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EXPLORING THE RELATIONSHIP BETWEEN PERSONALITY AND SUBJECTIVE
COGNITIVE IMPAIRMENT IN OLDER ADULTS WITHOUT DEMENTIA

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ABSTRACT

Subjective cognitive impairment (SCI) refers to the perception of cognitive impairment that is not detected upon objective testing. SCI in the older adult population may be an indicator of preclinical dementia or may be affected by other factors, such as personality. Currently neuroticism, a personality trait that indicates the extent to which an individual is apt to be anxious, worried, or depressed, has been most frequently associated with SCI. Understanding the relationship between SCI and personality traits would influence how SCI is assessed and managed in the older adult population. The purpose of this systematic review was to understand the relationship between personality (specifically the “big five” traits of neuroticism, extraversion, openness, agreeableness, and conscientiousness) and SCI in older adults without dementia. A comprehensive literature search was conducted using PubMed, Web of Science, and CINAHL databases by searching for personality and twelve key terms for SCI commonly used in the literature. Inclusion criteria were that the articles must be written in English, measure and discuss SCI and a big five personality trait together, and include participants that were older than 50 or had a mean age older than 60. Articles were excluded if they were duplicates of previously identified articles or focused on changes in personality throughout dementia. The year of publication was neither an inclusion nor exclusion criteria because the science on this subject is early. A total of fifteen articles were included in the review.

The evidence was reviewed overall as well as comparisons made based on study design (cross-sectional versus longitudinal), SCI measure, sample size, and sample age ranges. The most notable finding was that a high level of SCI was found to be positively associated with neuroticism. Additionally, just over half of the studies found a negative association between a higher level of extraversion and SCI, a majority of the studies found no relationship between

openness and SCI, a majority of the studies found no relationship between agreeableness and SCI, and half of the studies found a negative relationship between higher conscientiousness and SCI. The results did not differ greatly when comparing the different study designs and characteristics. Clinically, nurses need to be aware of the relationship between neuroticism and personality. Implementing a personality test to recognize neuroticism in individuals could help nurses screen which individuals will be more likely to report SCI and which individuals may not. Future research needs to determine the reason for the relationship between neuroticism and SCI and whether individuals with a high level of neuroticism are better at recognizing their cognitive decline that cannot be measured objectively or more apt to complain about their memory when there is not actual cognitive impairment.

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Chapter 1

Introduction

Subjective cognitive impairment (SCI) is a broad term that is defined as an individual perceiving their cognitive performance to be less than average without any objective cognitive impairment detected upon testing (Jessen et al., 2010). A literature review by Mark and Sitskroon (2013) found that of the studies reviewed, approximately one-third of the older population that is not in institutions reported SCI. Older individuals do not always seek help for SCI; a study found that out of patients aged 65 years or older, 23% reported SCI and only 19% of those patients sought help because of their SCI (Waldorff, Rishoj, & Waldemar, 2008). Researchers have found that individuals with SCI are more likely to develop dementia as they age (Jessen et al., 2010). SCI can be present in adults of any age; however, it is typically of most interest among older adults because the complaints are usually more prevalent as a person ages (Jorm et al., 1994; Pearman & Storandt, 2004). In this literature review, we focus specifically on SCI in the older adult population.

Mild cognitive impairment (MCI) is an intermediate stage of cognitive impairment that often occurs prior to a dementia diagnosis. The National Institute on Aging-Alzheimer's Association has outlined four clinical criteria to diagnose MCI (Albert et al., 2011). However, a clinical judgment must still be made to differentiate it from normal cognition and dementia (Albert et al., 2011). The four clinical criteria to diagnose MCI are first, that there must be a concern regarding the individual's change in cognition (Albert et al., 2011). This first criterion may reflect SCI or may be a concern raised by an informant or clinician (Albert et al., 2011). The last three criteria to diagnose MCI are that the individual must still have independence in their daily life, have impairment in at least one domain of cognition, and not be demented (Albert et

al., 2011). When an individual with SCI progresses to dementia, MCI is often the transitional stage (Jessen et al., 2010).

The most common cause of dementia is Alzheimer's disease (Archer, Newson, & Coulthard, 2015), and the National Institute on Aging-Alzheimer's Association has categorized this disease into three stages so targeted dementia prevention strategies can be offered at each stage (Jessen et al., 2014). The first stage involves no objective impairment in cognition or brain alterations that indicate AD (Jessen et al., 2014). The second stage is MCI with objective impairment of a domain of cognition and biomarker evidence for AD (Jessen et al., 2014). The last stage is the presence of dementia and biomarker evidence that indicates AD (Jessen et al., 2010). Currently, dementia prevention strategies are targeted for the second and third stage (Jessen et al., 2014). However, oftentimes by this stage cognitive impairment has already occurred (Archer, Newson, & Coulthard, 2015; Jessen et al., 2010). With better understanding of SCI, prevention strategies can be targeted earlier, in the first stage, to reduce the level of cognitive impairment that occurs (Jessen et al., 2014).

A further understanding of SCI may be useful in the early detection of MCI and dementia (Glodzik-Sobanska et al., 2007; Mark & Sitskoorn, 2013). Some researchers argue that SCI indicates actual cognitive impairment in some people that cannot yet be detected on diagnostic tests (Stewart et al., 2011). However, at this point SCI is not well defined and is not used effectively to diagnose preclinical Alzheimer's disease (AD) (Jessen et al., 2014). As AD becomes increasingly prevalent, it is imperative to diagnose this disease earlier so treatment can be instituted before permanent cognitive impairment occurs (Mark & Sitskoorn, 2013).

Factors Affecting SCI

It is unclear if SCI is a true indicator of preclinical dementia or if it is affected by other factors. In some cases, the presence of SCI has shown no relationship to actual cognitive performance (Kliegel, Zimprich, & Eschen, 2005). Personality, depression, and anxiety are all factors that have also been shown to strongly influence SCI (e.g., Comijs, Deeg, Dik, Twisk, & Jonker, 2002, Jorm et al., 1994, & Snitz et al., 2015). One of the main symptoms of adults with depression is SCI (Reid & MacLulich, 2008). Depression has been consistently related to an increased reporting of SCI, but researchers are not sure if depression leads to SCI or if SCI leads to depression (Marks & Sitskroon, 2013). Similarly, SCI is thought to cause anxiety among older adults, which may be a contributor to the observed relationship between SCI and anxiety symptoms (Marks & Sitskroon, 2013). Personality is also associated with SCI, but the nature of the relationship is unclear. Researchers are unsure if individuals with certain personality traits, such as a highly anxious, self-conscious individuals, are more likely to report SCI regardless of actual cognitive status, or if they may be more sensitive to subtle cognitive changes (Reid & MacLulich, 2013).

The relationship between SCI and anxiety, depression, personality, and cognitive decline may be unclear because of the many different ways SCI is measured and studied (Slavin et al., 2010). This includes participants reporting SCI to a physician who then refers them to a memory clinic (Ausen, Edman, Almkvist, & Bogdanovic, 2009), asking a group of healthy older adults with no cognitive impairment a single question or two about memory complaints (Luchetti, Terracciano, Stephan, & Sutin, 2015) versus a battery of questions about memory complaints (Slavin et al., 2010), or having individuals answer yes/no questions about SCI (Studer et al., 2014) versus using a rating scale to define SCI (Merema, Speelman, Foster, & Kaczmarek,

2013). At this point, there is no widely and consistently used instrument to detect SCI (Archer, Newson, & Coulthard, 2015).

Personality and SCI

Personality is defined as the broad factors that characterize a person and the specific traits that define those broad factors (Costa & McCrae, 1995). The Five Factor Model of Personality was developed to measure the basic personality factors of an individual (Costa & McCrae, 1992). The NEO personality inventory was designed to measure the “big five” personality traits (Costa & McCrae, 1995). However, there are other personality measures that may be used that also study the “Big Five” factors of neuroticism, extraversion, openness, agreeableness, and conscientiousness (Costa & McCrae, 1992).

Neuroticism is the extent to which an individual is anxious, worried, depressed, or angered (Kwantes, Derbentseva, Lam, Vartanian, Marmurek, 2016). Individuals with a high level of neuroticism are more likely to report anxiety, have higher feelings of self-consciousness, make decisions impulsively, and worry more (Costa & McCrae, 1992). In a longitudinal forty-year study, higher neuroticism was shown to be more predictive of low subjective well-being and lower mortality risk for men and less predictive of late-life physical health (Friedman, Kern, Reynolds, 2010). Neuroticism may be less predictive of late-life physical health because individuals high in neuroticism take action when they sense something wrong with their physical health because they worry more (Friedman, Kern, Reynolds, 2010). For example, patients with a high level of neuroticism may be more distressed about forgetting keys at home or the name of an acquaintance. When asked about their memory, this patient may report having SCI. However, a patient with a low level of neuroticism may forget keys or the names of acquaintances just as often, but fail to report it as SCI on questioning because it does not cause them distress.

Individuals with a higher level of neuroticism may also be more likely to complain about all things in their life, including their health (Kliegel, Zimprich, & Eschen, 2005; Pearman, Hertzog, & Gerstorf, 2014). Individuals with a lower level of neuroticism are more likely to react better to stress and have better emotional stability (Costa & McCrae, 1992).

Extraversion is the extent to which an individual is outgoing, friendly, and warm towards others (Kwantes, Derbentseva, Lam, Vartanian, Marmurek, 2016). Individuals with a high level of extraversion are more likely to be described as optimistic, seek out thrill rides, and feel at home with a large group of people (Costa & McCrae, 1992). Individuals with a low level of extraversion tend to be more pessimistic and feel more comfortable around fewer people (Costa & McCrae, 1992). Because highly extraverted individuals are more optimistic, they may tend to rate their health more positively (Löckenhoff, Sutin, Ferrucci, & Costa, 2008).

Openness is the extent to which an individual is curious, creative, and imaginative (Kwantes, Derbentseva, Lam, Vartanian, Marmurek, 2016). A high level of openness means a person enjoys intellectually stimulating conversations, has a wide array of things they enjoy doing, and does not change to fit in with the norm (Costa & McCrae, 1992). A person with a low level of openness may feel uncomfortable trying new things and try to fit the role of sex-based social stereotypes (Costa & McCrae, 1992). Regarding their health, individuals with a high level of openness are more likely to participate in activities that improve their overall cognitive functioning (Booth, Schinka, Brown, Mortimer, & Borenstein, 2006). These individuals have also been shown to have better verbal memory (Booth, Schinka, Brown, Mortimer, & Borenstein, 2006).

Agreeableness is the extent to which an individual is trusting, collaborative, and supportive (Kwantes, Derbentseva, Lam, Vartanian, Marmurek, 2016). Individuals with a high

level of agreeableness tend to be more trusting of people, have a straightforward way of talking, and are generally warm towards others (Costa & McCrae, 1992). Individuals with a low level of agreeableness tend to be more concerned with themselves than others and are more cynical towards others (Costa & McCrae, 1992). Agreeableness has shown with mixed results to be associated with a high level of health (Friedman, Kern, Reynolds, 2010).

Conscientiousness is the extent to which an individual is organized, likely to follow through on tasks, and highly motivated (Kwantes, Derbentseva, Lam, Vartanian, Marmurek, 2016). A high level of conscientiousness means that an individual tends to be more productive, behave more ethically, have high ambitions, and always keep their word (Costa & McCrae, 1992). A low level of conscientiousness means that an individual tends to base decisions on what will give that person the most pleasure in the moment and will often forget things they said they would do or slack on deadlines (Costa & McCrae, 1992). Generally, highly conscientious individuals tend to practice more healthy behaviors than individuals low in conscientiousness (O'Connor, Conner, Jones, McMillan, & Ferguson, 2009).

Overall, SCI and personality traits are important to examine because consistent relationships between these factors would influence how SCI is assessed and managed. If personality affects SCI measurement, it would then have to be determined if certain personality types are better at recognizing their own memory loss, which may improve early dementia risk detection, or which individuals are simply more bothered by age-related cognitive changes. Detecting the individuals who are at risk for SCI or have SCI earlier allows better prevention methods and better intervention programs to be put in place, respectively (Luchetti, Terracciano, Stephan, & Sutin, 2015). By assessing both the presence of SCI and personality, healthcare providers could also implement personality-tailored interventions to reduce cognitive decline

(Luchetti, Terracciano, Stephan, & Sutin, 2015) and increase cognitive performance (Steinberg et al., 2013).

Problem, Purpose, and Research Questions

Understanding the relationship between personality and SCI would help us determine whether individuals reporting SCI are at risk for dementia or are reporting SCI due to other factors, such as personality traits (Jessen et al., 2014). Some studies have found a relationship between high neuroticism, low conscientiousness, and SCI (e.g., Eramudugolla, Cherbuin, Easteal, Jorm, & Anstey, 2012; Jorm et al., 1994; Pearman, Hertzog, & Gerstorf, 2014; Steinberg et al., 2013), which may indicate that SCI is more related to personality than actual cognitive impairment. However, other researchers argue that personality factors, such as neuroticism, are risk factors for cognitive decline (Terracciano et al., 2014). Although previous research has assessed personality and SCI, findings have been mixed and no systematic review has been conducted. The purpose of this systematic review is to examine the relationship between personality traits and SCI, specifically identifying what personality factors are related to the presence of SCI or a higher level of SCI. Ultimately, the goal of the review of literature is to answer the question, ‘In older adults without dementia, is there a relationship between personality and SCI?’

Chapter 2

Methods

The purpose of this systematic review is to examine what is currently known about the relationship between personality and SCI in older adults without dementia. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were utilized in this systematic review (Moher, Liberati, Tetzlaff, Altman, & PRISMA Group, 2009). A literature review was conducted in January 2016 using PubMed, Web of Science, and CINAHL databases. *Personality, neuroticism, OR neurotic AND subjective cognitive, subjective memory, cognitive complaints, memory complaints, cognitive concerns, memory concerns, cognitive difficulties, memory difficulties, cognitive failures, memory failures, perceived forgetfulness, OR cognitive functioning* were search terms used to find the relevant articles and are compiled in a table (see Appendix A). Articles were also added after searching through reference lists of the identified articles. Inclusion criteria were that the articles must be written in English, measure and discuss SCI and a big five personality factor together, and have participants that were older than 50 or had a mean age older than 60. Articles that had participants with MCI were included if they compared the relationship between personality and SCI to a participant group without MCI. The year of publication was not an inclusion or exclusion criteria because the science is early so any articles pertaining to SCI and personality were accepted into the corpus to be examined. Articles were excluded during the abstract screen if they were duplicates of previously identified articles or focused on changes in personality throughout dementia. These second group of studies were excluded because although personality changes throughout dementia is a highly studied topic it is not the focus of this review. Additionally, brain and personality disorders were excluded because the focus of the review was to explore the relationship between persons

without dementia. Opinion articles, editorials, literature reviews, and dissertations were all excluded from this systematic review.

The PRISMA flow diagram (see Appendix B) shows the process of the selection of articles included in the review. 660 articles were found with the initial search criteria. 618 of these articles were excluded by title and abstract. 12 of the articles were duplicates and 606 of the articles were not related to the topic. 42 articles were then retrieved for full-text evaluation and 28 of these articles were excluded because they did not fit the inclusion criteria for this review. One article was added in after searching through selected articles' reference lists and a total of 15 articles were selected for inclusion in the systematic review.

A critical appraisal of each study was then conducted using the weight of evidence (WoE) framework (Gough, 2007; Weed, 2005). Each article was rated for methodological quality (WoE A), methodological relevance (WoE B), and topic relevance (WoE C). Methodological quality is the only criteria that is not review-specific and is a rating that evaluates the overall quality of the study. Methodological relevance is review-specific and is a rating that evaluates the study design's appropriateness to answer the review question. Topic relevance is review-specific and is a rating that evaluates the study's focus to answer the review's question. The articles were given a rating of low, medium, or high rating for each of the three criteria. A low methodological relevance was ground to not include that article in the systematic review. Two reviewers evaluated all of the articles and discrepancies in regards to the ratings of each article were discussed among reviewers. A total of 45 WoE ratings were reviewed and the reviewers agreed on 37 of these ratings (82.2% agreement). Any disagreements on ratings were discussed and a single rating was agreed upon.

Chapter 3

Findings

Of the fifteen total articles included in the review, eleven of the articles were cross-sectional (Arbuckle, Gold, & Andres, 1986; Ausen, Edman, Almkvist, & Bogdanovic, 2009; Jorm et al., 2004; Jorm et al., 1994; Kliegel, Zimprich, & Eschen, 2005; Merema, Speelman, Foster, & Kaczmarek, 2013; Pearman & Storandt, 2004; Ponds & Jolles, 1996; Slavin et al., 2010; Steinberg et al., 2013; Studer et al., 2014) and four of the studies were longitudinal (Comijs, Deeg, Dik, Twisk, & Jonker, 2002; Eramudugolla, Cherbuin, Easteal, Jorm, & Anstey, 2012; Luchetti, Terracciano, Stephan, & Sutin, 2015; Pearman, Hertzog, & Gerstorf, 2014). However, although Eramudugolla, Cherbuin, Easteal, Jorm, & Anstey (2012) had both cross-sectional and longitudinal measures, SCI and personality were only measured by their cross-sectional relationship. The sample size ranged from 85 participants (Ausen, Edman, Almkvist, & Bogdanovic, 2009) to 13,987 participants (Luchetti, Terracciano, Stephan, & Sutin, 2015).

The most common personality measurement used was the NEO-Five Factor Inventory (NEO-FFI) that measures neuroticism, extraversion, openness, agreeableness, and conscientiousness (Eramudugolla, Cherbuin, Easteal, Jorm, & Anstey, 2012; Kliegel, Zimprich, & Eschen, 2005; Merema, Speelman, Foster, & Kaczmarek, 2013; Pearman, Hertzog, & Gerstorf, 2014; Pearman & Storandt, 2004; Slavin et al., 2010; Steinberg et al., 2013; Studer et al., 2014) followed by the Eysenck Personality Inventory (Arbuckle, Gold, & Andres, 1986; Jorm et al., 2004; Jorm et al., 1994;). Other measures included the Dutch Personality Scale for Neuroticism (Comijs, Deeg, Dik, Twisk, & Jonker, 2002; Ponds & Jolles, 1996), the Midlife Development Inventory Personality Scales (Luchetti, Terracciano, Stephan, & Sutin, 2015), and the Swedish Universities Scales of Personality (Ausen, Edman, Almkvist, & Bogdanovic, 2009).

There were a wide variety of instruments used to measure SCI. These included asking one to three questions compared to asking a battery of questions, asking yes/no questions about the participant's memory, having participants rate their memory on a scale, or determining an SCI group by participants reporting to a memory clinic and then not showing objective cognitive impairment.

The characteristics of the fifteen total articles included in this review of literature were synthesized into a matrix (see Appendix C). Each article was reviewed for purpose, sample, setting, design, instruments used, key findings, and strengths and limitations. The articles in this matrix are arranged by year from most current to least current.

Out of 15 studies evaluated, ten were rated as high methodological quality and five were rated as medium methodological quality. The five rated as medium methodological quality generally had lower sample sizes compared to the other studies rated. For topic relevance, thirteen of the studies were rated as having high topic relevance and the other two studies were rated as having medium topic relevance. These two studies were rated as medium because the main objective of the study was not to study the relationship between personality and SCI, but one or both of these two variables were measured as an additional measure to the main objective. Nine of the studies for methodological relevance received a high and the rest of the studies were a medium. These six studies received a medium rating because they either assessed personality or SCI with only a one-item measurement or SCI was determined by participants being referred to a clinic because of SCI but then having no objective impairment on testing. Overall, the studies represented medium to high quality evidence, as no studies received low ratings on any of the WoE scales.

Findings are presented first based on the big five personality traits: neuroticism,

extraversion, openness, agreeableness and conscientiousness. Then, findings are compared based on the relationship between personality and MCI versus SCI groups, cross-sectional versus longitudinal results, over three SCI measurements used versus under three SCI measurements used, a large sample size (over one thousand) versus a small sample size (under one thousand), and an older (equal to or greater than 65 years) sample versus a younger (below 65 years) sample.

The Big Five Personality Traits

Neuroticism

Of the fifteen studies that examined neuroticism, thirteen of the studies found that there was a positive association between higher neuroticism and SCI (Ausen, Edman, Almkvist, & Bogdanovic, 2009; Comijs, Deeg, Dik, Twisk, & Jonker, 2002; Eramudugolla, Cherbuin, Easteal, Jorm, & Anstey, 2012; Jorm et al., 2004; Jorm et al., 1994; Kliegel, Zimprich, & Eschen, 2005; Luchetti, Terracciano, Stephan, & Sutin, 2015; Merema, Speelman, Foster, & Kaczmarek, 2013; Pearman, Hertzog, & Gerstorf, 2014; Pearman & Storandt, 2004; Ponds & Jolles, 1996; Slavin et al., 2010; Steinberg et al., 2013). Five of the studies found that a higher level of neuroticism was associated with the presence of SCI (Ausen, Edman, Almkvist, & Bogdanovic, 2009; Comijs, Deeg, Dik, Twisk, & Jonker, 2002; Eramudugolla, Cherbuin, Easteal, Jorm, & Anstey, 2012; Jorm et al., 2004; Ponds & Jolles, 1996) and eight of the studies found that a higher level of neuroticism was associated with a higher level of SCI (Jorm et al., 1994; Kliegel, Zimprich, & Eschen, 2005; Luchetti, Terracciano, Stephan, & Sutin, 2015; Merema, Speelman, Foster, & Kaczmarek, 2013; Pearman, Hertzog, & Gerstorf, 2014; Pearman & Storandt, 2004; Slavin et al., 2010; Steinberg et al., 2013) and the remaining two studies

(Arbuckle et al., 1986; Studer, Donati, Popp, & Gunten, 2014) found that there was no relationship between a higher level of neuroticism and the presence of SCI.

Ausen, Edman, Almkvist, & Bogdanovic (2009) measured personality traits with the Swedish Universities Scales of Personality (SSP) which measures anxiety proneness factors, extraversion factors, and aggression hostility factors on a four-point scale of how much the item applies to the individual. Ausen, Edman, Almkvist, & Bogdanovic (2009) found that the SCI group had a higher level of Somatic Trait Anxiety, Psychic Trait Anxiety, and Stress Susceptibility. We are able to attribute these characteristics to neuroticism because Aluoja et al. (2009) studied 197 participants with an average age of 35.7 years and an age range from 18-74 years old and found that Somatic Trait Anxiety, Psychic Trait Anxiety, and Stress Susceptibility of the SSP was significantly associated with neuroticism in the NEO-PI-R. Five of the studies that found a positive association between higher neuroticism and the presence (Ausen, Edman, Almkvist, & Bogdanovic, 2009; Comijs, Deeg, Dik, Twisk, & Jonker, 2002; Eramudugolla, Cherbuin, Easteal, Jorm, & Anstey, 2012; Jorm et al., 2004) or the level (Luchetti, Terracciano, Stephan, & Sutin, 2015) of SCI only received a medium for methodological relevance according to the WoE framework while one out of the two studies that found no relationship between neuroticism and SCI (Arbuckle et al., 1986) received a medium for methodological relevance according to the WoE framework. All of the other studies received a high for methodological relevance. Overall, a majority of the studies found a positive association between neuroticism and SCI.

Extraversion

Of the nine studies that examined extraversion, five of the studies found that there was a negative association between higher extraversion and SCI (Ausen, Edman, Almkvist, &

Bogdanovic, 2009; Jorm et al., 2004; Jorm et al., 1994; Luchetti, Terracciano, Stephan, & Sutin, 2015; Steinberg et al., 2013). Two of the studies found that a higher level of extraversion was associated with the absence of SCI (Ausen, Edman, Almkvist, & Bogdanovic, 2009; Jorm et al., 2004), three of the studies found that a higher level of extraversion was associated with a lower level of SCI (Jorm et al., 1994; Luchetti, Terracciano, Stephan, & Sutin, 2015; Steinberg et al., 2013) and the four remaining studies found that there was no relationship between a higher level of extraversion and the presence (Arbuckle et al., 1986; Studer, Donati, Popp, & Gunten, 2014) or level (Kliegel, Zimprich, & Eschen, 2005; Pearman & Storandt, 2004) of SCI.

Ausen, Edman, Almkvist, & Bogdanovic (2009) used the SSP to measure five domains of extraversion: impulsivity, adventure seeking, detachment, embitterment, and social desirability. Ausen, Edman, Almkvist, & Bogdanovic (2009) found that the SCI group had a lower degree of the domain adventure-seeking than healthy controls. Three of the studies that found a negative association between higher extraversion and the presence (Ausen, Edman, Almkvist, & Bogdanovic, 2009; Jorm et al., 2004) or the level (Luchetti, Terracciano, Stephan, & Sutin, 2015) of SCI only received a medium for methodological relevance according to the WoE framework while one out of the four studies that found no relationship between extraversion and SCI (Arbuckle et al., 1986) received a medium for methodological relevance according to the WoE framework. All of the other studies received a high for methodological relevance. Three out of the four studies that found no relationship between a higher level of extraversion and SCI used the NEO-FFI to measure extraversion (Kliegel, Zimprich, & Eschen, 2005; Pearman & Storandt, 2004; Studer, Donati, Popp, & Gunten, 2014) while only one of the studies that found a negative association between higher extraversion and SCI used the NEO-FFI to measure extraversion (Steinberg et al., 2013). The other studies used varied personality measurements to

determine the participants' level of extraversion. Overall, just over half of the studies found a negative association between a higher level of extraversion and SCI.

Openness

Of the six studies that examined openness, two of the studies found that there was a negative relationship between higher openness and the level of SCI (Luchetti, Terracciano, Stephan, & Sutin, 2015; Slavin et al., 2010). The remaining four studies found that there was no relationship between higher openness and the presence (Ponds & Jolles, 1996; Studer, Donati, Popp, & Gunten, 2014) or level (Kliegel, Zimprich, & Eschen, 2005; Steinberg et al., 2013) of SCI. One of the studies that found a negative relationship between higher openness and the level of SCI (Slavin et al., 2010) received a medium for methodological relevance according to the WoE framework while all of the other studies received a high for methodological relevance. All of the studies that found no relationship between higher openness and SCI had a cross-sectional design while one of the two studies that found a negative association between higher openness and the level of SCI (Luchetti, Terracciano, Stephan, & Sutin, 2015) had a longitudinal design. Overall, a majority of the studies found no relationship between openness and SCI.

Agreeableness

Of the five studies that examined agreeableness, one study found a positive relationship between lower agreeableness and the level of SCI (Luchetti, Terracciano, Stephan, & Sutin, 2015). The remaining four studies found that there was no relationship between agreeableness and the presence (Studer, Donati, Popp, & Gunten, 2014) or level (Kliegel, Zimprich, & Eschen, 2005; Pearman & Storandt, 2004; Steinberg et al., 2013) of SCI. The study that found a positive relationship between lower agreeableness and the level of SCI (Luchetti, Terracciano, Stephan, & Sutin, 2015) received a medium for methodological relevance according to the WoE

framework while all of the other studies received a high for methodological relevance. Overall, a majority of the studies found no relationship between agreeableness and SCI.

Conscientiousness

Of the seven studies that examined conscientiousness, four of the studies found a negative relationship between higher conscientiousness and the level of SCI (Luchetti, Terracciano, Stephan, & Sutin, 2015; Pearman & Storandt, 2004; Slavin et al., 2010; Steinberg et al., 2013). The remaining three studies found that there was no relationship between conscientiousness and the presence (Studer, Donati, Popp, & Gunten, 2014) or level (Kliegel, Zimprich, & Eschen, 2005; Merema, Speelman, Foster, & Kaczmarek, 2013) of SCI. One of the studies that found a negative relationship between higher conscientiousness and the level of SCI (Luchetti, Terracciano, Stephan, & Sutin, 2015) only received a medium for methodological relevance according to the WoE framework while all of the other studies received a high for methodological relevance. Overall, over half of the studies found a negative relationship between higher conscientiousness and SCI.

MCI vs. SCI

In addition to examining the relationship between personality and SCI, two studies examined the relationship between personality and MCI. Both studies examined neuroticism and extraversion and found a positive relationship between a high level of neuroticism (Ausen, Edman, Almkvist, & Bogdanovic, 2009; Studer, Donati, Popp, & Gunten, 2014) and the presence of SCI in the MCI group and one study found a positive relationship between a high level of extraversion (Ausen, Edman, Almkvist, & Bogdanovic, 2009) and the presence of MCI. One study examined agreeableness and found a negative relationship between a high level of agreeableness (Studer, Donati, Popp, & Gunten, 2014) and the presence of SCI in the MCI

group. One study examined openness and conscientiousness and found no relationship between openness and conscientiousness and the presence of MCI (Studer, Donati, Popp, & Gunten, 2014).

Studer, Donati, Popp, & Gunten, (2014) used the NEO-FFI and found that in their group of healthy participants, no personality factors were associated with SCI. However, in their group of mild cognitive impairment (MCI) participants, a high level of neuroticism was significantly associated with a high level of SCI and a high level of agreeableness was associated with a low level of SCI (Studer, Donati, Popp, & Gunten, 2014). Ausen, Edman, Almkvist, & Bogdanovic (2009) assessed the relationship between SCI and personality in a three cohort study with one cohort consisting of healthy controls, another cohort consisting of SCI participants, and the last cohort consisting of MCI participants. They used the SSP to measure personality and found no significant difference between the SCI and MCI cohorts but the SCI cohort had a lower degree of the domain adventure-seeking that is part of the factor extraversion than healthy controls (Ausen, Edman, Almkvist, & Bogdanovic, 2009) and the MCI cohort had a higher degree of the domain detachment that is part of the factor extraversion than healthy controls (Ausen, Edman, Almkvist, & Bogdanovic, 2009). Both of the participant groups with SCI and MCI participants had higher levels of neuroticism than the healthy controls (Ausen, Edman, Almkvist, & Bogdanovic, 2009). Ausen, Edman, Almkvist, & Bogdanovic (2009) only received a medium for methodological relevance according to the WoE framework while Studer, Donati, Popp, & Gunten (2014) received a high for methodological relevance according to the WoE framework. Overall, both of the studies that examined neuroticism found a positive relationship between a higher level of neuroticism and MCI. Half of the studies that examined extraversion found a positive relationship between a high level of extraversion and the presence of MCI and the study that

examined agreeableness found a negative relationship between a high level of agreeableness and the presence of SCI in the MCI group. The study that examined openness and conscientiousness found no relationship between openness and conscientiousness and the presence of MCI.

Cross-sectional vs. Longitudinal

Three studies also examined the relationship between SCI and personality longitudinally. Of the three studies that examined neuroticism, all of the studies found a positive relationship between higher neuroticism and the presence (Comijs, Deeg, Dik, Twisk, & Jonker, 2002) or level (Luchetti, Terracciano, Stephan, & Sutin, 2015; Pearman, Hertzog, & Gerstorf, 2014) of SCI over time. One study examined extraversion, openness, agreeableness, and conscientiousness and found a negative relationship between higher extraversion, openness, and conscientiousness and the level of SCI and a positive relationship between lower agreeableness and the level of SCI over time (Luchetti, Terracciano, Stephan, & Sutin, 2015).

Luchetti, Terracciano, Stephan, & Sutin (2015) used participants drawn from the Health and Retirement Study (HRS), a longitudinal study that is sponsored by the National Institute of Aging. This study used participants older than 50 years and had measured half of the group in 2006, the other half of the group in 2008, and used the 2006 and 2008 measurements as their baseline (Luchetti, Terracciano, Stephan, & Sutin, 2015). Then, in 2010 and 2012 the participants completed the same cognitive measures as the baseline (Luchetti, Terracciano, Stephan, & Sutin, 2015). At baseline, a high level of neuroticism was associated with a higher level of SCI, a high level of extraversion, openness, and conscientiousness was associated with a lower level of SCI, and a low level of agreeableness is associated with a low level of SCI (Luchetti, Terracciano, Stephan, & Sutin, 2015). These associations between personality and SCI were also significant longitudinally as well (Luchetti, Terracciano, Stephan, & Sutin, 2015).

Pearman, Hertzog, & Gerstorf (2014) used data from the Berlin Aging Study where 504 patients from age 70-100 were studied four times over six years. This study also found that a high level of neuroticism was significantly associated with a high level of SCI at the baseline measurement. Over the next six years, a high level of neuroticism was still significantly related to a high level of SCI (Pearman, Hertzog, & Gerstorf, 2014). Comijs, Deeg, Dik, Twisk, & Jonker (2002) conducted a study that was a part of the Longitudinal Aging Study Amsterdam that assessed people from 55-85 years old. The baseline measurement took place in 1992/1993, the first follow-up took place in 1995/1996, and the second follow-up took place in 1998/1999. A total of 2032 respondents were measured. At the baseline measurement, it was found that a high level of neuroticism was associated with the presence of SCI (Comijs, Deeg, Dik, Twisk, & Jonker, 2002). Over time, a high level of neuroticism was still significantly associated with the presence of SCI (Comijs, Deeg, Dik, Twisk, & Jonker, 2002). Overall, all three of the studies that examined neuroticism found a positive relationship between a high level of neuroticism and SCI. The study that examined extraversion, openness, agreeableness, and conscientiousness found a negative relationship between higher extraversion, openness, and conscientiousness and the level of SCI and a positive relationship between lower agreeableness and the level of SCI.

Twelve studies examined the relationship between SCI and personality through cross-sectional measures. Of the twelve studies that examined neuroticism, ten of the studies found that there was a positive association between higher neuroticism and SCI (Ausen, Edman, Almkvist, & Bogdanovic, 2009; Eramudugolla, Cherbuin, Easteal, Jorm, & Anstey, 2012; Jorm et al., 2004; Jorm et al., 1994; Kliegel, Zimprich, & Eschen, 2005; Merema, Speelman, Foster, & Kaczmarek, 2013; ; Pearman & Storandt, 2004; Ponds & Jolles, 1996; Slavin et al., 2010; Steinberg et al., 2013) and two of the studies found no relationship between neuroticism and SCI

(Arbuckle et al., 1986; Studer, Donati, Popp, & Gunten, 2014). Of the eight studies that examined extraversion, four of the studies found that there was a negative association between higher extraversion and SCI (Ausen, Edman, Almkvist, & Bogdanovic, 2009; Jorm et al., 2004; Jorm et al., 1994; Steinberg et al., 2013) and four of the studies found no relationship between a higher level of extraversion and SCI (Arbuckle et al., 1986; Kliegel, Zimprich, & Eschen, 2005; Pearman & Storandt, 2004; Studer, Donati, Popp, & Gunten, 2014). Of the five studies that examined openness, one study found that there was a negative relationship between higher openness and the level of SCI (Slavin et al., 2010) and four of the studies found no relationship between openness and SCI (Kliegel, Zimprich, & Eschen, 2005; Ponds & Jolles, 1996; Steinberg et al., 2013; Studer, Donati, Popp, & Gunten, 2014). Of the four studies that examined agreeableness, none of them found a relationship between agreeableness and SCI (Kliegel, Zimprich, & Eschen, 2005; Pearman & Storandt, 2004; Steinberg et al., 2013; Studer, Donati, Popp, & Gunten, 2014). Of the six studies that examined conscientiousness, three of the studies found a negative relationship between higher conscientiousness and the level of SCI (Pearman & Storandt, 2004; Slavin et al., 2010; Steinberg et al., 2013). The remaining three studies found that there was no relationship between conscientiousness and SCI (Kliegel, Zimprich, & Eschen, 2005; Merema, Speelman, Foster, & Kaczmarek, 2013; Studer, Donati, Popp, & Gunten, 2014). Overall, a majority of the studies found a positive association between higher neuroticism and SCI, half of the studies found a negative association between higher extraversion and SCI, nearly all of the studies found no relationship between openness and SCI, none of the studies found a relationship between agreeableness and SCI, and half of the studies found a negative relationship between higher conscientiousness and SCI.

SCI Measurements

A variety of SCI measurements were used throughout the systematic review but a big difference between the studies was whether SCI was measured by asking the participants over three items or fewer than three items. Four total studies measured SCI by asking the participants fewer than three questions or to rate how they assessed their memory on fewer than three items. Of the four studies that examined neuroticism, three of the four studies found a positive relationship between higher neuroticism and SCI (Comijs, Deeg, Dik, Twisk, & Jonker, 2002; Jorm et al., 2004; Luchetti, Terracciano, Stephan, & Sutin, 2015). Of the three studies that examined extraversion, two of the studies found a negative relationship between higher extraversion and SCI (Jorm et al., 2004; Luchetti, Terracciano, Stephan, & Sutin, 2015). One study examined openness, agreeableness, and conscientiousness and found a negative relationship between openness and conscientiousness and the level of SCI and a positive relationship between lower agreeableness and the level of SCI (Luchetti, Terracciano, Stephan, & Sutin, 2015). One study found no relationship between extraversion and neuroticism and SCI (Arbuckle et al., 1986).

Luchetti, Terracciano, Stephan, & Sutin (2015) asked the participants two questions to measure SCI and found at a baseline measurement that a high level of neuroticism is significantly associated with a high level of SCI, a high level of extraversion, openness, and conscientiousness is significantly associated with a low level of SCI, and a low level of agreeableness is significantly associated with a low level of SCI. This study also measured the relationship between personality and SCI after a four-year follow-up period and found the same relationship between the personality traits and SCI (Luchetti, Terracciano, Stephan, & Sutin, 2015). Comijs, Deeg, Dik, Twisk, & Jonker (2002) is a longitudinal panel study that measured

SCI by asking the participants one question and found that at baseline and during three observation cycles over six years a high level of SCI was consistently associated with a high level of neuroticism. Jorm et al. (2004) asked the participants one to three questions to measure SCI depending on the participant's answer to the first question and found that a high level of neuroticism was significantly associated with a high level of SCI and that a high level of extraversion was significantly associated with a low level of SCI. Arbuckle et al. (1986) asked the participants to rate their memory on a nine-point scale and found no relationship between SCI and the big five personality traits. All of these studies received a medium on methodological quality methodological relevance according to WoE framework. Overall, a majority of the studies found a positive association between higher neuroticism and SCI, a majority of the studies found a negative association between higher extraversion and SCI, and the study that examined openness, agreeableness, and conscientiousness found a negative relationship between higher openness and conscientiousness and the level of SCI and a positive relationship between lower agreeableness and the level of SCI

Ten studies measured SCI by asking the participants to rate their memory on three items or over or asked three questions or over. Of the ten studies that examined neuroticism, nine of the studies found a positive relationship between higher neuroticism and SCI (Eramudugolla, Cherbuin, Easteal, Jorm, & Anstey, 2012; Jorm et al., 1994; Kliegel, Zimprich, & Eschen, 2005; Merema, Speelman, Foster, & Kaczmarek, 2013; Pearman, Hertzog, & Gerstorff, 2014; Pearman & Storandt, 2004; Ponds & Jolles, 1996; Slavin et al., 2010; Steinberg et al., 2013) and one study found no relationship between neuroticism and SCI (Studer, Donati, Popp, & Gunten, 2014). Of the six studies that examined extraversion, three of the studies found a negative relationship between higher extraversion and SCI (Ausen, Edman, Almkvist, & Bogdanovic, 2009; Jorm et

al., 1994; Steinberg et al., 2013) and three of the studies found no relationship between extraversion and SCI (Kliegel, Zimprich, & Eschen, 2005; Pearman & Storandt, 2004; Studer, Donati, Popp, & Gunten, 2014). Of the five studies that examined openness, one study found that there was a negative relationship between higher openness and the level of SCI (Slavin et al., 2010). The remaining four studies found no relationship between openness and SCI (Kliegel, Zimprich, & Eschen, 2005; Ponds & Jolles, 1996; Steinberg et al., 2013; Studer, Donati, Popp, & Gunten, 2014). Of the four studies that examined agreeableness, none of the studies found a relationship between agreeableness and SCI (Kliegel, Zimprich, & Eschen, 2005; Pearman & Storandt, 2004; Steinberg et al., 2013; Studer, Donati, Popp, & Gunten, 2014). Of the six studies that examined conscientiousness, three of the studies found a negative relationship between higher conscientiousness and SCI (Pearman & Storandt, 2004; Slavin et al., 2010; Steinberg et al., 2013). The remaining three studies found no relationship between conscientiousness and SCI (Kliegel, Zimprich, & Eschen, 2005; Merema, Speelman, Foster, & Kaczmarek, 2013; Studer, Donati, Popp, & Gunten, 2014). Overall, a majority of the studies found a positive association between higher neuroticism and SCI, half of the studies found a negative association between higher extraversion and SCI, nearly all of the studies found no relationship between openness and SCI, none of the studies found a relationship between agreeableness and SCI, and half of the studies found a negative relationship between higher conscientiousness and SCI.

For Aussen, Edman, Almkvist, & Bogdanovic, (2009), SCI was determined by participants being referred to a clinic because of SCI but then having no objective impairment on testing. This study used the SSP to measure neuroticism and extraversion and found a positive relationship between higher neuroticism and the presence of SCI and a negative relationship between lower neuroticism and the presence of SCI.

Large Sample Size vs. Small Sample Size

The fifteen studies that made up the systematic review had different sample sizes, but a big difference between the studies was whether the studies had over one thousand participants or under one thousand participants. Five of the studies had sample sizes greater than one thousand participants with the amount of participants ranging from 1037 participants to 13987 participants. Of the five studies that examined neuroticism, all of the studies found a positive relationship between higher neuroticism and SCI (Comijs, Deeg, Dik, Twisk, & Jonker, 2002; Eramudugolla, Cherbuin, Easta, Jorm, & Anstey, 2012; Jorm et al., 2004; Luchetti, Terracciano, Stephan, & Sutin, 2015; Slavin et al., 2010). Of the two studies that examined extraversion, both of the studies found a negative relationship between higher extraversion and SCI (Jorm et al., 2004; Luchetti, Terracciano, Stephan, & Sutin, 2015). Of the two studies that examined openness and conscientiousness, both of the studies found a negative relationship between higher openness and SCI (Luchetti, Terracciano, Stephan, & Sutin, 2015; Slavin et al., 2010). One study examined agreeableness and found a positive relationship between lower agreeableness and the level of SCI (Luchetti, Terracciano, Stephan, & Sutin, 2015). Overall, all of the studies found a positive association between higher neuroticism and SCI, a negative relationship between higher extraversion, higher openness, higher conscientiousness and SCI, and a positive relationship between lower agreeableness and the level of SCI.

The remaining ten studies had sample sizes with fewer than one thousand participants ranging in size from 85 participants to 877 participants. Of the ten studies that examined neuroticism, eight of the studies found a positive relationship between higher neuroticism and SCI (Ausen, Edman, Almkvist, & Bogdanovic, 2009; Jorm et al., 1994; Kliegel, Zimprich, & Eschen, 2005; Merema, Speelman, Foster, & Kaczmarek, 2013; Pearman, Hertzog, & Gerstorf,

2014; Pearman & Storandt, 2004; Ponds & Jolles, 1996; Steinberg et al., 2013) and two studies found no relationship between neuroticism and SCI (Arbuckle, Gold, & Andres, 1986; Studer, Donati, Popp, & Gunten, 2014). Of the seven studies that examined extraversion, three of the studies found a negative relationship between higher extraversion and SCI (Ausen, Edman, Almkvist, & Bogdanovic, 2009; Jorm et al., 1994; Steinberg et al., 2013) and four of the studies found no relationship between extraversion and SCI (Arbuckle et al., 1986; Kliegel, Zimprich, & Eschen, 2005; Pearman & Storandt, 2004; Studer, Donati, Popp, & Gunten, 2014). Of the four studies that examined openness, all of the studies found no relationship between openness and SCI (Kliegel, Zimprich, & Eschen, 2005; Ponds & Jolles, 1996; Steinberg et al., 2013; Studer, Donati, Popp, & Gunten, 2014). Of the four studies that examined agreeableness, all of the studies found no relationship between agreeableness and SCI (Kliegel, Zimprich, & Eschen, 2005; Pearman & Storandt, 2004; Steinberg et al., 2013; Studer, Donati, Popp, & Gunten, 2014). Of the five studies that examined conscientiousness, two of the studies found a negative relationship between higher conscientiousness and SCI (Pearman & Storandt, 2004; Steinberg et al., 2013). The remaining three studies found no relationship between conscientiousness and SCI (Kliegel, Zimprich, & Eschen, 2005; Merema, Speelman, Foster, & Kaczmarek, 2013; Studer, Donati, Popp, & Gunten, 2014). Overall, a majority of the studies found a positive association between higher neuroticism and SCI, over half of the studies found no relationship between higher extraversion and SCI, all of the studies found no relationship between openness and SCI, all of the studies found no relationship between agreeableness and SCI, and over half of the studies found no relationship between higher conscientiousness and SCI.

Younger Sample Size vs. Older Sample Size

The fifteen studies that made up the systematic review had different age ranges for their samples, and seven of the studies had sample age ranges that started at 65 years or higher. There were seven studies with participants whose ages started at or greater than 65 years old or where participants' mean age was over 65. Of the seven studies that examined neuroticism, six of the studies found a positive relationship between higher neuroticism and SCI (Jorm et al., 1994; Kliegel, Zimprich, & Eschen, 2005; Merema, Speelman, Foster, & Kaczmarek, 2013; Pearman, Hertzog, & Gerstorf, 2014; Slavin et al., 2010; Steinberg et al., 2013) and one study found no relationship between neuroticism and SCI (Arbuckle, Gold, & Andres, 1986). Of the five studies that examined extraversion, two of the studies found a negative relationship between higher extraversion and SCI (Jorm et al., 1994; Steinberg et al., 2013) and three of the studies found no relationship between extraversion and SCI (Ausen, Edman, Almkvist, & Bogdanovic, 2009; Jorm et al., 1994; Steinberg et al., 2013). Of the three studies that examined openness, one of the studies found a negative relationship between higher openness and the level of SCI (Slavin et al., 2010) and two of the studies found no relationship between openness and SCI (Kliegel, Zimprich, & Eschen, 2005; Steinberg et al., 2013). Of the two studies that examined agreeableness, all of the studies found no relationship between agreeableness and SCI (Kliegel, Zimprich, & Eschen, 2005; Steinberg et al., 2013). Of the four studies that examined conscientiousness, two of the studies found a negative relationship between higher conscientiousness and SCI (Slavin et al., 2010; Steinberg et al., 2013). The remaining two studies found no relationship between conscientiousness and SCI (Kliegel, Zimprich, & Eschen, 2005; Merema, Speelman, Foster, & Kaczmarek, 2013). Overall, a majority of the studies found a positive association between higher neuroticism and SCI, over half of the studies found no

relationship between higher extraversion and SCI, a majority of the studies found no relationship between openness and SCI, all of the studies found no relationship between agreeableness and SCI, and half of the studies found no relationship between higher conscientiousness and SCI.

The remaining eight studies had sample age ranges that started below sixty-five years old. Of the eight studies that examined neuroticism, seven of the studies found a positive relationship between higher neuroticism and SCI (Ausen, Edman, Almkvist, & Bogdanovic, 2009; Comijs, Deeg, Dik, Twisk, & Jonker, 2002; Eramudugolla, Cherbuin, Easteal, Jorm, & Anstey, 2012; Jorm et al., 2004; Luchetti, Terracciano, Stephan, & Sutin, 2015; Pearman & Storandt, 2004; Ponds & Jolles, 1996) and one study found no relationship between neuroticism and SCI (Studer, Donati, Popp, & Gunten, 2014). Of the five studies that examined extraversion, three of the studies found a negative relationship between higher extraversion and SCI (Ausen, Edman, Almkvist, & Bogdanovic, 2009; Jorm et al., 1994; Steinberg et al., 2013) and two of the studies found no relationship between extraversion and SCI (Pearman & Storandt, 2004; Studer, Donati, Popp, & Gunten, 2014;) Of the three studies that examined openness, one of the studies found a negative relationship between higher openness and the level of SCI (Luchetti, Terracciano, Stephan, & Sutin, 2015) and two of the studies found no relationship between openness and SCI (Ponds & Jolles, 1996; Studer, Donati, Popp, & Gunten, 2014). Of the two studies that examined agreeableness, one of the studies found a positive relationship between lower agreeableness and the level of SCI (Luchetti, Terracciano, Stephan, & Sutin, 2015) and two of the studies found no relationship between agreeableness and SCI (Pearman & Storandt, 2004; Studer, Donati, Popp, & Gunten, 2014). Of the three studies that examined conscientiousness, two of the studies found a negative relationship between higher conscientiousness and SCI (Luchetti, Terracciano, Stephan, & Sutin, 2015; Pearman & Storandt, 2004) and the remaining study found no

relationship between conscientiousness and SCI (Studer, Donati, Popp, & Gunten, 2014).

Overall, a majority of the studies found a positive association between higher neuroticism and SCI, over half of the studies found a negative relationship between higher extraversion and SCI, a majority of the studies found no relationship between openness and SCI, a majority of the studies found no relationship between agreeableness and SCI, and over half of the studies found a negative relationship between higher conscientiousness and SCI.

Summary

Overall, a majority of the studies found a positive association between neuroticism and SCI, just over half of the studies found a negative association between a higher level of extraversion and SCI, a majority of the studies found no relationship between openness and SCI, a majority of the studies found no relationship between agreeableness and SCI, and half of the studies found a negative relationship between higher conscientiousness and SCI. For studies that examined the relationship between personality and MCI, all of the studies found a positive association between neuroticism and MCI, half of the studies found a negative association between a higher level of extraversion and MCI, the study that examined agreeableness found a negative relationship between a high level of agreeableness and the presence of MCI, and the study that examined openness and conscientiousness found no relationship between openness and conscientiousness and the presence of MCI.

For the three longitudinal studies, all of the studies found a positive relationship between a high level of neuroticism and SCI, and the study that examined extraversion, openness, agreeableness, and conscientiousness found a negative relationship between higher extraversion, openness, and conscientiousness and the level of SCI and a positive relationship between lower agreeableness and the level of SCI. For these three longitudinal studies, the relationship between

the personality traits and SCI also stayed consistent over time. For the twelve studies that examined the relationship between SCI and personality through cross-sectional measures, a majority of the studies found a positive association between higher neuroticism and SCI, half of the studies found a negative association between higher extraversion and SCI, nearly all of the studies found no relationship between openness and SCI, none of the studies found a relationship between agreeableness and SCI, and half of the studies found a negative relationship between higher conscientiousness and SCI.

For the four studies that measured SCI by asking the participants fewer than three items, a majority of the studies found a positive association between higher neuroticism and SCI, a majority of the studies found a negative association between higher extraversion and SCI, and the study that examined openness, agreeableness, and conscientiousness found a negative relationship between higher openness and conscientiousness and the level of SCI and a positive relationship between lower agreeableness and the level of SCI. For the studies that measured SCI by asking the participants to rate their memory on three items or over or asked three questions or over, a majority of the studies found a positive association between higher neuroticism and SCI, half of the studies found a negative association between higher extraversion and SCI, nearly all of the studies found no relationship between openness and SCI, none of the studies found a relationship between agreeableness and SCI, and half of the studies found a negative relationship between higher conscientiousness and SCI.

For the sample sizes over one thousand participants, all of the studies found a positive association between higher neuroticism and SCI, a negative relationship between higher extraversion, higher openness, higher conscientiousness and SCI, and a positive relationship between lower agreeableness and the level of SCI. For sample sizes with fewer than one

thousand participants, a majority of the studies found a positive association between higher neuroticism and SCI, over half of the studies no relationship between higher extraversion and SCI, all of the studies found no relationship between openness and SCI, all of the studies found no relationship between agreeableness and SCI, and over half of the studies found no relationship between higher conscientiousness and SCI.

For studies with sample ages starting at greater than sixty-five years old, a majority of the studies found a positive association between higher neuroticism and SCI, over half of the studies found no relationship between higher extraversion and SCI, a majority of the studies found no relationship between openness and SCI, all of the studies found no relationship between agreeableness and SCI, and half of the studies found no relationship between higher conscientiousness and SCI. For studies with sample ages starting at less than sixty-five years old, a majority of the studies found a positive association between higher neuroticism and SCI, over half of the studies found a negative relationship between higher extraversion and SCI, a majority of the studies found no relationship between openness and SCI, a majority of the studies found no relationship between agreeableness and SCI, and over half of the studies found a negative relationship between higher conscientiousness and SCI.

Chapter 4

Discussion

This systematic review sought to examine the relationship between the big five personality factors (Costa & McCrae, 1992) and SCI and answer the question, ‘In older adults without dementia, is there a relationship between personality and SCI?’ The fifteen studies in this review were either cross-sectional or longitudinal, used many different SCI measurements, and had a range in the number of participants in the study and the age of the participants in the study. Overall, the most conclusive evidence was that there is a positive relationship between higher neuroticism and the presence of SCI as well as higher level of SCI. The findings regarding the other four personality factors were less conclusive, and are described in detail below.

Relationship between SCI and Big Five Personality Traits

In this systematic review, the relationship between SCI and neuroticism, extraversion, openness, agreeableness, and conscientiousness was examined separately. Neuroticism was consistently found to be positively associated with SCI. About half of the studies found a negative association between higher extraversion and conscientiousness and SCI and majority of the studies found no relationship between openness and agreeableness and SCI.

Neuroticism

Individuals with high neuroticism may have a higher level of SCI or presence of SCI because they are often termed the “worried well” (Slavin et al., 2010). These individuals tend to be more anxious and thus worry about losing their memory. Therefore, while other older adults may become used to cognitive changes as they age, older adults with high neuroticism may focus on each memory failure. This idea is backed by previous research that individuals high in

neuroticism are sensitive to and apt to report somatic symptoms (Costa & McCrae, 1985). This could lead these individuals to have a poorer quality of life and is associated in women with suicidal ideation and depression severity (Mandelli et al., 2015). Essentially, higher neuroticism may be associated with higher SCI because these individuals report normal cognitive changes as cognitive impairment.

However, it is also possible that individuals high in neuroticism are more hyper-aware of actual cognitive impairment. These individuals may recognize cognitive decline before it shows up on objective measurements (Pearman, Hertzog, & Gerstorf, 2014; Snitz et al., 2015) and thus score higher in SCI measurements. A high level of neuroticism may therefore be beneficial to these individuals as they take more appropriate action when they sense that something is wrong (Friedman, Kern, & Reynolds, 2010). Although this study shows that a high level of neuroticism is associated with a high level of SCI, future research needs to be conducted to find out the reason for this association.

Depression/Anxiety. Both high neuroticism (Balash et al., 2013; Mandelli et al., 2015) and SCI (Mark & Sitskroon, 2013) have been associated with depression/anxiety. Currently, the relationship between these factors is unclear. Depression/anxiety and neuroticism are considered pre-existing factors that increases the likelihood of an individual reporting SCI (Mark & Sitskroon, 2013). However, symptoms of anxiety and depression have been reported in participants with SCI that later develop dementia (Jessen et al., 2014). Similarly, individuals with high neuroticism that report SCI may be noticing their own cognitive impairment before it is measurable on objective tests (Snitz et al., 2015). The relationship is still unclear on whether neuroticism and depression/anxiety is predictive of objective impairment or whether these are simply a pre-existing factor that increases the likelihood of SCI.

Extraversion and Conscientiousness

The results for extraversion and conscientiousness were inconclusive, with about half of the studies showing a negative association between a higher level of extraversion/conscientiousness and SCI.

Conscientiousness. Conscientiousness contains the traits of high self-discipline, order, dutifulness, deliberation, and achievement striving (Costa & McCrae, 1992). Therefore, highly conscientiousness individuals tend to have positive healthy behaviors such as eating well and exercising more (O'Connor, Conner, Jones, McMillan, & Ferguson, 2009). However, these behaviors may depend on the type of stress that a highly conscientiousness individual experiences and the types of traits that individual has that makes him or her highly conscientiousness. On high stress days with low self-efficacy, highly conscientiousness individuals were shown to smoke and drink caffeine more than controls (O'Connor, Conner, Jones, McMillan, & Ferguson, 2009). Therefore, the level of SCI a highly conscientiousness individual experiences may depend on the different traits that make up their level of conscientiousness and the type of day that individual had, explaining the inconclusive results between conscientiousness and SCI.

Extraversion. Extraversion is associated with warmth, gregariousness, assertiveness, activity, excitement seeking, and positive emotions (Costa & McCrae, 1992). On one hand, individuals with a high level of extraversion may be overly positive about how they view their cognition (Buratti, Allwood, & Kleitman, 2012). However, this effect may be moderated if the individual also has a high level of neuroticism (Williams, O'Brien, & Colder, 2004). Therefore, although a high level of extraversion alone may be positively associated with SCI, the individual's level of other personality factors may determine whether they report a high level of SCI.

Openness and Agreeableness

A majority of the studies found no relationship between openness/agreeableness and SCI. However, only six studies examined openness and SCI and five studies examined agreeableness and SCI in this systematic review. It might be necessary to further study the relationship between openness/agreeableness and SCI to determine whether a relationship exists between these factors.

Differences in Study Designs and Characteristics

SCI measures, the sample size, age of participants, and the design of the study were compared. Overall, the results did not majorly shift when comparing these different study designs and characteristics.

SCI Measures

It was difficult to conclude if the results changed when fewer than three SCI items or more than three SCI items were asked because only one study that measured all five personality traits asked fewer than three SCI items. However, generally the results stayed the same between the two ways to measure SCI. Currently, there is no consistent tool that is used to measure SCI. SCI may be measured by an examiner asking the participant a few questions, or the examiner filling out a questionnaire or completing a scale (Hill, Mogle, Munoz, Wion, & Colancecco, 2015). Although this systematic review had studies that used a range of measurements to determine SCI, comparing the items asked in the SCI measures showed that the range of measurements used did not impact the overall results.

Sample Size

It was again difficult to conclude if the results changed for sample sizes over one thousand participants or under one thousand participants because only two studies or less for the studies over one thousand participants examined extraversion, openness, agreeableness, and conscientiousness. Although the results generally stayed the same between the two categories of sample sizes, the studies with sample sizes over one thousand participants generally found significant relationships between the personality traits and SCI while the studies with sample sizes with fewer than one thousand participants generally found no relationship between the personality traits and SCI excluding neuroticism. Overall, this indicates that a larger sample size of people may aid in determining the relationship between personality traits and SCI.

Younger vs. Older

Similarly to the other study characteristics, there was no major change in results when comparing studies with participants whose ages started at over sixty-five to participants with sample ages starting at younger than sixty-five. This systematic review only looked at participants that were older than 50 or had a mean age older than 60. We sought to examine this age group because the SCI that this group is experiencing is more likely related to dementia, whereas SCI that younger age groups experience are more likely related to factors other than dementia (Jessen et al., 2014). For that reason, SCI tends to be more prevalent in this age group (Mark & Sitskroon, 2013), as older adults worry about SCI leading to dementia (Reid & MacLulich, 2006). Future research will need to determine the difference between age-associated cognitive decline and SCI as a sign leading up to dementia.

Longitudinal vs. Cross-Sectional

Overall, the results did not vary greatly when comparing the cross-sectional and longitudinal studies. Although only three studies in this review were longitudinal, all three longitudinal studies found a positive relationship between a high level of neuroticism and SCI. It is important to recognize that not only is there a positive relationship between a high level of neuroticism and SCI, but this relationship continues longitudinally.

Clinical Implications

Nurses must be aware of the effect that personality can have on the reporting of SCI. A battery of questions about neuroticism could be included in the health history of patients of a certain age to understand how their personality might affect their SCI reporting (Luchetti, Terracciano, Stephan, & Sutin, 2015). Understanding the relationship between SCI and personality can help nurses identify earlier those patients at risk for cognitive decline (Steinberg et al., 2013). Interventions could then be implemented, such as cognitive training that has shown to have lasting benefits for individuals reporting SCI (Steinberg et al., 2013). These interventions could work to reduce cognition decline in individuals with SCI or individuals at risk for dementia (Luchetti, Terracciano, Stephan, & Sutin, 2015).

Future Research Implications

Although the relationship between a high level of neuroticism and high level of SCI has been established, the reason for this relationship is still unclear. One possible suggestion is that individuals with a high level of neuroticism worry more and thus report memory complaints when they have no actual objective impairment. Another possible suggestion is that individuals with a high level of neuroticism are more attuned to their own cognition and recognize a decline

in their memory before it shows up on an objective measurement (Snitz et al., 2015). Future research is needed regarding the relationship between neuroticism and SCI.

It is also unclear if SCI should be a diagnostic criterion for MCI because SCI may have more to do with neuroticism than actual cognition. To be used as an effective tool to diagnose MCI, SCI would need to be valid, sensitive, and specific (Slavin et al., 2009). In Studer, Donati, Popp, & Gunten (2014), 50% of their MCI patients did not report SCI which also indicates that SCI should not be used as a definitive tool in the case of objective cognitive impairment. Jorm et al. (2004) also supported the idea that memory complaints should not be used as a diagnostic criterion for MCI. Pearman, Hertzog, & Gerstorf (2014) explains that SCI may be more related to personality than actual cognitive impairment, and therefore not a good tool to diagnose MCI. However, studies also show that an individual reporting SCI may be at an increased risk of cognitive decline (Steinberg et al., 2013).

SCI measurements need to be further studied to determine the best way to accurately measure the level of SCI of an individual. This systematic review compared the studies that used fewer than three items to measure SCI to studies that used over three items to measure SCI and whether these studies found a significant relationship between SCI and personality. This study was inconclusive in whether using fewer than three items to measure SCI or over three items to measure SCI was more likely to find a relationship between SCI and personality. Establishing one consistent and effective tool to measure SCI would make it easier to compare results from different studies.

Limitations

One of the major limitations in this systematic review is the variable measurements used to assess SCI in participants. Unlike personality, there is not one widespread tool used to

measure SCI. Therefore, studies often use a variety of different items, questions, or scales to try to determine the level of SCI in an individual. Using variable measurements to determine SCI makes it harder to compare the results of each study.

Currently, SCI measurements are very inconsistent in regards to how each measurement determines SCI. For example, in this systematic review we had studies that asked a series of questions about memory concerns, studies that asked participants to rate their memory, and one study that determined SCI by participants reporting to a memory clinic but having no objective impairment on testing. Self-reporting of SCI by patients may be more clinically relevant because the SCI experienced by the patient is so profound that they feel the need to tell someone. However, self-reporting of SCI may be influenced by other factors, such as personality, anxiety, and depression. Additionally, if healthcare facilities rely on self-reporting of SCI many patients may be overlooked that do have SCI that affects their life. On the other hand, asking each patient a series of questions to determine if they experience SCI may lead to a lot of false positives. These patients may be more apt to report SCI even if it does not affect their everyday life simply because they are being prompted with questions.

When asking questions to determine SCI, the phrasing of the question may also be misleading. For example, are the questions asking the patients to determine their cognition level and memory based on those around them or on their cognition level and memory earlier in life? Alternatively, are the questions letting the patients decide how to best assess their SCI? A standardized tool needs to be created to measure SCI so the results of the SCI measurement can be more consistently compared from one study to the next.

A second limitation in this systematic review is the lack of a clear definition for SCI. Currently, a variety of different measurements are used to determine SCI. However, a standard

for determining SCI has not yet been created. The National Institute on Aging/Alzheimer's Association recommends creating a measurement that is sensitive to slight cognitive decline (Sperling et al., 2011) so that interventions can be implemented earlier before irreversible damage occurs. In order to establish measurements that are patient specific and sensitive, it may be best for healthcare providers to track long-term patient's perception of their cognition (Mark & Sitskoorn, 2013). However, if pre-existing measures are used, the target population must be an adequate fit for the measurement and the measurement must adequately cover SCI content for the target population (Rabin et al., 2015). Additionally, the pre-existing measures should be validated and appropriately measure all aspects of SCI (Rabin et al., 2015). A need for an adequate, consistent SCI measurement that is quick and simple to administer is still necessary for future use (Rabin et al., 2015).

The final limitation in this systematic review is the variable years of when the studies were conducted. Because studying the relationship between SCI and personality is a fairly new topic, the year of publication was not an exclusion criterion because the science is early. Therefore, the studies included in the review were published as late as 1986 or as early as 2015. The variable years included in this review makes it harder to compare how SCI and personality were studied thirty years ago to how it is currently being studied. However, the older articles evaluated with the WoE framework still received medium to high ratings for all three articles. Therefore, although the research articles were older, they still were pertinent to this systematic review based on their methodological quality, topic relevance, and methodological relevance.

Chapter 5

Conclusion

Overall, a higher level of neuroticism was found to be consistently associated with either the presence of SCI or a higher level of SCI. The reason for this relationship is still unclear and needs to be studied further to determine whether individuals with a high level of neuroticism are better at recognizing their cognitive decline that can't be measured objectively or more apt to complain about their memory when there is not actual cognitive impairment. Clinically, nurses need to be aware of the relationship between neuroticism and personality. Implementing a personality test to recognize neuroticism in individuals could help nurses screen which individuals will be more likely to report SCI and which individuals may not. Implementing cognitive training for these individuals could help improve their subjective and objective cognition and may have lasting beneficial effects.

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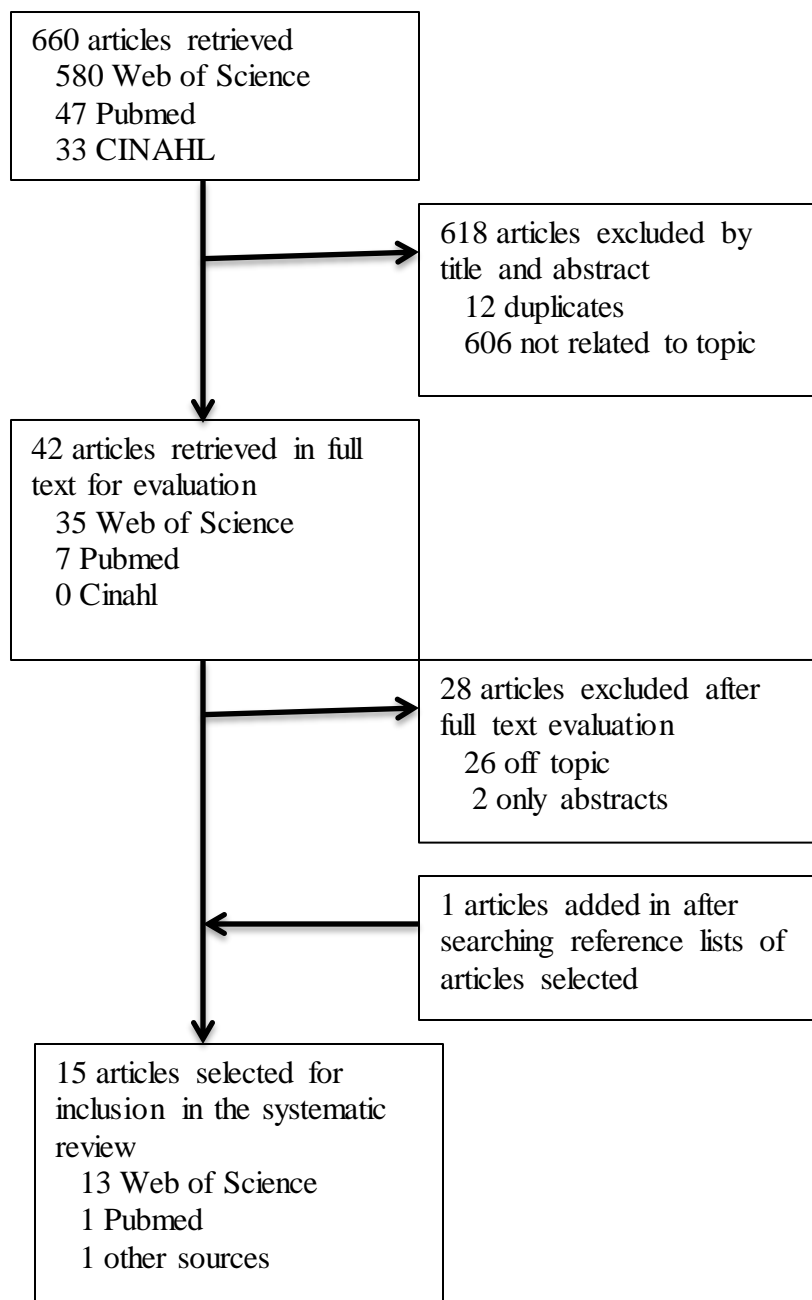
Appendix A

Databases and Search Terms Used

Databases Searched	Search Terms
Web of Science	(personality OR neuroticism OR neurotic) AND (“subjective cognitive” OR “subjective memory” OR “cognitive complaints” OR “memory complaints” OR “cognitive concerns” OR “memory concerns” OR “cognitive difficulties” OR “memory difficulties” OR “cognitive failures” OR “memory failures” OR “perceived forgetfulness” OR “cognitive functioning”)
Pubmed	(personality OR neuroticism OR neurotic) AND (“subjective cognitive” OR “subjective memory” OR “cognitive complaints” OR “memory complaints” OR “cognitive concerns” OR “memory concerns” OR “cognitive difficulties” OR “memory difficulties” OR “cognitive failures” OR “memory failures” OR “perceived forgetfulness” OR “cognitive functioning”)
CINAHL	(personality OR neuroticism OR neurotic) AND (“subjective cognitive” OR “subjective memory” OR “cognitive complaints” OR “memory complaints” OR “cognitive concerns” OR “memory concerns” OR “cognitive difficulties” OR “memory difficulties” OR “cognitive failures” OR “memory failures” OR “perceived forgetfulness” OR “cognitive functioning”)

Appendix B

Selection of Articles for Inclusion in the Review



Appendix C

Characteristics of Articles in the Review of Literature

CITATION	PURPOSE	SAMPLE, SETTING	DESIGN	INSTRUMENTS		KEY FINDINGS	STRENGTHS, LIMITATIONS
				Personality	SCI		
Luchetti, M., Terracciano, A., Stephan, Y., & Sutin, A. R. (2015). Personality and Cognitive Decline in Older Adults: Data From a Longitudinal Sample and Meta-Analysis. <i>The Journals of Gerontology Series B: Psychological Sciences and Social Sciences</i> . http://doi.org/10.1093/geronb/gbu184	To examine the association between five personality traits and three aspects of cognition: memory performance, subjective cognition, and global cognitive status	13987 w/ a 4-year follow-up period Age: >50 years 59.3% women Education = 12.6 years Drawn from HRS (longitudinal study sponsored by National Institute of Aging)	Longitudinal	Personality with Midlife Development Inventory Personality Scales	Assessed memory and perception of memory with 2 questions "How would you rate your memory at the present time?" "Would you say it is excellent, very good, good, fair, or poor?"	Higher neuroticism and predicts higher SCI Lower agreeableness predicts lower SCI Higher extraversion, openness, and conscientiousness predicts lower SCI	<u>Strengths</u> Large sample size Measured five major dimensions of personality Meta-analysis <u>Limitations</u> Tests subjective memory not subjective complaints Traits associated with worse performance completed only baseline assessment

CITATION	PURPOSE	SAMPLE, SETTING	DESIGN	INSTRUMENTS		KEY FINDINGS	STRENGTHS, LIMITATIONS
				Personality	SCI		
<p>Pearman, A., Hertzog, C., & Gerstorf, D. (2014). Little evidence for links between memory complaints and memory performance in very old age: Longitudinal analyses from the Berlin Aging Study. <i>Psychology and Aging, 29</i>(4), 828–842. http://doi.org/10.1037/a0037141</p>	<p>In this oldest-old sample, what is the cross-sectional relationship between memory performance and memory complaints</p>	<p>504 subjects Age: 70 – 100 years Male 84.7 From Berlin Aging Study Measured 4 times over the course of 6 years Stratified by age and gender with 43 men and 43 women in six age brackets (70-74, 75-79, 80-84, 85-89, 90-94, 95+ years)</p>	<p>Longitudinal</p>	<p>Neuroticism assessed using NEO-FFI</p>	<p>Three questions from BASE psychiatric battery (GMS) and one from the BASE psychological battery</p>	<p>Older adults' memory complaints strongly linked to neuroticism than to memory itself (high neuroticism may prevent older old adults from becoming habituated to memory changes: more likely to construe memory errors as highly sig.: more likely to complain about all types of things including memory: more attuned to notice memory failures)</p>	<p><u>Strengths</u> Participants measured 4 times over the course of 6 years Large sample size <u>Limitations</u> Discussed both subjects with and without dementia Brief and global measurement of memory complaint Small interval between time of measurements</p>

CITATION	PURPOSE	SAMPLE, SETTING	DESIGN	INSTRUMENTS		KEY FINDINGS	STRENGTHS, LIMITATIONS
				Personality	SCI		
<p>Studer, J., Donati, A., Popp, J., & Von Gunten, A. (2014). Subjective cognitive decline in patients with mild cognitive impairment and healthy older adults: Association with personality traits: Subjective decline in healthy older adults and MCI. <i>Geriatrics & Gerontology International</i>, 14(3), 589–595. http://doi.org/10.1111/ggi.12139</p>	<p>To investigate the difference between MCI patients and healthy older adults in SCD, and to examine whether the association of SCD with personality traits differed between the two groups</p>	<p>139 subjects 55 patients with MCI and 84 healthy older adults</p> <p>Age: > 55 years Caucasian Diagnosis of MCI with clinical dementia</p> <p>> 4 yrs school</p> <p>Healthy controls recruited through newspapers or word of mouth</p> <p>Exclusion: Psychiatric or neurological disorders, substance abuse, severe physical illness</p>	<p>Cross-sectional</p> <p>Secondary analysis</p>	<p>NEO-FFI</p>	<p>10 yes/no questions in last 6 months</p> <p>Cognitive Complaints Questionnaire (QPC)</p>	<p>Depressive affect positively related to SCD but none of the other predictors reached significance</p>	<p><u>Strengths</u> Exclusion criteria</p> <p><u>Limitations</u> Data collected at baseline assessment of a larger longitudinal study that explored the influence of premorbid personality characteristics on symptoms of MCI</p> <p>Smaller sample size</p>

CITATION	PURPOSE	SAMPLE, SETTING	DESIGN	INSTRUMENTS		KEY FINDINGS	STRENGTHS, LIMITATIONS
				Personality	SCI		
Merema, M. R., Speelman, C. P., Foster, J. K., & Kaczmarek, E. A. (2013). Neuroticism (not depressive symptoms) predicts memory complaints in some community-dwelling older adults. <i>The American Journal of Geriatric Psychiatry, 21</i> (8), 729–736. http://doi.org/10.1016/j.jagp.2013.01.059	To examine association between depressive s/s and memory complaints in older adults and that it exists beyond personality characteristics	177 subjects 115 women and 82 men Age: 66-90 years Mean: 73.6 Recruited via advertisement in local newspapers Perth metropolitan area of Western Australia Inclusive: English-speaking 121 of these participants used in another recently published study	Cross-sectional	NEO-Five Factor Inventory	General Frequency of Forgetting Scale from MFQ	Memory complaints related to neuroticism Depressive symptoms significantly predicted memory complaints when conscientiousness was taken out but accounted for almost none of the variance in complaints when neuroticism was taken out	<u>Strengths</u> Three-stage hierarchical regression analysis to examine predictive utility of depression beyond personality <u>Limitations</u> Can't rule out possibility that depressive symptoms had an influence on reporting of personality measures (could report higher levels of neuroticism because of symptoms of depression)

CITATION	PURPOSE	SAMPLE, SETTING	DESIGN	INSTRUMENTS		KEY FINDINGS	STRENGTHS, LIMITATIONS
				Personality	SCI		
<p>Steinberg, S. I., Negash, S., Sammel, M. D., Bogner, H., Harel, B. T., Livney, M. G., ... Arnold, S. E. (2013). Subjective memory complaints, cognitive performance, and psychological factors in healthy older adults. <i>American Journal of Alzheimer's Disease and Other Dementias</i>, 28(8), 776–783. http://doi.org/10.1177/153331751350481</p>	<p>To examine the relationship between SMCs and objective cognitive performance and to examine the association of SMCs with meaning-in-life and personality traits as well as negative emotional states and stress</p>	<p>125 subjects Age: >65 years 66% women 16 mean years of education 24 % African American 76% Caucasian Exclusion: No acute medical conditions/ cog. impairment</p> <p>Recruited from University of Pennsylvania Alzheimer's Disease center from normal controls and in outreach to residential setting, registry for African Americans, and community-dwelling in Philadelphia area</p>	<p>Longitudinal</p>	<p>NEO-Five Factor Inventory</p>	<p>16-item PRMQ</p>	<p>Subjective memory complaints were significantly associated with personality traits, where higher PRMQ scores were related to lower scores on extraversion, conscientiousness, and higher scores on neuroticism</p> <p>Subjective cognitive complaints were related to the personality trait of neuroticism</p>	<p><u>Strengths</u> Reports baseline data of ongoing longitudinal study of community-dwelling older adults</p> <p><u>Limitations</u> Relatively small sample of well-educated, professionally successful, reasonably health participants Selection bias (those who agreed to participate)</p>

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Eramudugolla, R., Cherbuin, N., Easteal, S., Jorm, A. F., & Anstey, K. J. (2012). Self-Reported Cognitive Decline on the Informant Questionnaire on Cognitive Decline in the Elderly Is Associated with Dementia, Instrumental Activities of Daily Living and Depression but Not Longitudinal Cognitive Change. <i>Dementia and Geriatric Cognitive Disorders</i> , 34(5-6), 282–291. http://doi.org/10.1159/000345439	To examine the longitudinal predictors of self-reported decline, including rate of cognitive change, clinical diagnosis, depressive symptoms, and personality	1973 subjects Age: 60-64 years Community-dwelling Excluded: MCI Tracked cognitive functioning over 3 waves across a period of 8 years Data collected as part of the Personality and Total Health through Life Sample randomly drawn from electoral roll of residents of city of Canberra and neighboring town of Queanbeyan in Australia	Longitudinal panel study but only measures the relationship between SCI and personality with cross-sectional measures	Neuroticism using NEO-FFI	IQCODE (short-version) Self-rated memory (1)	Neuroticism predictor of self-reported decline	<u>Strengths</u> Large sample size community-based cohort Longitudinally assessed in 3 ways Few studies have considered biomarkers of dementia as predictors of self-reported decline Well-validated instrument for SCC change <u>Limitations</u> Data collected as part of PATH longitudinal cohort study Sample attrition low Only assessed neuroticism

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<p>Slavin, M. J., Brodaty, H., Kochan, N. A., Crawford, J. D., Trollor, J. N., Draper, B., & Sachdev, P. S. (2010). Prevalence and predictors of “subjective cognitive complaints” in the Sydney Memory and Ageing Study. <i>The American Journal of Geriatric Psychiatry</i>, 18(8), 701–710.</p>	<p>The aim is to determine the point prevalence of subjective cognitive complaints (SCCs)</p>	<p>1037 subjects</p> <p>Age: 70-90 years M: 78.55 years Men: 44%</p> <p>Listed on electoral roll in Sydney, Australia, English speaking background</p> <p>Education of 3-24 years</p> <p>Exclusion: Dementia, psychotic symptoms, MS, motor neuron disease, developmental disability, Progressive malignancy</p>	<p>Cross-sectional</p>	<p>Neuroticism , Openness, and Conscientiousness from NEO FFI (1)</p>	<p>18 SCC questions devised by study group</p> <p>15 items from MAC-Q</p>	<p>Complaints correlated with neuroticism, and inversely correlated with openness, conscientiousness</p> <p>Personality was more predictive of complaints than cognitive factors (clinicians should keep this in mind when interpreting complaints)</p>	<p><u>Strengths</u></p> <p>Large sample size Use of informant</p> <p><u>Limitations</u></p> <p>Neuroimaging and or APOE e4 status not examined All participants directly questioned about cognition instead of spontaneously reporting SCCs Did not measure severity of complaints Did not measure longitudinally No formal cognitive screening for informants</p>

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<p>Ausén, B., Edman, G., Almkvist, O., & Bogdanovic, N. (2009). Personality Features in SCI and Mild Cognitive Impairment – Early Indicators of Dementia? <i>Dementia and Geriatric Cognitive Disorders</i>, 28(6), 528–535. http://doi.org/10.1159/000255104</p>	<p>To investigate patterns of personality characteristics in memory clinic patients with SCI and MCI, compared to healthy controls</p>	<p>85 subjects 24 with SCI, 35 with MCI, 26 healthy</p> <p>Age: > 55 years</p> <p>Healthy controls recruited through advertising</p> <p>Exclusion: Traumatic brain injuries Severe psychiatric disorders Somatic diseases that may cause cognitive problems Drugs</p>	<p>Cross-sectional</p>	<p>SSP (25-items in-hose structured phone interview)</p>	<p>Subjective memory subjects referred to clinic</p>	<p>Subjective cognitive complaint group and objective cognitive impairment group demonstrated increased stress, anxiety, and detachment compared to healthy controls (characteristics of a neurotic personality) Results indicate a pattern of personality features in patients with SCI and MCI (tense, worried)</p>	<p><u>Strengths</u> This study is one of the first to reveal a shift in personality in preclinical patient groups</p> <p><u>Limitations</u> 55 patients consecutively included in a European clinical multicenter study and another 9 included from clinical population Small group sizes Heterogeneity inherent in MCI connect</p>

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<p>Kliegel, M., Zimprich, D., & Eschen, A. (2005). What do subjective cognitive complaints in persons with aging-associated cognitive decline reflect? <i>International Psychogeriatrics</i>, 17(03), 499. http://doi.org/10.1017/S104161020501638</p>	<p>To find out whether SCCS reflect depressive affect and/or personality traits</p>	<p>123 AACD 291 controls</p> <p>Control mean age: 66.87 AACD Mean age: 66.92</p> <p>Data was collected as part of Interdisciplinary study on Adult development (sampling see Martin et al)</p> <p>Ind. Var.: SCCS Dep. Var.: Depressive affect/ personality trait</p>	<p>Cross-sectional</p>	<p>NEO - FFI</p>	<p>Subscale of Nuremberg Self-Assessment List (self-assessment of problems in life)</p>	<p>In control participants neuroticism related to SCCS</p> <p>In AACD (aging-associated cognitive decline) only gender and neuroticism related to cognitive control</p> <p>Neuroticism related to SCCs</p>	<p><u>Strengths</u> Medium sample size</p> <p><u>Limitations</u> Data collected as part of Interdisciplinary study on Adult development (longitudinal study)</p>

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<p>Jorm, A. F., Butterworth, P., Anstey, K. J., Christensen, H., Easteal, S., Maller, J., ... Sachdev, P. (2004). Memory complaints in a community sample aged 60–64 years: Associations with cognitive functioning, psychiatric symptoms, medical conditions, APOE genotype, hippocampus and amygdala volumes, and white-matter hyperintensities. <i>Psychological Medicine</i>, 34(08), 1495. http://doi.org/10.1017/S0033291704003162</p>	<p>To examine a range of possible determinants of memory complaints, covering psychiatric and personality factors, medical history, cognitive test performance, biological risk factors for dementia</p>	<p>2546 subjects Age: 60-64 years</p> <p>Living in Canberra and Queanbeyan</p> <p>Part of PATH through life project (longitudinal study)</p> <p>Participants recruited randomly from electoral roll</p> <p>Interviewed at home by professional survey interview or chose to interview at Centre for Mental Health Research</p>	<p>Cross-sectional</p>	<p>Extraversion, Neuroticism, and Psychotism scales of the Eysenck Personality Questionnaire – Revised</p>	<p>Memory complaints with three questions</p>	<p>Memory complaints linked to higher scores on personality traits involving negative affect</p> <p>Participants with memory complaints were found to have higher scores on personality traits involving negative affect</p> <p>Personality traits important predictors of SCC</p>	<p><u>Strengths</u> High subject sample</p> <p><u>Limitations</u> Self-reported measures of health Did not specifically state limitations</p>

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Pearman, A., & Storandt, M. (2004). Predictors of subjective memory in older adults. <i>The Journals of Gerontology Series B: Psychological Sciences and Social Sciences</i> , 59(1), P4–P6.	To identify psychological characteristics associated with memory complaints by nondemented older adults in order to achieve improved treatment of complaints	283 subjects Age: 45-94 years Mean age: 70.6 years Mean education: 14.7 years Solicited through senior groups and the Washington University Aging and Development research volunteer approval Excluded: cog. dysfunction	Cross-sectional	NEO FFI	Ability and Frequency Scale	Conscientiousness, self-esteem, and neuroticism contribute explain 1/3 or variance in subjective memory evaluation Individuals low in conscientiousness had more memory complaints High neuroticism contributed to the prediction of memory complaints Low self-esteem contributed to memory complaints	<u>Strengths</u> Confirms similar results from another study (conscientiousness with subjective memory evaluation) <u>Limitations</u> Result from stepwise regression analysis which can capitalize on chance sampling fluctuations

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Comijs, H., Deeg, D., Dik, M., Twisk, J., & Jonker, C. (2002). Memory complaints: The association with psycho-affective and health problems and the role of personality characteristics a 6-year follow-up study. <i>Journal of Affective Disorders</i> , 72(2), 157-165.	To investigate whether memory complaints in older persons without manifesting cognitive decline are assoc. with physical health, and personality characteristics AND whether personality characteristics have a modifying effect on the association of memory complaints with depressive and anxiety	2032 respondents Aged 55-58 years Part of Longitudinal Aging Study Amsterdam Examined during three observation cycles over 6 years Random sample stratified for age and sex from population in 11 municipalities in three regions of Netherlands Excluded MMSE under 24, sig. cog. decline, and only participated once in study	Longitudinal panel study	Dutch Personality Scale for Neuroticism (15 items)	Memory complaints assessed by one question ‘Do you have complaints about your memory?’)	Memory complaints associated with personality traits (high neuroticism) Personality characteristics had a modifying effect on assoc. between memory complaints and psychological and physical health problems	<u>Strengths</u> First longitudinal community based study on memory complaints <u>Limitations</u> Sample also used for NESTOR program Living arrangements and Social networks Might have included people experiencing cog. decline because they defined it as MMSE dropped 5 pt or more between two measurements Used dichotomized scales

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Ponds, R., & Jolles, J. (1996). Memory complaints in elderly people: The role of memory abilities, metamemory, depression, and personality. <i>Educational Gerontology</i> , 22(4), 341-357.	To examine the relation between memory complaints, memory performance, and metamemory variables	102 subjects 50 training participants Mean age: 63.1 years 35 women and 15 men 52 control group Mean age: 63.5 37 women and 15 men Recruited from newspaper advertisement for training program for memory complaints 56 control participants from healthy volunteers Excluded: MMSE for early stages of dementia Participants paid	Cross-sectional	Dutch Personality Scale for Neuroticism (15 items)	Metamemory Adulthood Questionnaire (rate on a Likert scale 108 statements) MAC-S (frequency of occurrence subscale) MAC-F (frequency of occurrence subscale)	High complaint group had higher neuroticism than control and normal population	<u>Strengths</u> Multivariate and additional univariate analyses of variance <u>Limitations</u> Relatively small sample size

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Jorm, A., Christensen, H., Henderson, A., Korten, A., Mackinnon, A., & Scott, R. (1994). Complaints of cognitive decline in the elderly: A comparison of reports by subjects and informants in a community survey. <i>Psychological Medicine</i> , 23, 365-374. http://doi.org/10.1017/S0033291700027343	To examine whether complaints of memory and intellectual decline are related to objective measures of memory performance, depression, anxiety, neuroticism, or education	431 females 446 males Three age strata (70-74) (75-79) (>80) for each sex Elderly persons living in community from Canberra and Queanbeyan Australia sampled from electoral roll of eligible voters	Cross-sectional	Neuroticism and Extraversion form Eysenck Personality Scale	Memory decline scale Memory complaints with three questions Global ratings of memory decline	Neuroticism associated with complaints and neuroticism measure did not contain questions about cognitive complaints	<u>Strengths</u> Use of informant Large sample size <u>Limitations</u> Informants' reports had higher correlations with cognitive complaints but smaller than reported possibly because sample came from community High refusal rate could have biased sample High refusal rate could have biased sample

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<p>Arbuckle, T. Y., Gold, D., & Andres, D. (1986). Cognitive functioning of older people in relation to social and personality variables. <i>Psychology and Aging, 1</i>(1), 55.</p>	<p>To examine age difference in performance on memory measures and in subjective ratings of memory adequacy examined in the context of social, personality, adjustment, and lifestyle measures</p>	<p>285 subjects Age: 65 – 93 years Middle and working-class backgrounds Recruitment through universities, retirement clubs, community centers All living independently in home</p>	<p>Cross-sectional</p>	<p>Eysenck Personality Inventory</p>	<p>Rated memory on nine-point scale (memory ratings score – participants self-ratings of their memory)</p>	<p>Those who rated their subjective memory higher have higher lie scores Insignificant result for the relationship between SCI and personality</p>	<p><u>Strengths</u> Larger sample size Reliability of measures <u>Limitations</u> Older study</p>

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