need of consistent cut-offs or continuous scales rather than just dichotomous response options (or dichotomizing in analyses). Those most at risk for decline may better be captured by appropriately determining the cut-off point rather than lumping everyone with varying degrees of self-reported cognitive problems together.

The studies that used a measure of self-reports of peer perceptions (i.e., how others perceive their memory) found that this item was associated with the greatest risk for dementia or AD in comparison to the other items within their studies, including self-perception of memory or cognitive problems or decline.[36,50,51] Comments or concerns about memory made to an older adult by friends or family may be a good indication of future cognitive problems. There is some evidence that suggests informant reports of memory problems may be more indicative of risk for cognitive decline than self-reports.[58–60] For example, in a longitudinal cohort study of aging, Rabin et al[59] found that both self- and informant-reports of memory problems were associated with AD; however, when analyzed together in the final model, self-reports were no longer associated with AD risk and informant-reports were associated with AD risk. This is consistent with the Rönnlund et al[36] finding of the self-report measure not being predictive of dementia and AD, while the peer perceptions memory problems item was associated with risk for these outcomes.

Rabin et al[18] recommends the use of more specific items of cognitive self-report over global measures because specific items tap into an older adult's actual experience (i.e., they can relate to it) while global items may make them think more broadly such as things that affect older adults in general (i.e., expectation that memory gets worse with age). Two types of specific items used in the studies for this systematic review were peer comparison of memory problems or decline[49,51] and memory problems or decline that affect daily function.[21,30] The peer comparison outcomes were mixed. Abner et al[49] found that endorsement of the peer comparison item had three times the risk for dementia compared to the item measuring self-reported memory problems "*Have you noticed any changes in your memory?*" Rönnlund et al[51] determined that the peer comparison item was slightly more predictive than the item measuring self-reported memory decline but not the peer perceptions of memory problems item. However, the groupings for analysis between the peer comparison and self-reported memory decline item were inconsistent. The peer comparison item combined the "worse" and "much worse" response into one category while the self-reported memory decline item groupings had the "worse" and "much worse" responses analyzed in separate categories.

In the current literature, items of peer comparison have been associated with memory performance (i.e., objective measures).[61] Tandetnik et al[61] examined the association of different types of cognitive self-report items on objective memory performance and found that only the peer comparison item was associated with memory performance in the in the final model. For the self-reported memory affecting daily function items the risk of cognitive decline was not definitive. In our review, Chary et al[30] determined self-reported memory problems that affect daily function to be slightly more predictive of dementia when compared to the other measures of self-reported memory problems in their sample using a ten-year window. However, in the three-year window sample, this association did not hold true. Sargent-Cox et al[21] found that the item related to memory decline affecting daily function was predictive of MCI only. People with self-reported cognitive problems who also perceive that these problems are affecting their daily functioning may be at a greater risk for cognitive decline. Indeed, impairment in activities of daily living is a requirement for the diagnosis of AD so people who perceive this dysfunction may be foreshadowing their future risk. In a recent study, Roehr et al[62] found that older adults with subjective cognitive decline (SCD) and impairment in independent activities of daily living (IADLs) was associated with three times the risk of AD in comparison to those without impairment in IADLs. While the instrument used to measure IADLs (the Lawton and Brody IADL scale)[63] was not entirely comprised of items related to IADL impairment in the context of SCD, many of them are difficult to independently perform for those with cognitive decline.

The heterogeneity of the cognitive self-report measures made synthesizing the data challenging and the groupings and subgroupings of type of cognitive self-report items rather small. Further, a meta-analysis was unable to be conducted due to this heterogeneity. Item heterogeneity is a common problem encountered when examining self-reported cognition[18] and has been a point of confusion for study participants when responding to cognitive self-report measures.[64] Often, there was incongruence between the definition and operationalization of the cognitive self-report measures. For instance, an item measuring self-reported memory decline was referred to as measuring self-reported cognitive decline

in the study.[29] Further complicating the issue is that some composite measures labeled as memory measures assessed both self-reported memory and other aspects of self-reported cognition (i.e. the MFQ). Moreover, cognitive self-report items are often too vague and may need further clarification[64] for respondents, adding bias to the responses. Furthermore, the terms used in cognitive self-report items may not be the most appropriate for determining those most at risk. For example, it has been suggested to use a term such as “worry” about memory rather than “complaints” to capture those most at risk for cognitive decline.[65]

Given that depressive symptoms have been found to mediate the relationship between subjective cognition and cognitive decline[12,15] we examined whether the studies used depressive symptoms as a covariate. Most of the studies adjusted their analyses for depressive symptoms, in line with the evidence supporting the common overlap of these symptoms with self-reported cognitive problems.[12,15] Six studies did not control for depressive symptoms; however, two of those did not include people with depression in their sample. Five of the studies included depressive symptoms as a predictor of cognitive decline with only one[29] finding a positive association.

This review does have limitations. There is a risk for language bias as eligible studies were limited to English and publication bias because only peer-reviewed studies were included. Another limitation was due to the small groupings of cognitive self-report types within the narrative synthesis; there is a need for caution when making conclusions based upon the results. One reason for the small grouping is, due to the purpose of our review, the studies were limited to those that had at least two cognitive self-report measures. The heterogeneity of the cognitive self-report items then contributed to the small groupings. This heterogeneity can also prove problematic when synthesizing across studies.[66] Additionally, differences in types of outcome (i.e., AD, MCI) may have made it more difficult when comparing whether certain types of cognitive self-report measures were more predictive of the outcomes across studies. A final limitation was that many of the studies sampled from the same longitudinal dataset which may cause some overlap among the findings.

This review also has notable strengths. We used a rigorous process to select, review, and evaluate studies. The QUIPS evaluation tool was tailored toward our specific review and then adjusted as needed based on IRR results. An additional strength is the focus on studies comparing the two measures within a single study design; this reduces the influence of between-study heterogeneity which was shown to be high by Mitchell et al.[10] Therefore, we addressed a previous gap with this approach and were able to draw conclusions. Furthermore, although this review did not include studies without the direct comparison, this does give us important information about the types of items to examine more thoroughly.

This systematic review highlights the role of certain cognitive self-report measures in determining those most at risk for future cognitive decline when measures are directly compared within the same study. We chose to compare measures within the same studies as a method to avoid introducing between-study heterogeneity when comparing items on cognitive outcomes across studies which has been a limitation of previous reviews. Ultimately, the most effective measure could be a single item or one composite instrument. Self-reported memory decline with worry was consistently more predictive of AD and

dementia than self-reported memory decline alone. When evaluating self-reported cognition in older adults, including an item that measures worry would help to identify those most at risk. None of our studies included a memory clinic sample which would likely be mostly comprised of participants with worry related to the decline. Future studies should consider comparing cognitive decline risk in those who are worried about their decline in community-based samples with memory clinic- based samples to determine differences between the two groups. Also, when examining worry related to self-reported memory decline it would be important to include other factors that may contribute such as affective symptoms and personality traits (i.e., depressive symptoms or neuroticism as covariates). Previous studies have linked neuroticism[67] and affective symptoms[68] with a greater risk for developing cognitive decline. While often controlled for in the analyses that were assessed in this systematic review, only five studies (three of those from AgeCoDe) used depressive symptoms as predictors of cognitive decline and neuroticism was not assessed at all. Another possible limitation is that most of the studies in our review were from 2015 or later. While we may have missed some relevant studies, we did a rigorous search from database inception to help mitigate this possible source of bias. Furthermore, the importance of measuring self-reported cognition is fairly new with the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines for AD[69] identifying the potential importance of measuring subjective cognition (especially longitudinally) in the detection of future AD in 2011 and the subsequent creation of the Subjective Cognitive Decline Initiative (SCD-I) Working Group in 2012. Thus, this may be an explanation for why articles focusing on these measures started to increase in 2015 and later. Finally, while the risk of bias across studies was generally low, one area that was consistently high was inadequate or lack of reporting relating to participant attrition. Better reporting is needed to minimize this issue in future work.

Older adults who reported peer perceptions of their memory issues had a greater risk of future decline in cognition. Even though what we examined were not informant reports, this finding speaks to the utility of using informant reports for determining those older adults most at risk for cognitive decline.[59] Therefore, it may be important to include informant reports of participants' memory decline in addition to cognitive self-reports in future investigations. Furthermore, Jessen et al[54] recommend including informant confirmation of cognitive decline in participants who are classified as SCD plus (i.e. having factors related to greater risk for preclinical AD) if possible. Finally, the small groupings of cognitive self-report measure types made it difficult to compare across studies or make definitive conclusions. This points to the need to expand an examination of the role of types cognitive self-report measures are best used to predict cognitive decline from within studies to across studies.

Conclusions

This review was an important step in examining the longitudinal evidence related to the utility of certain characteristics of cognitive self-report measures for differentially predicting the risk of developing cognitive decline. Across the studies investigated in this review, worry related to self-reported decline and reports of peer perceptions of memory problems were associated with the greatest risk for future cognitive decline. The next

step for future investigations is to include items that measure these specific aspects of self-reported cognition. This could be accomplished through multiple items or a single composite measure. Such evidence would support early identification of older adults at risk for cognitive decline.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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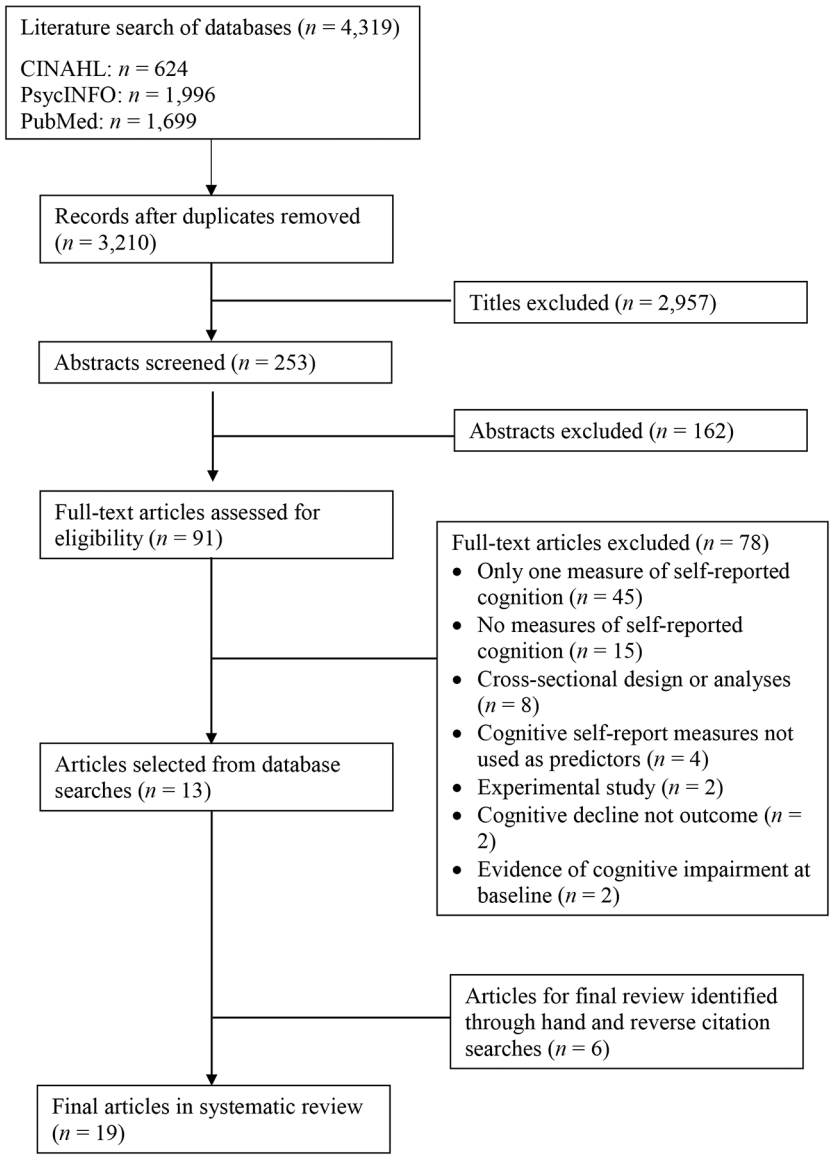

Figure 1.
Flow diagram of the article selection process.

Table 1

Final search terms used for systematic review separated by component

Exposure Terms	Predictive Utility Terms	Outcome Terms
Cognitive complaint*	Develop	Alzheimer*
Cognitive concern*	Development	Cognitive decline
Cognitive self-report	Develops	Dementia
Memory complaint*	Predict	Mild cognitive impairment
Memory concern*	Prediction	Objective cognition
Memory difficult*	Predictive	Objective cognitive impairment
Memory disorder*	Predicts	
Memory lapse*	Risk	
Memory self-report		
Perceived forgetfulness		
Self-reported cognition		
Self-reported cognitive complaint*		
Self-reported cognitive concern*		
Self-reported cognitive difficult*		
Self-reported cognitive failure*		
Self-reported cognitive function*		
Self-reported cognitive impairment		
Self reported cognitive impairment		
Self-reported cognitive problem*		
Self-reported memory		
Self-reported memory complaint		
Self-reported memory failure*		
Self-reported memory lapse*		
Self-reported memory problem*		
Self reported memory problem*		
Subjective assessment of memory		
Subjective cognitive concern*		
Subjective cognitive decline		
Subjective cognitive function		
Subjective cognitive impairment		
Subjective forgetfulness		
Subjective memory		
Subjective memory belief*		
Subjective memory complaint*		
Subjective memory impairment		
Subjective memory problem*		

Note. Each term was place within closed quotations.

Table 2

Characteristics of the included studies

References	Study design	Sample Mean age (SD) N (Gender)	Cognitive self-report measures	Outcome(s) examined	Relevant results[a] Covariates
Reports of Decline					
Worry vs. No Worry in Global Cognitive Decline					
van Harten et al.[34]	Prospective cohort Median follow-up time 3.9 (IQR 2.6–4.2) years	Community-based (United States) Median age 79.0 (IQR 75.3–83.6) years *N* = 1,166 (50.2% women)	ECog 12-item version (measures self-reported cognitive decline) Are you concerned you have a memory or thinking problem?	MCI	ECog score indicating self-reported cognitive decline was associated with risk for MCI (HR 2.17 CI [1.51–3.13]). Worry related to the decline was also associated with risk for MCI (HR 1.79 CI [1.24–2.58]). Adjusted for depressive symptoms, anxiety, gender, objective memory performance, physical comorbidities, and *ApoE4* carrier status.
Worry vs. No Worry in Memory Decline					
Heser et al.[29]	Prospective cohort Nine follow-up waves a (every 1.5 years until follow-up 7, then every ten months) after baseline	Community-based (Germany) 79.63 (3.5) years *N* = 2,422 (64.2% women)	Do you feel like your memory is becoming worse? *Yes, but this does not worry me.* *Yes, this worries me.*	Dementia AD	SMD without worry was associated with dementia (HR 1.48 CI [1.15–1.91]) and AD (HR 1.63 CI [1.22–2.19]). SMD with worry was associated with dementia (HR 2.48 CI [1.87–3.29]) and AD (HR 2.44 CI [1.73–3.44]). Gender stratified analysis SMD without worry was associated with dementia (HR 1.49 CI [1.16–1.92]) and AD (HR 1.65 CI [1.23–2.21]) in women. SMD with worry was associated with dementia (HR 2.53 CI [1.90–3.36]) and AD (HR 2.43 CI [1.72–3.44]) in women. SMD without worry was not associated with dementia or AD in men. SMD with worry was not associated with dementia but was associated with AD (HR 1.89 CI [1.04–3.42]) in men. Adjusted for depressive symptoms, age, education, and MMSE score.
Jessen et al.[20]	Prospective cohort Two follow-up waves after baseline (1.5 and 3 years).	Community-based (Germany) 79.4 (3.4) years *N* = 2,415 (66.7% women)	Do you feel like your memory is becoming worse? *Yes, but this does not worry me.* *Yes, this worries me.*	Dementia AD	SMD without worry was associated with dementia (HR 1.83 CI [1.12–2.99]) and AD (HR 3.04 CI [1.36–6.81]) risk. SMD with worry was also associated with dementia (HR 3.53 CI [2.07–6.03]) and AD (HR 6.54 CI [2.82–15.20]) risk. Adjusted for depressive symptoms, *ApoE4* genotype, age, gender, education, and baseline SISCO score.
Jessen et al.[45]	Prospective cohort Three follow-up waves (one every 18 months) after baseline.	Community-based (Germany) Participants were age ≥ 75 years *N* = 1,526 (65.1% women)	Do you feel like your memory is becoming worse? *Yes, but this does not worry me.* *Yes, this worries me.*	AD	SMD without worry was associated with AD risk (HR 1.88 CI [1.05–3.35]). SMD with worry was associated with AD risk (HR 3.66 CI [2.00–6.70]). Adjusted for age, IADL score, verbal fluency score, delayed recall score, and MMSE score.
Koppara et al.[46]	Prospective cohort Five follow-up waves (one every 18 months) after baseline.	Community-based (Germany) 79.58 (3.50) years *N* = 2,330 (63.9% women)	Do you feel like your memory is becoming worse? *Yes, but this does not worry me.* *Yes, this worries me.*	Dementia AD	SMD without worry was associated with dementia (HR 1.41 CI [1.07–1.85]) and AD (HR 1.64 CI [1.16–2.32]) risk. SMD without worry was also associated with dementia (HR

References	Study design	Sample Mean age (SD) N (Gender)	Cognitive self-report measures	Outcome(s) examined	Relevant results[a] Covariates
					2.63 CI [1.95–3.55]) and AD (HR 2.89 CI [1.96–4.26]) risk. Adjusted for age, gender, education, and depressive symptoms.
Snitz et al.[32]	Prospective cohort Mean follow-up time 3.09 (SD 2.95) years	Community-based (United States) 77.27 (7.30) years *N* = 1,181 (61.2% women)	16-item composite measure of self-reported memory decline Are you worried about these/this problem(s) with remembering?	MCI	Self-reported memory decline was not associated with risk for MCI. Self-reported memory decline with worry was associated with risk for MCI (HR 1.66 CI [1.24–2.24]). Adjusted for age, gender, and education.
Wolfsgruber et al.[22]	Prospective cohort Five follow-up waves (one every 18 months) after baseline.	Community-based (Germany) 81.1 (3.41) years Baseline (36.9% men) to follow-up one *N* = 1,990 Follow-up one to follow-up two *N* = 1,754 Participants categorized by: Inconsistent SMD (report SMD only at baseline *or* only at follow-up one) Consistent SMD without/ with inconsistent worries (SMD at baseline and follow-up one but no or inconsistent worries) Consistent SMD with worries (SMD with worries at baseline and follow-up one)	Do you feel like your memory is becoming worse? *Yes, but this does not worry me.* *Yes, this worries me.*	AD	Baseline to follow-up one: Inconsistent SMD was not associated with AD risk. Consistent SMD without/with inconsistent worries (HR 2.03 CI [1.30–3.15]) and consistent SMD with worries (HR 3.72 CI [2.13–6.50]) were both predictors of AD risk. Follow-up one to follow-up two: Inconsistent SMD was not a risk for AD. Consistent SMD without/with inconsistent worries (HR 2.95 CI [1.31–3.66]) and consistent SMD with worries (HR 3.22 CI [1.70–6.10]) were both predictors of AD. Adjusted for age, education, gender, *ApoE4* genotype, and depressive symptoms.
Memory Decline vs. Global Cognitive Decline					
Brodaty et al.[47]	Prospective cohort Followed over six years	Community-based (Australia) 78.1 (4.6) years *N* = 618 (43.9% men)	12-item composite measure of self-reported cognitive decline [participants were categorized as mild or severe self-reported cognitive decline based on cut-off score] MAC-Q (six-items; composite measure of self-reported memory decline)	Dementia	Self-reported cognitive decline was associated with risk for dementia in the participants whose cut-off score put them in the severe category (OR 2.2 CI [0.9–5.0]). Self-reported memory decline was not associated with risk for dementia. Did not report adjusting for covariates
Jorm et al.[35]	Prospective cohort 3.5-year follow-up (wave 1 to wave 2)	Community-based (Australia) Age ≥ 70 years at baseline *N* = 507 (Gender not reported)	Four-item composite measure of self-reported cognitive decline Four-item composite measure of self-reported memory decline	Dementia Cognitive decline	Self-reported cognitive decline and self-reported memory decline were not associated with risk for dementia or cognitive decline. Adjusted for depressive symptoms and anxiety.
Slavin et al.[31]	Prospective cohort 4-year follow-up (baseline to wave 2)	Community-based (Australia) 78.0 (4.6) years *N* = 620 (54.7% women)	Nine-item composite measure of self-reported cognitive decline 15-item composite measure of self-reported memory decline	MCI Dementia	Neither self-reported cognitive decline nor self-reported memory decline predicted risk of MCI or dementia. Adjusted for age, gender, education, and the openness scale of the NEO-FFI.
Memory Decline vs. Executive Function Decline					

References	Study design	Sample Mean age (SD) N (Gender)	Cognitive self-report measures	Outcome(s) examined	Relevant results[a] Covariates
Sacuiu et al.[48]	Prospective cohort Two follow-up waves after baseline (5 years, 9 years). Followed-up for dementia diagnosis until year 12.	Community-based and residential care-based (Sweden) 73.8 (5.2) years (no subjective memory/cognitive decline) 74.9 (5.7) years (subjective memory/cognitive decline) N = 921 (75.7% women)	CPRS – data grouped into memory decline and executive function decline domains. Executive function decline domain contained three subdomains: concentration; making decisions; taking initiative.	Dementia	Self-reported memory decline was associated with risk for dementia (HR 1.9 CI [1.3–2.7]). Executive function decline (with all subdomains) was associated with risk for dementia (HR 1.6 CI [1.2–2.3]). The concentration subdomain was associated with risk for dementia (HR 1.9 CI [1.2–3.1]). The making decisions and taking initiative subdomains were not associated with risk for dementia. Adjusted for age, gender, and depressive symptoms.
Daily Function Affected vs. Not Affected in Memory Decline					
Sargent-Cox et al.[21]	Prospective cohort Two follow-up waves after baseline	Community-based (Australia) 62.52 (1.51) years N = 2,082 (49.0% women)	Participants were asked if they could remember things as well as they used to in their earlier life. If they answered yes or depends/sometimes then they were asked whether their memory problem interfered with their daily life.	MCI CDR scale impairment MCD Cognitive decline	Self-reported memory decline was associated with a decreased risk for impairment on the CDR scale [OR 0.22 CI (0.05 – 0.92)]. Self-reported memory decline that affected daily functioning was associated with an increased risk for MCI [OR 3.54 CI (1.19–10.48)] but no other outcomes. Adjusted for age, gender, education, diabetes, hypertension, smoking status, alcohol use, and depressive symptoms.
Reports of Current Cognitive Performance					
Memory vs. Global Cognition					
Sohrabi et al.[33]	Prospective cohort Two follow-up waves (at least 12 months apart) after baseline over a period of three years	Community-based (Australia) 64.59 (7.83) years *N* = 209 (67.9% women)	MFQ (composite measure of self-reported cognitive problems) Do you have any difficulty with your memory?	Cognitive decline	Neither self-reported cognitive problems nor self-reported memory decline were associated with risk for cognitive decline. Adjusted for depressive symptoms.
Memory vs. Peer Comparisons					
Abner et al.[49]	RCT that transitioned to a prospective cohort study Mean follow-up time 5.7 (SD 2.8) years	Community-based (Canada, United States [includes Puerto Rico]) 67.5 (5.3) years *N* = 7,547 men	Have you noticed any changes in your memory? Do you feel that you have more problems with your memory than most people?	Dementia	Self-reported memory decline (HR 1.87 CI [1.47–2.38]) and peer comparison of self-reported memory decline (HR 6.01 CI [3.68–9.74]) were both predictive of dementia risk. Adjusted for age, education, race, ApoE4 genotype, history of head injury, diabetes, hypertension, and sleep apnea. <u>Subanalysis with Black participants</u> Self-reported memory decline at baseline: Self-reported memory decline (HR 2.46 CI [1.15–5.27]) and peer comparison of self-reported memory decline (HR 35.7 CI [12.99–100]) were associated with risk for dementia. No self-reported memory decline at baseline: Self-reported memory decline (HR 1.81 CI [1.41–2.33]) and peer comparison of self-reported memory decline (HR 4.5 CI [2.55–7.94]) were associated with risk for dementia.
Memory vs. Peer Perceptions					
Ronnlund et al.[36]	Prospective cohort Followed for 10–12 years after baseline	Community-based (Sweden) 71.5 (8.8) years *N* = 1,547 (unable	PRMQ (composite measure of self-reported memory problems) Does anyone close to you	Dementia AD	<u>Full sample</u> PRMQ was associated with risk for dementia (HR 1.18 CI [1.04–1.34]) and AD (HR 1.22 CI [1.04–1.43]) but not when

References	Study design	Sample Mean age (SD) N (Gender)	Cognitive self-report measures	Outcome(s) examined	Relevant results[a] Covariates
		to determine gender distribution of reported sample) Used a full sample and five+ years to dementia diagnosis sample (participants had a 5+ year survival time to dementia diagnosis)	(family, friends) think that you have a poor memory? (grouped into never, rarely, sometimes and often for analysis)		peer perceptions of memory was added to the model. Self-reported memory problems by others predicted both dementia (Rarely HR 1.65 CI [1.11–2.45]; Sometimes HR 2.04 CI [1.38–3.00]; Often HR 2.98 CI [1.60–5.54]) and AD (Rarely HR 1.78 CI [1.07–2.97]; Sometimes HR 2.06 CI [1.24–3.42]; Often HR 3.86 CI [1.79–8.35]). Five+ years to dementia diagnosis sample PRMQ was associated with risk for dementia only (HR1.23 CI [1.02–1.49]) but not AD. When peer perceptions of memory problems was added to the model, PRMQ was no longer predictive of dementia. Self-reported memory problems by others predicted both dementia (Rarely NS; Sometimes HR 1.76 CI [1.01–3.05]; Often HR 2.93 CI [1.15–7.47]) and AD (Rarely NS; Sometimes HR 2.24 CI [1.02–4.94]; Often HR 4.89 CI [1.36–17.60]). Adjusted for age, gender, marital status, education, and depressive symptoms.
Global Cognition vs. Peer Perceptions					
Tomata et al.[50]	Prospective cohort Follow-up period over 5.7 years	Community-based (Japan) 73.8 (5.9) years *N* = 13,974 (55.1% women)	Do you find yourself no knowing today's date? Do you make a call by looking up phone numbers? Do your family and friends point out your memory loss?	Dementia	Not knowing the current date (HR 2.11 CI [1.88–2.37]), having to look up phone numbers (HR 2.15 CI [1.84–2.51]), and peer perceptions of memory problems (HR 2.32 CI [2.06–2.60]) were all associated with risk for dementia. Endorsing one (HR 1.89 CI [1.65–2.15]), two (HR 3.01 CI [2.59–3.50]), or all three (HR 6.20 CI [4.87–7.90]) of the self-reported items was associated with increased risk for dementia. Adjusted for age and gender.
Daily Function Affected vs. Not Affected in Current Memory Performance					
Chary et al.[30]	Prospective cohort study Twenty-year timeline (for this paper, analyzed in three- or ten-year windows)	Community-based (France) 74.7 (6.4) years *N* = 2,882 (unable to determine gender distribution of reported sample)	Do you frequently have difficulties in retaining or remembering new simple information? Do you frequently have difficulties in retrieving or remembering old memories? Do you frequently have difficulties in finding words (naming objects and so forth)? Do you frequently have forgetfulness in activities of daily living (shopping list, in using household items, and so forth)?	Dementia	Three-year window Low education level: Neither self-reported memory problems nor self-reported memory problems that affect daily function were predictive of dementia. High education level: Difficulty in retaining or remembering new information (OR 2.5 CI (1.74–3.59]), difficulty in retrieving or remembering old memories (OR 1.32 CI [0.51–3.41]), difficulty finding words (OR 1.46 CI [1.02–2.09]) and self-reported memory problems that affected daily function (OR 1.35 CI [0.94–1.94]) were all predictive of dementia. Ten-year window Low education level: Neither self-reported memory problems nor self-reported memory problems that affect daily function were predictive of dementia. High education level: Difficulty in retaining or remembering new information (OR 1.47 CI [1.12–1.93]), difficulty finding words (OR 1.18 CI [0.91–1.53]), and self-reported memory problems that affected daily function (OR 1.47 CI [1.13–1.91]), were all risks for developing dementia. Difficulty in retrieving or remembering old memories was not a risk for developing dementia. Adjusted for age, IADLs, IST, BVRT, DSST, and MMSE

References	Study design	Sample Mean age (SD) N (Gender)	Cognitive self-report measures	Outcome(s) examined	Relevant results[a] Covariates
Reports of Decline vs. Current Cognitive Performance					
Memory Decline vs. Current Memory Performance					
Jungwirth et al.[52]	Prospective cohort Two follow-up waves (every 2.5 years) after baseline	Community-based (Austria) 75.8 (0.04) years *N* = 487 (65.0% women)	Four-item composite measure of self-reported memory decline. Do you have any complaints about your memory?	AD	Self-reported memory decline was associated with risk for AD (OR 1.68 CI [1.34–2.10]). Self-reported memory problems were also associated with risk for AD (OR 3.00 CI [1.07–5.37]).
Memory Decline vs. Peer Perceptions					
Ronnlund et al.[51]	Prospective cohort Varying waves were baseline depending on sample. Follow-up time ranged from 5–17 years.	Community-based (Sweden) Age ≥ 60 years at baseline *N* = 2,043 (Unable to determine gender distribution of reported sample) Used a full sample and a five+ years to dementia diagnosis sample (participants had a 5+ year survival time to dementia diagnosis)	How do you perceive your memory today compared with five years ago? (grouped into better/same [reference], worse, much worse) Does anyone close to you (family, friends) think that you have a poor memory? (grouped into never [reference], rarely, occasionally and often/usually for analysis)	Dementia AD	Full sample Self-reported memory decline predicted both dementia (Worse HR 1.48 CI [1.19–1.85]; Much worse HR 1.66 CI [1.06–2.60]) and AD (Worse HR 1.51 CI [1.12–2.03]; Much worse HR 1.94 CI [1.09–3.44]) risk. Peer perceptions of memory problems predicted both dementia (Rarely HR 1.38 CI [1.05–1.80]; Occasionally HR 1.50 CI [1.15–1.96]; Often/Usually HR 4.04 CI [2.54–6.45]) and AD (Rarely HR 1.56 CI [1.08–2.23]; Occasionally HR 1.91 CI [1.34–2.72]; Often/Usually HR 5.92 CI [3.17–11.07]) risk. Five+ years to dementia diagnosis sample (only analyzed for dementia prediction and did not report all response groupings) Self-reported memory decline with a “worse” response predicted dementia risk (HR 1.33 CI [1.02–1.73]). Peer perceptions of memory problems with response “often/usually” was associated with dementia risk (HR 3.62 CI [2.01–6.54]). Adjusted for age, gender, education, cardiovascular risk factors, depressive symptoms, and episodic memory score.
Memory Decline vs. Peer Comparisons					
Ronnlund et al.[51]	Prospective cohort Varying waves were baseline depending on sample. Follow-up time ranged from 5–17 years.	Community-based (Sweden) Age ≥ 60 years at baseline *N* = 2,043 (Unable to determine gender distribution of reported sample) Used a full sample and a five+ years to dementia diagnosis sample (participants had a 5+ year survival time to dementia diagnosis)	How do you perceive your memory today compared with five years ago? (grouped into better/same [reference], worse, much worse) How do you perceive your memory in comparison with that of others of your age? (grouped into better, same [reference], and worse/much worse)	Dementia AD	Full sample Self-reported memory decline in comparison to five years ago predicted both dementia (Worse HR 1.48 CI [1.19–1.85]; Much worse HR 1.66 CI [1.06–2.60]) and AD (Worse HR 1.51 CI [1.12–2.03]; Much worse HR 1.94 CI [1.09–3.44]) risk. Peer comparison of self-reported memory decline with a response of “worse/much worse” predicted both dementia (HR 1.92 CI [0.86–1.40]) and AD (HR 2.54 CI [1.72–3.74]) risk. Five+ years to dementia diagnosis sample (only analyzed for dementia prediction and did not report all response groupings) Self-reported memory decline in comparison to five years ago with a “worse” response predicted dementia risk (HR 1.33 CI [1.02–1.73]). Peer comparison of self-reported memory decline with a response of “worse/much worse” predicted dementia risk (HR 2.03 CI [1.38–2.98]). Adjusted for age, gender, education, cardiovascular risk factors, depressive symptoms, and episodic memory score.

Note. AD = Alzheimer's disease; BVRT = Benton Visual Retention Test; CDR = Clinical Dementia Rating; CI = 95% confidence interval; CPRS = Comprehensive Psychopathological Rating Scale; DSST = Digit Symbol Substitution Test; ECog = Everyday Cognition Scale; HR = hazard ratio; IADL = Independent Activities of Daily Living; IQR = interquartile range; IST = Isaacs Set Test; MAC-Q = Memory Assessment Clinic Questionnaire; MCD = mild cognitive disorder; MCI = mild cognitive impairment; MFQ = Memory Functioning Questionnaire; MMSE = Mini-Mental State Examination; NEO-FFI = NEO – Five Factor Inventory; NS = not significant; OR = odds ratio; PRMQ = Prospective and Retrospective Memory Questionnaire; RCT = randomized controlled trial; SISCO = Structured Interview for Diagnosis of Dementia of Alzheimer Type, Multi-infarct Dementia and Dementia of Other Etiology According to *DSM-IV* and *ICD-10* Cognitive score; SD = standard deviation; SMD = self-reported memory decline

[a]All results are reported from the final adjusted model unless otherwise indicated

[b]Cognitive self-report items were measured in separate analyses

[c]Assigned to two different categories

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Table 3

QUIPS ratings for all studies included in the systematic review

Article	Study Participation	Study Attrition	Prognostic Factor Measurement	Outcome Measurement	Study Covariates	Statistical Analysis and Reporting
Abner et al.[49]	low	moderate	low	low	moderate	low
Brodaty et al.[47]	low	low	low	low	moderate	low
Chary et al.[30]	low	moderate	moderate	low	low	low
Heser et al.[29]	low	high	moderate	low	low	low
Jessen et al.[20]	low	moderate	low	low	low	low
Jessen et al.[45]	low	moderate	moderate	low	moderate	low
Jorm et al.[35]	moderate	low	moderate	low	high	moderate
Jungwirth et al.[52]	low	low	moderate	low	moderate	low
Koppara et al.[46]	low	moderate	low	low	low	low
Ronnlund et al.[36]	low	moderate	low	low	low	low
Ronnlund et al.[51]	low	moderate	moderate	low	low	low
Sacuiu et al.[48]	low	moderate	low	low	low	low
Sargent-Cox et al.[21]	low	high	moderate	low	low	low
Slavin et al.[31]	low	high	low	low	low	low
Snitz et al.[32]	moderate	high	moderate	low	moderate	low
Sohrabi et al.[33]	low	high	low	low	low	low
Tomata et al.[50]	low	low	low	moderate	low	low
van Harten et al.[34]	low	high	low	low	low	low
Wolfsgruber et al.[22]	low	low	low	low	low	low

Table 4

Cognitive self-report measures by studies and thematic groupings

Measures	Measure Characteristics	Number of Items	Studies
Reports of Decline			
12-item Everyday Cognition Scale[37]	**Scoring:** Scores range from 12 – 48 with higher scores indicating worse self-reported cognition Includes items that measure multiple domains of cognition (memory, language, visuospatial abilities, and executive functioning) Measures global cognitive decline without worry	12	van Harten et al.[34]
Are you concerned you have a memory or thinking problem?	**Scoring:** yes or no Measures global cognitive decline with worry	1	van Harten et al.[34]
Do you feel like your memory is becoming worse? Yes, but this does not worry me.	**Scoring:** yes or no For a yes response, participants chose between, “yes, but this does not worry me” or “yes, this worries me” Measures memory decline without worry	1	Heser et al.;[29] Jessen et al.;[20] Jessen et al.;[45] Koppara et al.;[46] Wolfsgruber et al.[22]
“Yes, this worries me” response to the item “Do you feel like your memory is becoming worse?”	None Measures memory decline with worry	1	Heser et al.;[29] Jessen et al.;[20] Jessen et al.;[45] Koppara et al.;[46] Wolfsgruber et al.[22]
Composite measure of self-reported memory decline	**Scoring:** Scores range from 0–16 with higher scores indicating worse decline Comprised of items relating to self-appraisal of memory decline Measures memory decline without worry	16	Snitz et al.[32]
Are you worried about these/this problem(s) with remembering?	**Scoring:** yes or no Measures memory decline with worry	1	Snitz et al.[32]
Composite measure of self-reported cognitive decline	**Scoring:** Score range from 12–48 with higher scores indicating greater decline Includes items that measure current cognition in comparison with five years ago Measures global cognitive decline	12	Brodaty et al.[47]
Memory Assessment Clinic Questionnaire[38]	**Scoring:** Scores range from 7–35 with higher scores indicating greater decline Comprised of items that measure self-reported memory decline based on comparisons with either five or ten years in the past Measures memory decline	6	Brodaty et al.[47]
Composite measure of self-reported cognitive decline	**Scoring:** Did not indicate how these were scored but response options were yes or no Measures global cognitive decline	4	Jorm et al.[35]
Composite measure of self-reported memory decline	**Scoring:** Scores range from 0–8 with higher scores indicating greater decline Measures memory decline	4	Jorm et al.[35]
Composite measure of self-reported cognitive decline	**Scoring:** Scores for each item were dichotomized as yes = 1 or no = 0 and higher scores indicated greater decline Measures global cognitive decline	9	Slavin et al.[31]
Composite measure of self-reported memory decline	**Scoring:** Scores for each item were dichotomized as yes = 1 or no = 0 and higher scores indicated greater decline Items were from both the Memory Assessment Clinic Questionnaire[38] and investigator derived Measures memory decline	15	Slavin et al.[31]
Comprehensive Psychopathological Rating Scale – item measuring memory decline[39]	**Scoring:** Scores range from 0–6 with higher scores indicating greater decline Measures memory decline	1	Sacuiu et al.[48]

Measures	Measure Characteristics	Number of Items	Studies
Comprehensive Psychopathological Rating Scale – items measuring executive function decline[39]	**Scoring:** Scores range from 0–18 with higher scores indicating greater decline Measures executive functioning decline	3	Sacuiu et al.[48]
Participants were asked if they could remember things as well as they used to in their earlier life	**Scoring:** no, depends/sometimes, or yes Measures memory decline without daily function affected	1	Sargent-Cox et al.[21]
If they answered yes or depends/sometimes then they were asked whether their memory problem interfered with their daily life.	**Scoring:** yes or no Measures memory decline with daily function affected	1	Sargent-Cox et al.[21]
Reports of Current Cognitive Performance			
Memory Functioning Questionnaire[40]	**Scoring:** Items were scored on a scale from 1–7 with higher scores indicating better global cognition Items measure self-reported memory problems as well as problems related to other non-memory cognitive domains Measures global cognitive performance	64	Sohrabi et al.[33]
Do you have any difficulty with your memory?	**Scoring:** yes or no Item derived from the Cambridge Examination for Mental Disorders of the Elderly – Revised[41] Measures memory performance	1	Sohrabi et al.[33]
Have you noticed any changes in your memory?	**Scoring:** yes or no Measures memory performance	1	Abner et al.[49]
If there was a “yes” response to the above question they were asked, Do you feel that you have more problems with your memory than most people?	**Scoring:** yes or no Measures peer comparisons of memory performance	1	Abner et al.[49]
Prospective and Retrospective Memory Questionnaire[42]	**Scoring:** Scores range from 16–80 with higher scores indicating greater frequency of problems There are two subscales with items measuring prospective and retrospective memory problems Measures memory performance	16	Ronnlund et al.[36]
Does anyone close to you (family, friends) think that you have a poor memory?	**Scoring:** Scores range from 1–5 (never – often) Measures peer perceptions of memory performance	1	Ronnlund et al.[36]
Do you find yourself not knowing today’s date?	**Scoring:** yes or no Measures self-reported cognitive problem	1	Tomata et al.[50]
Do you make a call by looking up phone numbers?	**Scoring:** yes or no Measures self-reported memory problem	1	Tomata et al.[50]
Do your family and friends point out your memory loss?	**Scoring:** yes or no Measures peer perceptions of memory problems	1	Tomata et al.[50]
Do you frequently have difficulties in retaining or remembering new simple information?	**Scoring:** yes or no Measures memory problem	1	Chary et al.[30]
Do you frequently have difficulties in retrieving or remembering old memories?	**Scoring:** yes or no Measures memory problem	1	Chary et al.[30]
Do you frequently have difficulties in finding words (naming objects and so forth)?	**Scoring:** yes or no Measures memory problem	1	Chary et al.[30]
Do you frequently have forgetfulness in activities of daily living (shopping list, in using household items, and so forth)?	**Scoring:** yes or no Measures memory problem affecting daily function	1	Chary et al.[30]
Reports of Decline vs. Current Cognitive Performance			
Composite measure of self-reported memory decline[43]	**Scoring:** Scores ranged from 0–8 with higher scores indicating greater decline Measures memory decline	4	Jungwirth et al.[52]

Measures	Measure Characteristics	Number of Items	Studies
Do you have any complaints about your memory?[44]	**Scoring:** Item scored from 1–4 (no – yes, is a serious problem) with higher scores indicating a worse problem Measures memory problems	1	Jungwirth et al.[52]
How do you perceive your memory today compared with five years ago?	**Scoring:** Item scored 1–5 (much better – much worse) with higher scores indicating worse memory decline Measures memory decline	1	Ronnlund et al.[51]
Does anyone close to you (family, friends) think that you have a poor memory?	**Scoring:** Item scored 1–5 (never – usually) with higher scores indicating worse peer perceptions of memory problems Measures peer perceptions of memory problems	1	Ronnlund et al.[51]
How do you perceive your memory in comparison with that of others your age?	**Scoring:** Item scored 1–5 (much better – much worse) with higher scores indicating worse memory decline Measures memory decline	1	Ronnlund et al.[51]

Note. Only measures related to relevant results to the outcome of the systematic review are included.