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Neuropsychological Assessment of Mild Cognitive Impairment in Latinx Adults: A Scoping Review

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Abstract

Objective: Latinx populations are rapidly growing and aging in the US. There is a critical need to accurately and efficiently detect those at risk for dementia, particularly those with Mild Cognitive Impairment (MCI). MCI diagnosis often relies on neuropsychological assessment, although cultural, demographic, and linguistic characteristics may impact test scores. This study provides a scoping review of neuropsychological studies on MCI in Hispanic/Latinx populations to evaluate how studies report and account for these factors in diagnosis of MCI.

Method: Studies were identified utilizing Web of Science, PubMed, and Scopus, using search terms “(Hispanic* OR Latin* OR “Mexican American* OR “Puerto Ric*” OR Caribbean)” and (“Mild Cognitive Impairment” OR MCI). Studies utilizing neuropsychological tests in diagnosis of MCI for Latinx individuals in the US were identified. Sample characterization (e.g., country of origin, literacy, language preference and proficiency), neuropsychological testing methods (e.g., test selection and translation, normative data source), and method of MCI diagnosis were reviewed.

Results: Forty-four manuscripts met inclusion criteria. There was considerable variability in reporting of demographic, cultural and linguistic factors across studies of MCI in Latinx individuals. For example, only 5% of studies reported nativity status, 52% reported information on language preference and use, and 34% reported the method and/or source of test translation and adaptation.

Conclusions: Future studies of diagnosis of MCI in Latinx individuals should report culturaldetails and use of appropriate neuropsychological assessment tools and normative data. This is important to accurately estimate the prevalence of MCI in Latinx individuals.

Keywords

neuropsychological assessment; mild cognitive impairment; Hispanics; Latinos; Latinx; Mexican Americans

Individuals of Hispanic ethnicity represent a rapidly growing demographic in the US population, with projections that they will represent 26% of the US population by 2050 (Vincent & Velkoff, 2010). Individuals self-identifying as of Hispanic ethnicity represent considerable cultural, linguistic, and demographic diversity. The Census Bureau's code list contains more than 30 Hispanic or Latino subgroups (US Census Bureau.); in 2010, 63% of this group identified as Mexican American, 9.2% as Puerto Rican, 3.5% as Cuban, and 24% as another country of origin. Of the 53.7 million Hispanics aged 5 and older living in the US in 2017, 72% reported speaking a language other than English, and (28%) reported speaking only English Individuals of Hispanic ethnicity in the US represent a broad spectrum with regard to the degree of identification with the majority US culture versus a heritage culture, ranging from recent US immigrants to families living in the US for several generations (Flores, 2017). These factors, for example, relate to disparities with regard to access to and quality of education, with Hispanic adults disproportionately impacted by limited or no access to education relative to non-Hispanics (Judd et al., 2009; Musu-Gillette et al., 2017). Of note, although the US Census and the research literature has traditionally used the term "Hispanic" or "Latino/a" to describe this population, the term "Latinx" has been proposed as a more inclusive term. We will thus use the term "Latinx" for the remainder of this manuscript.

Cultural, linguistic, and demographic factors have a known impact on neuropsychological test performance, which has been summarized comprehensively elsewhere (Cagigas & Manly, 2014; Fujii, 2017; Loewenstein, Argüelles, Argüelles, & Linn-fuentes, 1994; Rivera Mindt, Byrd, Saez, & Manly, 2010a) including their considerations in neuropsychological assessment of older adults (e.g., Rivera Mindt et al., 2019). Education has a clear and pervasive impact on neuropsychological test performance (Lezak et al., 2012). Although educational experience is typically quantified as number of years of education, disparities in educational quality are known to contribute to differences in neuropsychological test scores (Sisco et al., 2015). Literacy has been used as a proxy for educational quality (Manly, Jacobs, Touradji, Small, & Stern, 2002), and illiteracy impacts performance across all neuropsychological domains (Ardila et al., 2010). Of relevance to Latinx immigrants, educational systems provide educational content and skills (e.g., test-taking) that are culturally relevant. As such, individuals living and educated in the US may be more likely, relative to individuals living and educated in other countries, to have been exposed to culturally-salient information that aligns with items and constructs being evaluated in North American neuropsychological tests. For example, cultural factors have been shown to impact approach to speeded tests (e.g., (Agranovich, Panter, Puente, & Touradji, 2011) and cognitive abilitites associated with tests of intellectual functioning (Fasfous, Hidalgo-

Ruzzante, Vilar-Lopez, Catena-Martinez, & Perez-Garcia, 2013). Indeed, several studies have reported relationships between the number of years educated outside of the US and neuropsychological test performance (Krch et al., 2015; Razani, Burciaga, Madore, & Wong, 2007). In addition, diagnostic errors (i.e., false identification of impairment) have been demonstrated in healthy populations during use of North American neuropsychological tests for diverse populations (e.g., Daughterty et al., 2017).

The neuropsychological testing experience is impacted by cultural identity and values (Rivera-Mindt et al., 2019; Cagigas & Manly, 2014; Fujii, 2017). Acculturation, or the degree to which one identifies with the dominant versus heritage culture, has been associated with neuropsychological test performance (Razani et al., 2007), with higher performance in those with higher dominant culture acculturation (Arentoft et al., 2012) and number of years lived in the US (Gasquoine, 1999). However, operationalization of this construct has proven challenging, may be multidimensional (Huynh, Howell, & Benet-Martínez, 2009), and may not explain additional variance beyond education and language use (Mungas, Reed, Haan, & Gonzalez, 2005). Given the cultural, demographic, linguistic, and socioeconomic diversity amongst Latin American countries, it is not surprising that differences have been reported in neuropsychological test performance in healthy individuals across these countries, despite equivalent inclusion and exclusion criteria (Arango-Lasprilla et al., 2015; Rivera & Arango-Lasprilla, 2017). These findings may be particularly relevant to consider for relatively recent immigrants to the US from Latin America. Differences in neuropsychological test performance by region of origin has also been shown in an HIV+ Latinx sample (Marquine et al., 2018). Taken together, it is unclear whether and when it is appropriate to combine individuals from various countries of origin into an ostensibly homogenous group.

Language use is an important consideration in neuropsychological assessment of Latinx individuals. In bilinguals, some studies have found lower performance on some language-based neuropsychological tests relative to monolinguals (Gasquoine & Gonzalez, 2012), such as confrontation naming (e.g., Gollan, Fennema-Notestine, Montoya, & Jernigan, 2007), and higher performance on measures of attention, particularly inhibitory control (Rivera Mindt et al., 2008). Bilingualism is a possible protective factor in onset of dementia diagnosis (Bialystok, Abutalebi, Bak, Burke, & Kroll, 2016), although these findings have been inconsistent (Zahodne, Schofield, Farrell, Stern, & Manly, 2014) and may be moderated by education level (Estanga et al., 2017; Gollan, Salmon, Montoya, & Galasko, 2011). Determination of the most appropriate language for neuropsychological assessment can be complex, particularly in the context of bilinguals with comparable proficiency in both languages, and bilingual individuals may be best assessed through a combination of languages (Judd et al., 2009; Rivera Mindt et al., 2008). Guidelines for determining best language for testing are limited; studies suggest that self-rating of language proficiency can be inaccurate (Judd et al., 2009), leading some to recommend objective methods of measuring language proficiency (Miranda et al., 2016; Rivera Mindt et al., 2008). For individuals evaluated in Spanish, selection of neuropsychological tests that have been appropriately translated, culturally adapted, and sufficiently equivalent to the English-language version is a challenging endeavor, and the field has been faced by a dearth of such instruments (Rivera-Mindt et al., 2019).

In light of these complex factors, it is clear that the creation, selection, and implementation of culturally appropriate normative data is difficult, and ethnicity alone clearly does not fully capture the numerous factors impacting neuropsychological test performance in cognitively healthy individuals in these populations. Use of culturally appropriate normative data can be critical so as to reduce the risk of false-positive errors (i.e., designation of cognitively normal as impaired; e.g., Manly et al., 2005), although use of demographically corrected normative data is complex and requires nuanced decision-making (Romero et al., 2009). Differential false-positive errors by ethnicity has important and widespread research and clinical implications, ranging from policy decisions derived from prevalence estimates to conclusions drawn from investigation of mechanisms of disease process.

The above challenges may be particularly relevant to diagnostic accuracy for Mild Cognitive Impairment (MCI), given that one of the core components of this diagnosis is evidence of cognitive impairment, with generally preserved functional independence. Whereas early iterations of the criteria for this diagnosis (Petersen et al., 2001) required impairment in one or more cognitive domains, greater than expected given the patient's age and educational background, newer criteria (Albert et al., 2011) specify that cognitive decline should be observed relative to *culturally appropriate norms*. Similarly, the DSM-5's inclusion of the minor neurocognitive disorder diagnosis (American Psychiatric Association, 2013) notes an expectation of cognitive impairment around 1–2 standard deviations (SD) below expectation based on culturally appropriate norms. Despite the mandate to utilize culturally appropriate normative data, there does not exist a consensus regarding normative data or neuropsychological assessment tools that are appropriate for all Latinx older adults (Rivera-Mindt et al., 2019).

In summary, there are multiple cultural, linguistic, and demographic factors that are known to impact neuropsychological test scores in Latinx populations, and may also impact the prevalence, expression, course of age-related cognitive impairment in older adults. To our knowledge, there has been only one review published on the diagnosis of MCI in Hispanics (Rose, 2005), which did not focus on neuropsychological assessment. In light of the importance of neuropsychological assessment in diagnosis of MCI, the present study aimed to conduct a scoping review of the existing literature on the diagnosis of MCI in Latinx individuals. Specifically, we aimed to evaluate: 1) whether relevant demographic, cultural and linguistic factors were reported in studies on MCI in Latinx individuals, and 2) whether these factors were considered in MCI diagnostic methodology, particularly with regard to selection of normative data. We hypothesized that we would find variability in the reporting of relevant cultural, linguistic, and demographic information, and with regard to the extent to which neuropsychological data used for MCI diagnosis incorporated these factors. A scoping review was selected as the methodology for this research question given the methodological focus of our research questions (Peters et al., 2015). More specifically, whereas systematic reviews often seek to synthesize the strength and quality of the evidence for a particular research question, scoping reviews seek to provide an overview of a particular literature (e.g., Pham et al., 2014). The scoping review framework is often recommended when a topic has not been extensively reviewed, is complex and heterogeneous, and to address questions regarding *how* research on a particular topic is conducted (Munn et al., 2018; Pham et al., 2014). Similar to systematic reviews, scoping

reviews include rigorous, systematic methodology, with recent publication of PRISMA guidelines (i.e., Preferred Reporting Items for Systematic reviews and Meta-Analyses; (Tricco et al., 2018) for this approach.

Method

We follow the PRISMA guidelines in design and reporting of our scoping review (Tricco et al., 2018). We developed an a priori protocol after pilot testing of the literature.

Identification of relevant studies

We conducted a search of three scientific databases: Web of Science, PubMed, and Scopus (final search date: 4/30/2019). We used the following search criteria for all databases: ("Mild Cognitive Impairment" OR MCI) AND (Hispanic* OR Latin* OR "Mexican American*" OR (Puerto Ric*) OR Caribbean).

Selection criteria

We utilized the following selection criteria for studies: 1) research manuscript (e.g., excluded editorials, reviews) 2) abstract included search terms (when relevance was ambiguous based on abstract, full article text was accessed); 3) clinical/behavioral focus (e.g., excluded studies reporting exclusively biomarker analyses) 4) manuscript written in English or Spanish; and 5) study utilized neuropsychological assessment as component of MCI diagnosis (e.g., studies in which MCI diagnosis was based on cognitive screening were excluded). Neuropsychological assessment was defined as administration of greater than two neuropsychological tests and sampling at least two cognitive domains (given that the focus was on neuropsychological assessment, we did not include studies that administered 1–2 cognitive screening instruments); 6) study sample included Latinx individuals in the US; 7) analyses and/or reported outcomes included ethnicity and MCI diagnosis (e.g., we excluded papers that included Latinx individuals in the sample, but did not describe analyses or results by ethnicity). We did not limit by publication year.

Procedure

After removal of duplicates, each study was reviewed. We extracted information regarding the samples' cultural, demographic, and linguistic characteristics, in addition to MCI diagnostic methods. We extracted the following data items. With regard to sample characteristics, we identified whether the manuscript described: 1) the Latinx sample's countries of origin; 2) the proportion of the sample that was US-born, 3) the number of years lived in the US (when sample was not described as entirely US-born); 4) country of education, 5) assessment of literacy; and 6) assessment of acculturation. With regard to language functioning and use, we identified: 1) whether any information was provided with regard to language use (i.e., English and/or Spanish-speaking); 2) whether and how assessment of language proficiency and/or preference was completed; 3) language used for neuropsychological assessment and proportion of sample tested in each language; 4) method used to determine language of assessment; 5) method of test translation/adaptation for neuropsychological assessments completed in Spanish. With regard to MCI diagnostic methods, we identified: 1) method of MCI diagnosis (i.e., clinical consensus, algorithm, or

single clinician/other method); 2) whether a specific normative cut-off was reported for MCI diagnosis; 3) whether the source of the normative data was reported; and 4) whether the normative data source included a meaningful number of Latinx individuals (i.e., >10% of normative sample). Data charting was completed by one reviewer (EMB).

Procedure for charting results: For each variable of interest, the text of each manuscript was scanned. Of note, many studies utilized data from a parent cohort study and cited a prior manuscript that described procedural details pertaining to MCI diagnostic methods. When these manuscripts were referenced, the referenced study was reviewed. We also performed this additional review for charting of region of origin, but not for other sample characteristics or linguistic functioning, as the composition of the specific analytic sub-sample may have varied from previously published cohort subsamples.

Synthesis of results

For each paper reviewed, we determined whether each data item was included, categorized the included data items, then tallied the number and proportion of included papers that reported each data item.

Results

Studies identified

Figure 1 displays number of studies identified from each source. After removal of studies that did not meet inclusion criteria and duplicates, 44 manuscripts were identified for inclusion.

Characteristics of sources of evidence

Tables 1 and 2 provide information on sample characterization and linguistic functioning (Table 1) and neuropsychological assessment and MCI diagnostic methods (Table 2) for each included study. Table 3 summarizes these findings.

Synthesis of Results

Sample characteristics: Less than two thirds (57%; n = 25 of 44) of studies provided any information on the region of origin of their Latinx sample, with the remaining studies (43%; n=19 of 44) of studies providing no information beyond the description of "Hispanic." Of note, of the studies that described their sample as "Hispanic" (n = 19), a subset of these (n = 8) cited a prior study that provided additional information on the cohort's region of origin. With regard to studies that did provide information on region of origin, 32% of all included studies (n = 14 of 44) described their sample as Mexican American, 7% (n = 3 of 44) described a sample with combined, specified countries of origin, and the remainder (18%; n = 8 of 44) provided information on region of origin but did not describe the specific countries of origin. Only two studies (5%; n = 2 of 44) provided information on the nativity status of Latinx participants, only 1 study reported number of years living in the US, and no studies described the countries of education of their sample. A minority (16%; n = 7 of 44) of studies reported completion of a literacy assessment in

English, and only 2 of 44 (5%) reported completion of a literacy assessment in Spanish. No studies in this sample reported use of an acculturation assessment.

Linguistic functioning: Half (52%; 23 of 44) of studies provided any information on language preference and use for their Latinx sample, and only one study reported use of an assessment of language proficiency or preference. Few studies (30%; n = 13 of 44) reported the proportion of their sample tested in English or Spanish. When a method was specified for determining the language to be used for testing (50% of studies; n = 22 of 44), all studies described using patient preference, and no studies reported use of an objective method. Thirty-four percent (n = 15 of 44) of included studies reported information regarding the method and/or source of neuropsychological test translation and/or adaptation.

MCI diagnostic method: Most (80%; n = 35 of 44) of the studies reported use of clinical consensus method for MCI diagnosis, and the remainder reported use of an algorithm (7%; n = 3 of 44)) or other clinical assessment method (14%; n = 6 of 44). Nearly half of the studies (45%; n = 20 of 44) reported use of a specific normative cut-off for diagnosis of MCI. However, only 57% of studies (n = 25 of 44) reported the source of the normative data used to interpret neuropsychological data. Of the studies that reported the source of normative data, most(72%; n = 18 of 25) reported use of normative data that included Latinx individuals.

Exploratory analysis by publication year: To investigate whether our findings differed by publication year, particularly in light of updates to MCI diagnostic criteria (DSM-5, Albert et al., 2011), we plotted each of our data items by publication year as an exploratory, qualitative analysis (Supplemental Figures 1 through 3). This analysis did not identify discernible trends by publication year for our data elements, particularly in light of the variable and limited number of studies published each year.

Discussion

The present scoping review sought to evaluate how relevant demographic, linguistic, and cultural factors are considered in neuropsychological diagnostic procedures for MCI in Latinx populations. This is the first scoping review of the literature on neuropsychological assessment of MCI in Latinx individuals, and the first paper to systematically evaluate how demographic, linguistic, and cultural factors are reported and considered when using neuropsychological assessment for as part of diagnosis of MCI in Latinx populations. Our analysis revealed considerable variability across studies with regard to reporting of Latinx sample characteristics, linguistic functioning, and methods for translation/adaptation and interpretation of neuropsychological tests for MCI diagnosis in Latinx individuals. Approximately half of studies reported the source of normative data used for determination of cognitive impairment, despite common use of a specific normative cut-off for classification of impairment for MCI diagnosis. Based upon these findings, it is difficult to ascertain the most important gaps in the science of MCI in Latinx individuals, the extent to which extant studies will generalize to various growing Latinx populations, and whether the neuropsychological assessment tools used for diagnosis result in differential diagnostic precision across ethnic groups.

Sample characteristics

We found that studies varied considerably in descriptions of their Latinx samples, with inconsistent reporting of relevant information such as immigration status, country of origin, country of education, literacy and acculturation. These Latinx populations may vary with regard to factors such as environmental and medical risk factors and associated resource needs for dementia risk reduction, symptom management, and caregiver support. Combining Latinx groups from various countries of origin, with different levels of acculturation and educational experience, may lead to unmeasured variance in neuropsychological test performance. This unmeasured variance may lead to erroneous attributions regarding ethnic differences in study outcomes, limiting hypothesis generation that may more precisely address research questions pertaining to cognitive health disparities (e.g., (Glymour & Manly, 2008). This may also lead to within-group variability in samples that tend to be differentially impacted by limited sample size. Finally, omission of this information limits feasibility to compare and synthesize findings across studies, particularly with methodologies such as systematic reviews and meta-analyses, and to identify knowledge gaps with regard to specific Latinx populations and/or specific contextual factors that are in need of further inquiry.

Linguistic functioning

Given that only 28% of Latinx individuals living in the US identify as monolingual English speakers, linguistic functioning in Latinx populations is of particular relevance. Bilinguals and monolinguals may also differ along other dimensions that may impact neuropsychological test performance, such as acculturation, length of time in the US, and SES. Although the question of whether and how bilingualism impacts the nature and trajectory of cognitive decline is unclear, many studies have found an impact of bilingualism on cross-sectional neuropsychological test performance (Zahodne et al., 2014), although this has not been entirely consistent (Early et al., 2018). If longitudinal data are not available for interpretation of neuropsychological tests for MCI diagnosis, the use of normative data is often the primary method used to infer cognitive decline. As such, bilingualism may impact MCI diagnostic validity when cross-sectional test performance is interpreted based on normative data for monolinguals (e.g., Gasquoine & Gonzalez, 2012).

Knowledge about bilingualism is also important for determining the language of neuropsychological test administration. Language of test administration is a relatively easy decision for those that are monolingual or strongly dominant in one language, although this determination becomes more complex for balanced bilinguals (Rivera Mindt et al., 2008). We found that individual preference was overwhelmingly reported as the method used for determining the language of testing. It is unclear whether self-reported preference is ideal, particularly when individuals present with age-related cognitive decline. Future research will be important to further clarify the most appropriate methods for determining language of test administration and their potential impact on cognitive test performance.

There are many challenges that may lead to barriers in the collection and reporting of Latinx sample characteristics. Time constraints often limit the amount of information that can be collected from each individual. Information about immigration status can be sensitive and

thus may not be asked. Sample sizes of minority groups or sub-groups are often small, and it may be thus impossible to recruit sufficient numbers of individuals in order to appropriately analyze the impact of variables such as nativity status or country of origin. Due to limitations of neuropsychological assessment tools, information on specific demographic, educational, and cultural characteristics may not impact decisions on methodology (e.g., test selection) or analysis (due to limited sample size). Manuscript space limitations may also lead researchers to make difficult decisions regarding inclusion of this information. However, dissemination of this information from individual studies is important for generation of hypotheses, to facilitate synthesis of available evidence, and to continue to identify gaps in our knowledge of this population.

Neuropsychological assessment methods

Fewer than half of studies reported their method or source of test translation or cultural adaptation of tests. The method of translation and adaptation is a critical aspect of study design for readers to evaluate, as translations that were developed for individuals from different countries of origin may not be universally appropriate, particularly those developed in Spain versus Latin America. Methods of translation/adaptation may vary from publisher's translations to local translations adapted specifically for the study population of interest. For example, there are several published Spanish language versions of the WAIS (e.g., Wechsler, 2001, 2003, 2008), with different adaptations and normative data. Selection of a test created for a different Latinx population may result in bias, or varying difficulty that is unrelated to the underlying cognitive ability being assessed. For example, words from test stimuli may be of differentially low frequency or have different meanings across different countries, and instructions adapted for a different Spanish-speaking country may be difficult to understand (e.g., Rivera Mindt et al., 2019). These factors may have a critical impact on test performance, and when the method of translation/adaptation is not reported, this aspect of the science remains unclear.

MCI diagnostic methods

Most studies used a clinical consensus method for diagnosis of MCI, whereas the remainder utilized algorithm or non-consensus-based clinical decisions. Less than two-thirds of studies reported the source of their normative data, despite relatively common use of a specific normative cut-off for diagnosis. When the source of normative data is not reported, readers cannot evaluate the appropriateness of these data and potential risk for false-positive errors. Of encouragement, most of the studies that reported use of normative data did report use of norms that included Latinx, and several have developed local demographically-corrected normative data (e.g., Manly et al., 2005; O'Bryant et al., 2018).

The neuropsychology literature has pointed to the importance of consideration of multivariate base rates of low scores in improving accuracy in classification of cognitive impairment. Studies have demonstrated that it is common, in the cognitively healthy older adult population, to obtain at least one cognitive test score in the impaired range when completing a comprehensive neuropsychological assessment (Brooks et al., 2017). The probability of obtaining at least one low score is impacted by education and culture (Brooks, Iverson, & White, 2007), and is common in some Spanish-speaking populations (e.g.,

(Diego Rivera et al., 2019). Attending to multivariate base rates of low scores may improve diagnostic precision in MCI (Oltra-Cucarella et al., 2018). As such, future work should consider the use of multivariate base rates of low scores in Latinx populations toward improved diagnostic precision for MCI. Taken together, each of these issues point to the complexity of accurately classifying MCI in minority populations. Diagnosis of MCI should incorporate the diverse cultural, sociodemographic, and linguistic characteristics of an individual. The diagnostic criteria for MCI have evolved since their inception to require consideration of cultural factors in interpreting neuropsychological data. It is unknown whether diagnostic approach (i.e., consensus-based versus algorithm) is of superior diagnostic accuracy for minority populations. When MCI is diagnosed with consensus conferences, consideration of cultural factors in rendering diagnosis is dependent upon the cultural competence of the clinicians performing the diagnosis. Similarly, the precision of an algorithm approach will be dependent upon the appropriateness of methods used to derive the algorithm. This may be a fruitful avenue for future work.

Clinical and research implications and future directions

Our findings have important implications for future clinical and research endeavors. More specific characterization of Latinx samples in research studies will aid clinicians in better evaluating whether particular research findings are relevant to their individual patient. Continued identification of the impact of contextual factors, including those identified in the present review, in addition to other factors (e.g., wealth/income, attitudes and beliefs about the assessment process and age-related cognitive changes) can aid clinicians working with minority populations in providing culturally appropriate care and improved diagnostic precision. These contextual factors should represent a critical component of the clinical conceptualization process, as has been summarized comprehensively elsewhere (Fujii, 2017, Fujii, 2018).

It is important to note that Latinx populations can be considered a vulnerable population, as they are at increased risk for poor health outcomes associated with social factors such as reduced access to health care (e.g., related to SES disparities, language barrier; Waisel, 2013). They may also be at increased risk for poorer quality of care related to a dearth of culturally competent health care providers (Rivera Mindt, Byrd, Saez, & Manly, 2010b). As such, it is critically important to better understand the expression and course of age-related cognitive disorders so as to better serve them. Future work can also be directed toward exploration of whether our findings generalize to assessment of MCI in other minority groups (e.g., Asian Americans) also with heterogeneous cultural and linguistic characteristics.

Our scoping review lays the groundwork for future systematic reviews and meta-analytic efforts focused on MCI in Latinx populations. Specifically, future systematic reviews addressing research questions regarding MCI in Latinx populations should now consider the absence of this important demographic and cultural information in the literature when considering the implications and generalizability of specific findings. In addition, future synthesis efforts may be thwarted by limited ability to understand to whom particular findings are applicable.

Limitations

We may have missed studies that are relevant to this area of inquiry. However, our search terms were broad and we feel that the present analysis reflects a representative sample of studies on MCI in Latinx individuals. Second, we did not include studies that utilized cognitive screening instruments to evaluate MCI in Latinx individuals. It is unclear whether our findings would generalize to studies that utilized cognitive screenings, although given that interpretation of cognitive screening instruments would also be impacted by the factors that we reviewed, we think that the implications of our findings would generalize to the use of cognitive screens. We also did not include studies on Latinx populations living outside of the US, so it is not clear whether our findings would generalize to those populations. This scoping review protocol was not pre-registered and a single reviewer performed the data extraction process. Finally, we analyzed the reporting of many of the most widely-reported factors that impact neuropsychological test interpretation, although there are other important contextual factors relevant to Latinx populations (e.g., income/wealth, attitudes/beliefs about testing) that were not included in this review.

Conclusions

Although Latinx populations are diverse along many dimensions important for interpretation of neuropsychological data (e.g., language use, nativity status), we found wide variability in the reporting of these factors in studies of MCI in Latinx populations. Increased detail is needed in reporting of neuropsychological assessment methodology for Latinx individuals, as this will lead to better identification of knowledge gaps in our understanding of MCI in these populations. Neuropsychological assessment for diagnosis of MCI in Latinx individuals is complex and complicated by a dearth of culturally appropriate neuropsychological assessment tools and normative data. As such, researchers must make difficult decisions about how to ascertain MCI diagnosis with tools that have generally not been developed and validated for this diverse and growing population. Efforts to develop psychometrically equivalent neuropsychological assessment tools (e.g., Mungas, Reed, Crane, Haan, & González, 2004) and generate local, robust normative data (e.g., Manly et al., 2005) are critical steps in continuing to develop culturally sound methods of cognitive assessment in these populations. We also recommend that future studies offer more detailed information regarding their Latinx samples and assessment methodology, and that manuscript space is allotted to report this information.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key Points:

- Question: Have studies described methods for accounting for demographic, cultural, and linguistic diversity when using neuropsychological assessment for mild cognitive impairment in Latinx populations?
- Findings: Studies often do not report their methods for accounting for demographic, linguistic, and cultural diversity in assessment of MCI in Latinx individuals.
- Importance: Increased detail is needed in reporting of neuropsychological assessment methodology for Latinx individuals, as this will lead to better identification of knowledge gaps in our understanding of MCI in these populations.
- Next Steps: Future work is needed to further develop culturally appropriate neuropsychological assessment methods in Latinx populations.

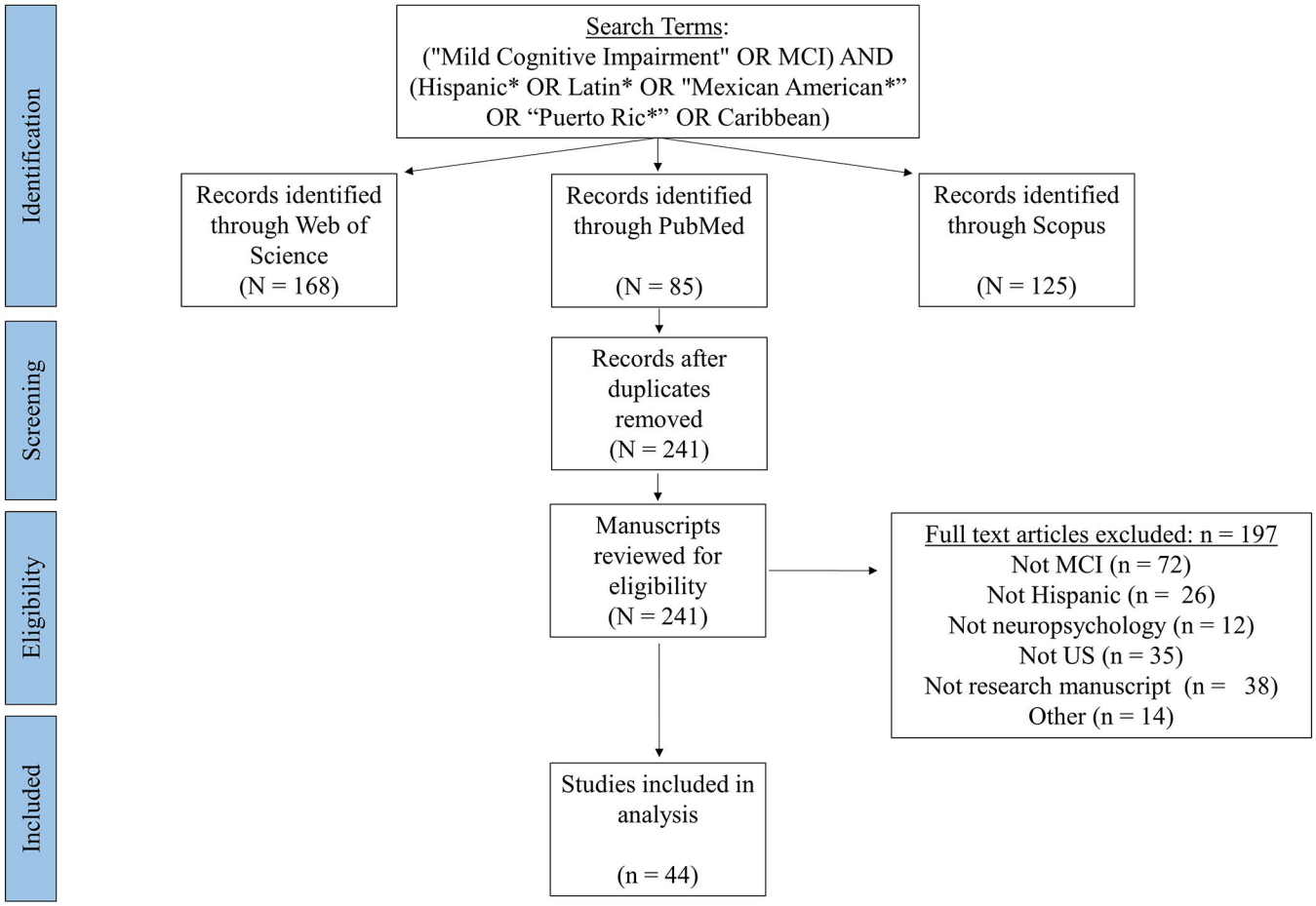

Figure 1.

Flow diagram of article identification, screening, eligibility, and inclusion. MCI = mild cognitive impairment.

Table 1.

Sample characterization and linguistic functioning in studies of MCI in Latinx individuals

Cohort	Study	Sample description	Nativity; Number of years in US	Country of education	Language use	Literacy	Acculturation
1Florida ADRC	Duara et al., 2019	Hispanic (in discussion: primarily from countries such as Cuba, Colombia, Venezuela)	NR	NR	Tested in English or Spanish (72% in Spanish)	NR	NR
Florida ADRC, Miami Beach	Rosselli et al., 2019	Immigrants to US from Latin-American countries	All immigrants; Reported mean age of immigration, number of years in US	NR	Measured bilingualism with self-report questionnaire; Tested in preferred language (62% in Spanish)	NR	NR
FRONTIER	Johnson et al., 2013	Hispanic[1]	NR	NR	NR	NR	NR
	Johnson et al., 2014	Mexican American	NR	NR	NR	NR	NR
FRONTIER, HABLE, TARCC	Johnson et al., 2015	Mexican American	NR	NR	NR	AMNART/WAT	NR
FRONTIER, TARCC	O'Bryant, Johnson, Reisch, et al., 2013	Mexican American	NR	NR	NR	NR	NR
FRONTIER, TARCC	O'Bryant, Johnson, Balldin, et al., 2013	Mexican American	NR	NR	39% tested in Spanish	NR	NR
HABLE	Johnson et al., 2016	Mexican American	NR	NR	NR	NR	NR
	Johnson et al., 2017	Mexican American	NR	NR	Tested in English or Spanish; proportion NR	NR	NR
	Johnson, Large, Izurieta Munoz, Hall, & O'Bryant, 2019	Mexican American	NR	NR	Tested in English or Spanish; proportion NR	NR	NR
	Szerlip et al., 2015	Mexican American	NR	NR	Tested in English or Spanish; proportion NR	NR	NR
NACC	(cclendon, Hernandez, Smyth, & Lerner, 2009	Hispanic	NR	NR	NR	NR	NR
	Milani, Marsiske, Cottler, Chen, & Striley, 2018	Hispanic	NR	NR	NR	NR	NR
	Pandya, Lacritz, Deschner, Woon, & Weiner, 2017	Hispanic	NR	NR	NR	NR	NR
NYU ADC	Guerrero-Berroa et al., 2014	Countries of origin specified (US/Latin America)	Reported number US-born; number of years in US NR	NR	All Spanish primary language; all tested in Spanish	NR	NR

Cohort	Study	Sample description	Nativity; Number of years in US	Country of education	Language use	Literacy	Acculturation
Predictors 3	Stem, Gu, Cosentino, Azar, & Lawless, 2017	Hispanic[2]	NR	NR	NA (methods paper)	NR	NR
SPS3	Dhamoon et al., 2015	Hispanic (note: participants from Spain were classified as nonHispanic white)	NR	NR	NR	NR	NR
	Jacova et al., 2015	Hispanics living in US were a subset of Hispanic sample. Countries of origin NR	NR	NR	Selected only monolingual (>90% Spanish) and bilingual (>50% Spanish) speakers; All tested in Spanish	NR	NR
	Pearce et al., 2014	Hispanics living in US were a subset of Hispanic sample	NR	NR	Reported proportion that spoke English and Spanish	NR	NR
SPRINT	Williamson et al., 2019	Hispanic	NR	NR	Reported tests available in Spanish	NR	NR
TARCC	O'Bryant, Johnson, Edwards, Soares, & Devous, 2013	Mexican American	NR	NR	NR	NR	NR
	Royall & Palmer, 2013	Mexican American	NR	NR	Reported tests available in Spanish, proportion tested in Spanish NR	NR	NR
	Royall & Palmer, 2014	Hispanic[1]	NR	NR	NR	NR	NR
	Royall & Palmer, 2016	Mexican American	NR	NR	Reported tests available in Spanish, proportion tested in Spanish NR	NR	NR
	Royall & Palmer, 2017	Mexican American	NR	NR	NR	NR	NR
	(Salazar, Velez, & Royall, 2014)	Mexican American	NR	NR	55% tested in Spanish	AMNART	NR
	Salazar, Dwivedi, & Royall, 2016	99% Mexican American	NR	NR	English or Spanish speaking; language of testing NR	AMNART	NR
UC Davis ADC	DeCarli et al., 2008	Hispanic	NR	NR	Reported proportion fluent in English (36%); number tested in Spanish (64%)	AMNART (subset)	NR
	Early et al., 2013	Hispanic (primarily Mexican descent)	NR	NR	Reported proportion tested in Spanish (54%)	AMNART (subset)	NR
	Farias, Mungas, & Jagust, 2005	Hispanic	NR	NR	Reported proportion tested in Spanish (46%)	NR	NR
	Farias, Mungas, Reed, Harvey, & Decarli, 2009	Hispanic	NR	NR	NR	AMNART	NR
	Hinton et al., 2010	Hispanic	NR	NR	NR	NR	NR

Cohort	Study	Sample description	Nativity; Number of years in US	Country of education	Language use	Literacy	Acculturation
	Miller et al., 2015	Region of ancestry reported (i.e., primarily North, Central, or South American ancestry; most commonly Mexico)	NR	NR	19% were monolingual Spanish speakers; proportion tested in Spanish NR	NR	NR
WHICAP	Blum et al., 2012	Hispanic[2]	NR	NR	NR	NR	NR
	Devanand et al., 2010	Caribbean Hispanic	NR	NR	Reported number that completed smell test in Spanish (n = 373 of 1092 participants)	NR	NR
	Gu et al., 2015	Hispanic[2]	NR	NR	Tested in English or Spanish; proportion not reported	NR	NR
	Luchsinger et al., 2007	Caribbean Hispanic	NR	NR	NR	NR	NR
	Manly et al., 2005	Caribbean Hispanic, from several countries of origin	NR	NR	28.7% of sample was Hispanic; 25% of full sample was Spanishspeaking; 93% of Hispanic sample tested in Spanish	NR	NR
	Manly et al., 2008	Caribbean Hispanic, from several countries of origin	NR	NR	92% tested in Spanish	NR	NR
	Manly et al., 2011	Caribbean Hispanic	NR	NR	Tested in English or Spanish; proportion not reported	NR	NR
	Rizvi et al., 2018	Hispanic[2]	NR	NR	English or Spanish speaking; language of testing NR	NR	NR
	Scarmeas et al., 2009	Hispanic[2]	NR	NR	NR	NR	NR
	Zahodne et al., 2013	Hispanic[2]	NR	NR	Sample was 36% Hispanic; 33% of sample tested in Spanish	WRAT-3/WAT	NR
Women's Health Initiative-Memory Study	Goveas et al., 2016	Hispanic	NR	NR	NR	NR	NR

Note: ADC = Alzheimer's Disease Center. ADRC = Alzheimer's Disease Research Center. AMNART = American National Adult Reading Test. FRONTIER = Facing Rural Obstacles to Healthcare Now Through Intervention, Education & Research. HABLE =Health & Aging Brain among Latino Elders. NA = not applicable. NACC = National Alzheimer's Disease Coordinating Center. NR = Not reported. NYU ADC = New York University Alzheimer's Disease Center. SPS3 = The Secondary Prevention of Small Subcortical Strokes study. TARCC = Texas Alzheimer's Research and Care Consortium. UC = University of California. WAT = Word Accentuation Test. WHICAP = Washington Heights-Inwood Columbia Aging Project (WHICAP). WRAT = Wide Range Achievement Test.

[1] Cited previous paper describing cohort as Mexican American.

[2] Cited previous paper describing cohort as Caribbean Hispanic.

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Table 2.

Neuropsychological assessment and MCI diagnostic methods in Latinx individuals

Cohort	Study	Method for selection of language of assessment	Translation/ adaptation	MCI diagnosis method	Normative data source	Normative data included Hispanics
1Florida ADRC	Duara et al. 2019	Patient preference	Cited published Spanish translations	Consensus with NACC D1 classification protocol	Cited normative data for Spanish translations	Yes
Florida ADRC, Miami Beach	Rosselli et al., 2019	Patient preference	NR	Clinician diagnosis. Impaired scores ≥ 1.5 SD below normal	NR	Assumed yes; reported that norms were corrected by age, education, and language
FRONTIER	Johnson et al., 2013	NR	NR	Clinical consensus	NR	No
	Johnson et al., 2014	NR	NR	Clinical consensus assumed but not specified in this paper. MCI generally considered when test scores were ≥ 1.5 SD below the mean.	Publisher's norms NHW; unpublished local norms for English- and Spanish-speaking Hispanics	Yes
FRONTIER, HABLE, TARCC	Johnson et al., 2015	NR	NR	Clinical consensus	NR	NR
FRONTIER, TARCC	O'Bryant, Johnson, Reisch, et al., 2013	Patient preference	NR	Clinical consensus	(Ivnik et al., 1992)	No
FRONTIER, TARCC	O'Bryant, Johnson, Balldin, et al., 2013	Patient preference	NR	Clinical consensus	Ivnik et al. (1992)	No
HABLE	Johnson et al., 2016	NR	NR	Clinical consensus. MCI generally considered when test scores were ≥ 1.5 SD below the mean.	NR	NR
	Johnson et al., 2017	Patient preference	NR	Clinical consensus	Unpublished local norms for English and Spanish-speaking Hispanics	Yes
	Johnson et al., 2019	Patient preference	NR	Clinical consensus. Impairment considered if test was ≥ 1.5 SD below age- and education-adjusted norms.	(O'Bryant et al., 2018)	Yes
	Szerlip et al., 2015	Patient preference	NR	Clinical consensus. Impairment considered if test was ≥ 1.5 SD below age- and education-adjusted norms.	Unpublished local norms for English and Spanish-speaking Hispanics	Yes
NACC	Mcclendon et al., 2009	NR	NR	Clinician diagnosis	NR	NR
	Milani et al., 2018	NR	NR	Clinician diagnosis	NR	NR

Cohort	Study	Method for selection of language of assessment	Translation/ adaptation	MCI diagnosis method	Normative data source	Normative data included Hispanics
	Pandya et al., 2017	NR	NR	Clinician diagnosis	(Shirk et al., 2011)	No (4.2% Hispanic in normative sample)
NYU ADC	Guerrero-Berroa et al., 2014	Patient preference	NR	Clinical consensus	Unclear; referenced (De Santi et al., 2008)(89% White, ethnicity NR); also referenced normative data for Wechsler for Spanish speakers	Y, reported as available for WAIS only (EIWA-III, Spain); referenced US validation study
Predictors 3	Stern et al., 2017	Patient opinion of best performance	Translated and back-translated by a committee of Spanish speakers from Cuba, Puerto Rico, Spain, and the Dominican Republic.	Clinical consensus	Source NR; describes age-, education-, ethnicity, and sex-corrected scores from WHICAP (Manly et al. (2005) assumed).	Yes
SPS3	Dhamoon et al. 2015	NR	NR	Algorithm; Impairment z ≤ −1·5 in at least 1 test domain; per Jacova et al. (2012)	Unclear; references methods from Jacova et al. (2012); (Englishspeaking sample)	No (if consistent with Jacova et al. (2012)
	Jacova et al., 2015	NR	Reported published and validated Spanish test versions with references.	Algorithm: Impairment on each test identified with z-score ≤ −1·5. Tests grouped into domains using PCA. MCI designation if impairment in ≥1 domain.	Yes; varied	Yes, for most tests
	Pearce et al., 2014	NR	NR	Algorithm: impairment defined as score of ≥1.5 SD below the mean.	Cited Jacova et al. (2012)	No, if consistent with Jacova et al. (2012)
SPRINT	Williamson et al., 2019	NR	Reported that validated Spanish translations were used when available; otherwise translated and back-translated	Expert adjudication panel	NR	NR
TARCC	Bryant et al., 2013	NR	NR	Clinical consensus	Ivnik et al. (1992)	No (0.2% Hispanic in normative sample)
	Royall & Palmer, 2013	NR	NR	NR in this paper (clinical consensus reported in other TARCC papers)	NR	NR
	Royall et al., 2014	NR	NR	NR in this paper (clinical consensus reported in other TARCC papers)	NR	NR
	Royall & Palmer, 2016	NR	NR	NR in this paper (clinical consensus reported in other TARCC papers)	NR	NR

Cohort	Study	Method for selection of language of assessment	Translation/ adaptation	MCI diagnosis method	Normative data source	Normative data included Hispanics
	Royall & Palmer, 2017	NR	NR	Clinical consensus	NR; notes that norms for MA are not available for many tests	NR
	Salazar et al., 2014	Patient opinion of best performance	NR	Clinical consensus	NR	NR
	Salazar et al., 2016	Patient opinion of best performance	NR	Clinical consensus	Ivnik et al. (1992)	No (0.2% Hispanic in normative sample)
UC Davis ADC	DeCarli et al., 2008	NR	NR	Clinical consensus. Must perform <10th percentile (age and education adjusted) in at least 1 cognitive domain.	NR	NR
	Early et al., 2013	Patient opinion of best performance	NR	Clinical consensus. Must perform <10th percentile (age and education adjusted) in at least 1 cognitive domain.	NR	NR
	Farias et al., 2005	Patient preference if bilingual	Psychometric ally matched with IRT (SENAS)	Clinical consensus; test score < 10th percentile (demographically adjusted)	(Mungas et al., 2004)	Yes
	Farias et al., 2009	NR	NR	Clinical consensus. impairment considered as approximately 1.5 SD below age-corrected norms; considering education and occupational background.	NR	NR
	Hinton et al., 2010	NR	NR	Clinical consensus	NR	NR
	Miller et al., 2015	NR	NR	“Standard criteria”	NR, but (Weintraub et al., 2009) referenced (non-Hispanic norms).	NR
WHICAP	Blum et al., 2012	Patient’s opinion of best performance (per Stern et al., 1992)	Translated & back-translated	NR; Manly et al. (2005) assumed	NR	NR
	Devanand et al., 2010	Patient’s opinion of best performance (per Manly et al., 2005)	Translated & back-translated	Clinical consensus *; 1.5 SD normative cut-off for impairment	Manly et al. (2005)	Yes
	Gu et al., 2015	Patient’s opinion of best performance (per Manly et al., 2005)	Translated & back-translated	Clinical consensus *; 1.5 SD normative cut-off for impairment	Manly et al. (2005)	yes
	Luchsinger et al., 2007	Patient’s opinion of best performance (per Manly et al., 2005)	Translated & back-translated	Clinical consensus *; 1.5 SD normative cut-off for impairment	Manly et al. (2005)	Yes

Cohort	Study	Method for selection of language of assessment	Translation/ adaptation	MCI diagnosis method	Normative data source	Normative data included Hispanics
	Manly et al., 2005	Patient's opinion of best performance	Translated & back-translated	Clinical consensus *; 1.5 SD normative cut-off for impairment	Local, robust norms, based on age, education, sex, and ethnicity	Yes
	Manly et al., 2008	Patient's opinion of best performance	Translated & back-translated	Clinical consensus *; 1.5 SD normative cut-off for impairment	Manly et al. (2005)	Yes
	Manly et al., 2011	Patient's opinion of best performance	Translated & back-translated	Clinical consensus *; 1.5 SD normative cut-off for impairment	Manly et al. (2005)	Yes
	Rizvi et al., 2018	Patient preference	Translated & back-translated	Clinical consensus *; 1.5 SD normative cut-off for impairment	Manly et al. (2005)	Yes
	Scarmeas et al., 2009	NR	Translated & back-translated	Clinical consensus *; 1.5 SD normative cut-off for impairment)	Manly et al. (2005)	Yes
	Zahodne et al., 2013	NR	Translated and back-translated	Clinical consensus *; 1.5 SD normative cut-off for impairment	Manly et al., (2005)	Yes
Women's Health Initiative-Memory Study	Goveas et al., 2016	NR	NR	Neurologist diagnosis	NR	NR

Note: ADC = Alzheimer's Disease Center. ADRC = Alzheimer's Disease Research Center. AMNART = American National Adult Reading Test. FRONTIER = Facing Rural Obstacles to Healthcare Now Through Intervention, Education & Research. HABLE =Health & Aging Brain among Latino Elders. NA = not applicable. NACC = National Alzheimer's Disease Coordinating Center. NR = Not reported. NYU ADC = New York University Alzheimer's Disease Center. SENAS = Spanish and English Neuropsychological Assessment Scales. SPS3 = The Secondary Prevention of Small Subcortical Strokes study. TARCC = Texas Alzheimer's Research and Care Consortium. WAT = Word Accentuation Test. WHICAP = Washington Heights-Inwood Columbia Aging Project (WHICAP). WRAT = Wide Range Achievement Test.

[1]Cited previous paper describing cohort as Mexican American.

[2]Cited previous paper describing cohort as Caribbean Hispanic.

*Diagnosis of dementia was ruled out through consensus conference

MCI classification was then performed through algorithm

Table 3.

Summary of results from 44 included manuscripts

Variable	N (%) reported
Latinx sample characteristics	
Provided any information on region of origin	25 (57%)
Mexican American	14 (32%)
Specified countries of origin of combined sample	3 (7%)
"*Hispanic*" only	19 (43%)
"Hispanic" only; cited prior study describing region of origin	8 (18%)
Nativity status	2 (5%)
Number of years in US	1 (2%)
Country of education	0 (0%)
Reported literacy assessment - English	7 (16%)
Reported literacy assessment- Spanish	2 (5%)
Reported acculturation assessment	0 (0%)
Linguistic functioning and language of testing	
Any information regarding language use/preference	23 (52%)
Any assessment of language proficiency/preference	1 (2%)
Reported proportion tested in English/Spanish	13 (30%)[a]
Reported method to determine language for testing	22 (50%)
Patient preference	22 (100%)[b]
Method of test translation/adaptation	15 (3%)
MCI Diagnosis method	
Clinical consensus method	35 (80%)
Algorithm (no clinician diagnosis)	3 (7%)
Other[c]	6 (14%)
Referenced specific normative cut-off for MCI	20 (45%)
Reported source of normative data	25 (57%)
Normative data included Latinx/validated in Latinx sample	18 (72%)[d]

Note:

[a] 43 studies considered; 1 study was methods paper.

[b] considered the 22 studies that reported method of selection of testing language.

[c] Other category was composed of clinician diagnosis.

[d] considered the 25 studies that reported normative data source.