THE MINI-MENTAL STATE EXAMINATION IN IRANIAN AMERICANS

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The Undersigned Faculty Committee Approves the

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The Mini-Mental State Examination in Iranian Americans

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May 27, 2010
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DEDICATION

This thesis is dedicated to my incredible parents who instilled in me the value of education. Dad, you have been an amazing role model. Leaving your home and family to come to the U.S. with a wife and child and 5,000 dollars to your name just so you could pursue your education and make a better life for your family has made me so thankful to have a father like you. If you didn’t do what you did, I would be where I am today. You have made all this possible.

Mom, your unconditional love and support has meant everything to me. You’ve always made me feel capable of achieving any goals I set for myself, and it’s because of your encouragement that I’ve achieved this goal. You’ve also shown me that learning doesn’t ever have to stop. Watching you go back to school later in life, battle with a language barrier, but fight through it all to earn your Psy D. has been inspirational.

I love you both more than anything and I thank you for allowing me this priceless opportunity.
An issue facing the field of neuropsychology is the proper assessment of cognitive function in ethnically diverse populations. This issue becomes of utmost importance when considering by the year 2055, the U.S. will not have an ethnic group in the majority. Most neuropsychological tests have been validated and normed for English-speaking Anglo-Americans; therefore, their utility with ethnically diverse populations has not been adequately researched. Numerous studies have found performance differences between ethnically diverse groups and Anglo-Americans on various neuropsychological assessments. Failure to acknowledge the influence of ethnicity on test performance could lead to misdiagnoses by clinicians. Additionally, acculturation factors have been associated with performance on neuropsychological tests, such that the more assimilated individuals from different ethnicities are into American culture, the better they would perform. Psychologists have tried to address ethnic disparities on neuropsychological measures by testing individuals in their native languages. However, few studies have examined the performance of Iranian Americans, a growing population of the U.S., on neuropsychological assessments in either English or Farsi (their native language). The Mini-Mental State Examination (MMSE) is one of the most widely used neuropsychological tests to measure cognitive function. Due to ease and rapidity of administration, as well as minimal required training, the MMSE is used by a range of health care professionals in varied settings. It has been validated and shown to be reliable in a variety of different languages. However, no studies have compared the performance of Iranian Americans on the MMSE when administered in English or Farsi. Therefore, the aim of the present study was to examine the performance of Iranian Americans on the MMSE when completed in English versus Farsi. The purpose was to see if performance would be comparable for both groups or if cultural and linguistic factors would affect their performance. In addition, factors that have been known to influence MMSE scores, such as acculturation, socioeconomic status (SES), age, and education were examined. Sixty healthy, fully bilingual Iranian Americans between the ages of 20-79 years participated in the study. Each participant was randomly assigned into a language condition. Half of the participants completed the MMSE in Farsi and half completing it in English. Participants then completed the Acculturation Rating Scale for Iranian/Persian Americans and two Scales of Subjective Social Status, which measure perceived SES, in either language, per their choice. Statistical analyses revealed no significant difference between Iranian Americans completing the MMSE in English or Farsi. Age was the only significant predictor of MMSE scores, indicating that MMSE scores significantly decreased as a function of increased age. The present results suggest the scores of Iranian Americans given the MMSE in English do not vary from those given the MMSE in Farsi. In comparison with
the established English norms, Iranian Americans completing the MMSE in English or Farsi were not uniquely different from the age and education adjusted norms. The findings of the current study add to the limited body of research focusing on Iranian Americans and support the use of the MMSE in this population.
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CHAPTER 1

INTRODUCTION

Neuropsychological tests are widely used to assess cognitive function associated with brain dysfunction. A major issue in the field of neuropsychology is the assessment of cognitive function in individuals from diverse ethnic backgrounds. With the minority population rapidly growing in the United States, this issue becomes increasingly important. Projections from the Census of Population (1990) estimate that by the year 2055, the United States will not have an ethnic or racial group in the majority (Census of Population, 1990). Most neuropsychological tests have been normed based on the performance of Anglo-American, English-speaking individuals so their use with ethnically diverse individuals that are bilingual may not accurately assess cognitive function (Harris, Tulsky, & Schultheis, 2003). While these individuals may be equally fluent in both English and their native language, their performance on cognitive tests could vary greatly from that of native English speakers, which could lead to misdiagnosis on the part of the clinician.

Ethnicity can greatly affect neuropsychological testing. Studies conducted in the United States have revealed discrepant neuropsychological test scores between ethnically diverse groups and Anglo-Americans (Boone, Victor, Wen, Razani, & Ponton, 2007; Gasquoine, 2009; Gurland, Wilder, Cross, Teresi, & Barrett, 1992; Helms, 1992; Mehta et al., 2004; Ogden & McFarlane-Nathan, 1997; Razani, Burciaga, Madore, & Wong, 2007). The test scores of minority groups such as African Americans and Hispanic Americans are lower than non-Hispanic Anglo-American Americans (Gurland et al., 1992). Boone and colleagues (2007) used archival data to examine the relationship between ethnicity and cognitive performance in a sample of individuals comprised of Anglo-Americans, African-Americans, Hispanic Americans, and Asian Americans. They found that African Americans, Hispanics, and Asians scored on average 9-10 points lower than Anglo-Americans on the Boston Naming Test, a test measuring object recognition and naming. Individuals who were native English-speakers performed significantly better on the Boston Naming Test, Verbal Fluency Test, and Digit Span Test, than those for whom English was their second language.
(Boone et al., 2007). Verbal Fluency is a test of speed and flexibility of verbal thought processes. Digit Span is a working memory task. On the Symbol Digit Modalities test, a measure of processing speed, and a modified version of the Mini-Mental State Exam, a measure of global cognitive function, older African-Americans scored significantly lower than Anglo-Americans (Mehta et al., 2004). Another study revealed that African Americans with Alzheimer’s disease scored lower on the Mini Mental State Exam than Anglo-Americans with Alzheimer’s disease (Welsh et al., 1995). Manly and colleagues (1998) found the performance of nondemented older African Americans and Anglo-Americans differed significantly on measures of category fluency, verbal abstract reasoning, figure memory, and visuospatial skills (Manly et al., 1998). A similar study by Wood, Giuliano, Bignell, and Pritham (2006), compared the scores of 414 older African American and Anglo-American women on the standard MMSE and on a version of the MMSE that adjusts scores for age and education. Each woman was matched with an interviewer of the same ethnicity. The interviewers were registered nurses trained in administering the MMSE to an older population. Even after scores were adjusted for age and education, African American women still performed significantly worse than Anglo-American women. Numerous studies have indicated that ethnicity may have an effect on performance on neuropsychological assessments.

Acculturation is a process through which members of one cultural group adopt the beliefs and behaviors of another group. Integration of one cultural group into another may be evidenced by changes in language preference, adoption of common attitudes and values, and loss of separate political or ethnic identification. An individual’s level of acculturation can affect his/her performance on neuropsychological tests. Arnold, Montgomery, Castaned, and Longoria (1994) examined the performance of a group of young Hispanic and Anglo-Americans on a subset of tests from the Halstead-Reitan, and whether their performance was affected by acculturation as measured by scores on an acculturation rating scale. All participants completed the test in English. Differences were seen when the participants were divided into subgroups based on different levels of acculturation. The three levels created were primarily Mexican, Mexican-American, and Anglo-American. Those who identified as being Anglo-American performed better on the Tactual Performance Test (TPT), the Seashore, Rhythm Test (SRT), and the Halstead Category Test (HCT) compared to those
who identified as primarily Mexican. The performance of those who identified themselves as Mexican-American fell somewhere in between the aforementioned groups. The TPT assesses memory, sensory function, motor function, and the transfer of information between the two hemispheres of the brain. The SRT examines the ability to differentiate between non-verbal sounds. The HCT evaluates abstraction ability. The findings suggest these measure may rely on cultural aspects more than the other measures in the study. In a similar study, Manly and colleagues (1998) discovered that the level of acculturation in older African-Americans, as measured by the African American Acculturation Scale, related to performance on tests of naming, memory, and figure matching. Mercer (1973) found Hispanic and African-American children who had greater “Anglo” sociocultural characteristics, or those who associated more with “Anglo” culture, scored higher on IQ tests than those who had less “Anglo” sociocultural characteristics. When using length of residency in the United States as a measure of acculturation, Touradji, Manly, Jacobs, and Stern (2001) discovered US-born older Anglo-American individuals performed better than individuals born outside of the US on neuropsychological measures of verbal reasoning, naming, and verbal fluency. Therefore, evidence suggests the more “Anglo” characteristics an ethnically diverse individual possesses, the better he/she performs on neuropsychological assessments. Conversely, the less an individual identifies with Anglo-American culture, the worse he/she will perform on these measures. Thus, individuals who still deeply identify with their native cultures may be at a disadvantage when given neuropsychological tests.

A myriad of acculturation factors have been found to correlate with various neuropsychological tests. When examining the differences between English-speaking Anglo-Americans and fluent English-speaking ethnically diverse individuals from Hispanic, Asian, and Middle Eastern backgrounds on the Wechsler Abbreviated Scale of Intelligence (WASI) Razani and colleagues found Anglo-Americans outperformed the ethnically diverse group on the verbal subscale (Razani, Murcia, Tabares, & Wong, 2006). However, both groups performed similarly on the nonverbal subscale. In the same study, the investigators examined the effects of language on performance. The ethnically diverse group was divided into two groups, one in which English was their first language, and one in which English was their second language. The two groups were then compared to the Anglo-American group on the four subscales of the WASI. The Anglo-Americans still outperformed both the English first
language and English second language groups, but there were no significant difference between the two language groups. A number of acculturation factors also were assessed to examine whether these factors affected performance. Significant positive correlations were found between level of acculturation and performance on verbal measures, as well as the percentage of time English was spoken and performance on verbal measures (Razani et al., 2006). Additionally, the more years of education obtained outside the U.S., the worse participants performed on certain verbal subtests of the WASI (Razani et al., 2006). In a more recent study, Razani et al. (2007) again examined the differences between fluent English-speaking ethnically diverse individuals from Hispanic, Asian, and Middle-Eastern backgrounds and English-speaking Anglo-Americans but this time on various measures of attention and information processing. The results were consistent with their previous study suggesting that the ethnically diverse group performed poorer than the Anglo individuals. However, for the ethnically diverse group, the higher the level of acculturation as measured by an acculturation scale, the better they performed on the Symbol Digit Modalities, Digit Span, Trail Making Test (TMT) Part B, and Stroop B. TMT Part B measures attention, psychomotor speed, and executive functioning. The Stroop B assesses executive function as well as information processing speed. Also, the more time participants spent speaking English while growing up, the less time they needed to complete the TMT Part B and Stroop B. In addition, the more education they obtained outside of the United States, the worse the ethnically diverse group scored on the tests (Razani et al., 2007).

Considering all the evidence revealing differences between ethnically diverse and Anglo-American individuals on neuropsychological assessments in combination with evidence suggesting that lower levels of acculturation are associated with poorer performance, a possible solution would be to translate the assessments into the native language of the individual being tested. However, this in itself is a difficult task. The measures not only need to be translated but also need to be consistent with the ethnically diverse populations linguistic, cultural, and educational norms; a process the World Health Organization [WHO] (1990) calls ‘harmonizing’. If translated and harmonized successfully, testing an individual with measures in his/her native language could mitigate possible cultural bias. Zhang and colleagues (1990) used Chinese versions of the Mini-Mental State Examination and Information-Memory-Concentration Test to detect cognitive impairment in
individuals living in Shanghai, China. The study reported that, although the pattern of performance differed between Chinese and Western individuals, both tests were just as effective as each other in identifying cognitive impairments.

One of the most widely used screening tests for cognitive impairment is the Mini-Mental State Examination (Folstein, Folstein, & McHugh, 1975). The test was originally designed to assess the cognitive performance of psychiatric patients in a short amount of time (Folstein et al., 1975). However, the test is now widely used in a variety of populations (Crum, Anthony, Basset, & Folstein, 1993; Mitrushina & Satz, 1991; Wood et al., 2006). The test consists of 11 scored questions examining five areas of cognition: orientation, registration, attention and calculation, recall, and language (Kurlowicz & Wallace, 1999). The maximum obtainable score is 30. Generally, a score of 23 or below suggests cognitive impairment in the patient; however, the MMSE has been shown to negatively correlate with age and positively correlate with education so these factors need to be taken into account (Crum et al., 1993).

Since its creation in 1975, numerous studies have examined the reliability and validity of the MMSE and have found it to be a highly valid and reliable measure (Anthony, Le Resche, Niaz, Von Korff, & Folstein, 1982; Dick et al., 1984; Folstein et al., 1975; Mitrushina & Satz, 1991). Folstein et al. (1975) found test-retest reliability over a 24-hour period to be .89 and over a 28-day period to be .99. Mitrushina and Satz (1991) found the MMSE to significantly correlate with performance on numerous neuropsychological measures such as the Wechsler Adult Intelligence Scale-Revised (Satz & Mogel, 1962), Rey-Osterrieth Complex Figure Test (Rey, 1941), and Boston Naming Task (Kaplan, Goodglass, & Weintraub, 1983).

The Mini-Mental State Exam is easy to administer, only takes 7-10 minutes, and can assess changes in cognitive functioning over time. In addition, it can discriminate between normal patients and those with cognitive impairments (Folstein et al., 1975). Minimal training is required to learn how to administer the MMSE. All these reasons have made the MMSE ubiquitous in emergency rooms and physician offices. Although the MMSE may be useful for the rapid assessment of cognitive function, a complete battery of neuropsychological tests are necessary to obtain a full neuropsychological profile. A few
disadvantages include its heavy reliance on verbal and vision skills as well as its dependence on strong level of English literacy (Folstein et al., 1975).

Because of its extensive use, the MMSE has been translated into over 50 languages. In spite of this, few studies exist examining the effectiveness of the translated versions. The Korean Mini-Mental State Exam (K-MMSE) translated by Kang, Na and Hahn (1997) is commonly used in Korea and has good psychometric properties (Kang & Na, 2003). DeSilva and Gunatilake (2002) examined the effectiveness of a Sinhalese version of the MMSE in detecting cognitive impairments in individuals living in Sri Lanka. After setting the cut off point to 17 in order to minimize the chances of not detecting cognitive impairment, the authors found the translated version to be sensitive in detecting decreased cognitive function.

In relation to the Middle Eastern population in the United States, specifically Iranians, there is a very limited body of research examining performance on neuropsychological tests. According to the United States Bureau of Census, in 1990 the number of people of Iranian ancestry living in the United States was 235,521. In the span of ten years, that number increased 43% to 338,226 (Census of Population, 1990). If this trend continues, the number of Iranians living in America in 2010 will be 483,663. While these individuals may only make up .1% of the population, Iranians have woven themselves into the fabric of America. Still, few studies have examined neuropsychological assessments in this population.

One study by Besharat (2007) investigated the psychometric properties of a Farsi version of the Emotional Intelligence Scale-41 (Austin, Sakolfske, Huange, & McKenny, 2004) and found it to be internally consistent with a Cronbach’s alpha coefficient of 0.89. To test for validity, the researchers examined the correlation between the measure and the participants’ grade point averages, which yielded a significant correlation of 0.48. Another study reported the Farsi translation of the Kiddie Schedule for Affective Disorders and Schizophrenia-Present and Lifetime (K-SADS-PL) to also be reliable and valid (Ghanizadeh, Mohammadi, & Yazdanshenas, 2006). These two studies showed translated versions of an intelligence scale and a clinical assessment to be effective with an Iranian population; however, no studies have examined the performance of Iranian Americans on other neuropsychological tests in English or translated into Farsi. Even though the MMSE has been translated into Farsi and is available through the Psychological Assessment Resources website, it has never been used in any studies to date.
While Iranians are an ethnic minority in the United States, they are rarely associated with some of the stereotypical characteristics of minority groups including limited opportunities for success, education, wealth, etc. Education is highly valued by Iranians. In the U.S., 86% of Iranian Americans are high school graduates and 50% are college graduates (Census of Population, 1990). In addition to education, a strong work ethic is greatly prized. Approximately 84% of Iranian American men and 47.6% of Iranian American women are employed (Waldinger & Bozorgmehr, 1996). The vast majority of working Iranians are employed in higher white-collar work such as managerial and professional jobs (Waldinger & Bozorgmehr, 1996). Numerous studies have shown certain demographic factors to be associated with performance on neuropsychological assessments. Typically, lower education, older age, and low socioeconomic status (SES) have been associated with lower MMSE scores (Brayne & Calloway, 1990; Crum et al., 1993). Even though Iranian Americans are typically educated and work white-collar jobs, it cannot be assume that their performance on a neuropsychological measure normed on Anglo-American English-speaking individuals, such as the MMSE, would be similar to that of Anglo-Americans because of cultural factors involved.

The inhabitants of the United States come from a variety of different ethnic backgrounds. Similar to Anglo-Americans, these individuals from different ethnicities obviously seek medical evaluation for cognitive dysfunction. For clinicians to properly address the needs of these individuals, their ethnic backgrounds must be taken into account. Specifically, when giving neuropsychological assessments that have been normed based on English-speaking Anglo-Americans, it is important to consider the influence of ethnicity on performance. Many studies have investigated this influence and have found it to be a significant factor. Besides ethnicity, factors such as age, education, and socioeconomic status also can affect performance on neuropsychological tests. One solution has been to translate neuropsychological measures into the native language of the individual; however, few studies have examined the effectiveness of the translated versions. Compared to other ethnic minority populations in the U.S., there has been little focus on Iranian Americans in the neuropsychological literature. These individuals are a growing population that have established themselves in the U.S., but rarely are studies conducted with Iranian Americans. No studies to date have examined the performance of Iranians on the MMSE, let alone their
performance on a Farsi version of the MMSE. Therefore, the primary aim of the present study was to examine the differences between the performances of bilingual Iranian Americans on the MMSE when completed in English versus Farsi to determine whether performance would be comparable for both groups or if cultural factors would affect their performance on the English version. Certain questions on the English MMSE, such as the question that asks participants to repeat “no ifs, ands, or buts”, lack cultural significance for the Iranian American population; therefore, some questions on the English MMSE needed to be modified for the Farsi version in order to be more culturally relevant. Past research also has shown factors such as acculturation, socioeconomic status (SES), age, and education can affect performance on neuropsychological measures. For this reason, the influence of these factors on MMSE performance was also examined.
CHAPTER 2

METHODS

PARTICIPANTS

Sixty healthy, bilingual Iranian Americans between the ages of 20-79 years ($M = 42.78$ yrs, $SE = 1.96$) were recruited for the present study. All participants were recruited through the Iranian American community. One participant was excluded from the study because the researcher observed that the individual was inebriated. The average years of education obtained by the participants was $15.88$ years ($SE = .39$). All participants were screened for self-reported head injury, neurological disorder, history of stroke, history of drug or alcohol abuse, or history of psychological problems. Any participants who reported having any of the above mentioned were excluded from the study. All participants were self-reported bilingual, indicating they were fluent in both English and Farsi. If this criterion was not met, the participant was excluded from the study. Of the 59 participants, 34 were men and 25 were women. Participants were randomly assigned into a language condition, either Farsi or English. Those in the Farsi condition completed the MMSE in Farsi, and those in the English condition completed the MMSE in English. Participants needed to be fully bilingual so that language preference did not need to be taken into consideration when participants were randomly assigned into a language condition. In most clinical and research settings, individuals would be given the English MMSE, assuming they could speak English, regardless of language preference. The participants then completed the Acculturation Rating Scale for Iranian/Persian-Americans, and two Subjective Social Status scales (SSS) in their self-reported preferred language. Language preference was determined by a question asking, “Which language do you prefer, English or Farsi?” on the intake form participants completed prior to taking any tests. Participants were allowed to complete the rest of the measure in their self-reported language preference in order to obtain the most accurate measure of acculturation and SES. Twenty-six participants elected to complete the tests in Farsi, while 33 completed the tests in English.
INSTRUMENTS

**Mini Mental State Examination (MMSE):** All participants were administered the Mini Mental State Examination (Folstein et al., 1975). Half of the participants received the English MMSE and half received the Farsi MMSE. Although most of the Farsi version of the MMSE was directly translated from the English version, some questions were modified to be more culturally relevant to an Iranian American population. The MMSE assesses aspects of cognitive function such as orientation, registration, attention and calculation, recall, and language. The test consists of 11 questions, with a total possible score of 30. Typically a score of 23 or lower indicates cognitive impairments; however, the MMSE has been age and education normed. Performance has been shown to correlate negatively with age and positively with education. Therefore, it is important to interpret scores on the MMSE by identifying where the score of the individual falls within a percentile that is based on his/her age and level of education (Crum et al., 1993). The MMSE required approximately 7-10 minutes to complete.

**Acculturation Rating Scale for Iranian/Persian-Americans (ARSIPA):** All participants also completed the Acculturation Rating Scale for Iranian/Persian-Americans adapted by Razani et al. (2006) from the Acculturation Rating Scale for Mexican Americans (ARSMA; Cueller, Harris, & Jasso, 1980). This is a 20-item scale that assesses four acculturation domains: (1) language familiarity, usage, and preference; (2) ethnic identity and generation; (3) reading, writing, and cultural exposure; and (4) ethnic interaction. Participants are asked to rate the questions on a 5-point Likert scale where 1 equals original heritage/language and 5 equals Anglo/English. Two additional questions were included as part of the total score and three questions were reduced from a 5-point Likert scale to a 3-point Likert scale. A score of 22 indicates the lowest level of acculturation while a score of 104 indicates highest level of acculturation. In cross-cultural research it is often necessary to translate measures (Peña, 2007). The ARSIPA was translated into Farsi using techniques to ensure linguistic equivalence *(Standards for Educational and Psychological Testing, 1999)*. The English version was directly translated into Farsi. A second translator then back translated the Farsi version of the scale back into English. Discrepancies between the Farsi version and back-translated English version were discussed and resolved. Participants completed the ARSIPA in their self-reported preferred language.
**Scale of Subjective Social Status (SSS):** The Scale of Subjective Social Status was developed to assess an individual’s sense of where he/she stands within his/her community and within the entire U.S. population based on different socioeconomic status indicators (Adler & Stewart, 2007). Participants were shown a picture of a “social ladder” and were asked to place an “X” on the rung that they believed represented where they stood in their communities. The community ladder was purposefully ambiguous so participants can define “community” however they please. Participants were shown another “social ladder” and were asked to place an “X” on the rung they believed represented where they stood in the U.S. as a whole. The U.S. social ladder was designed to be less subjective and more a measure of general status in the U.S. Both scales ranged from 0-10. Since a Farsi version of the SSS did not exist, the SSS was translated into Farsi by the researcher. Then a second translator back translated it into English. Differences between the two versions were discussed and resolved. The SSS was completed in the participants’ self-reported preferred language.

**Symbol Digit Modalities Test (SDMT):** The SDMT is a non-verbal test of processing speed (Smith, 1982). Participants are required to match nine symbols to corresponding numbers (1-9). They are given 90 seconds to manually fill in as many boxes containing symbols with their matching numbers. This measure was chosen as a comparison to the MMSE because it is a non-verbal measure that does not rely on language proficiency. As a result, instructions were verbally given to the participants in English.

**PROCEDURES**

All procedures were reviewed and approved by the SDSU Institutional Review Board. Participants first completed an informed consent form. Next, they were given an intake form to complete. Each participant was administered the MMSE by the researchers in either English or Farsi, depending on which language he/she was randomly assigned. Then each participant completed the Acculturation Rating Scale for Iranian/Persian-Americans, the U.S. scale of Subjective Social Status, and the community scale of Subjective Social Status in that order, in their self-reported preferred language. Although the community SSS was obtained from each participant, due to the subjectivity of how participants might have defined the word “community” it was left out of the analyses. In order to achieve the most accurate measure of acculturation and SES, participants completed the rest of the measures in
their preferred language. Finally, participants completed the Symbol Digit Modalities Test. Total testing time took approximately 30 minutes.
CHAPTER 3

HYPOTHESES

1. MMSE scores for bilingual Iranian-Americans completing the test in English will be lower than those completing the test in Farsi.

2. MMSE scores of bilingual Iranian-Americans completing the test in English or Farsi will be higher in individuals with more years of education; however, this relationship will be stronger for those individuals completing the test in English.

3. MMSE scores of bilingual Iranian-Americans completing the test in English or Farsi will decrease as a function of increased age; however, this relationship will be stronger for those individuals completing the test in English.

4. Level of acculturation will influence MMSE scores. The greater the acculturation score, the better participants will perform on the English version of the MMSE.

5. The U.S. SSS will influence scores on the MMSE. The higher participants place themselves on the U.S. social ladder, the better they will perform on the English version of the MMSE.
CHAPTER 4

RESULTS

Table 1 shows the mean and standard error for demographic variables and scores on the MMSE for participants completing the MMSE in English or Farsi. In addition, the mean and standard error for the ARSIPA, U.S. SSS, and SDMT are shown. Participants performed well on the MMSE with an average of 28.65 points out of a total of 30 points. Acculturation level, as measured by the ARSIPA, was relatively low. The average across groups was 56.42 points out of 104. A score of 104 indicates highest level of acculturation into U.S. culture and a score of 22 indicates lowest level of acculturation. Scores for the U.S. SSS ranged from 3 to 10, with 10 being the highest the individual could place him/herself on the ladder.

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<tr>
<td>Age</td>
<td>41.57 (3.33)</td>
<td>44.03 (3.48)</td>
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<tr>
<td>Education (in years)</td>
<td>15.87 (0.44)</td>
<td>15.90 (0.67)</td>
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<tr>
<td>MMSE</td>
<td>28.63 (0.27)</td>
<td>28.90 (0.29)</td>
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<tr>
<td>ARSIPA</td>
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<td>57.66 (2.58)</td>
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<tr>
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<td>SDMT</td>
<td>49.77 (3.44)</td>
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Chi square analysis revealed both the English and Farsi groups had similar proportions of males and females, $x^2 (1) = .47, p = .493$ and $x^2 (1) = .36, p = .549$ respectively. Multiple one-way analysis of variance (ANOVA) were used to examine
difference between the groups. The groups were similar on age, $F(1, 57) = .26, p = .610$, education, $F(1, 57) = .001, p = .970$, ARSIPA, $F(1, 57) = .44, p = .509$, U.S. SSS, $F(1, 57) = .02, p = .889$, and SDMT, $F(1, 57) = .81, p = .373$.

Hierarchical linear regression was conducted with gender entered in step 1, language, ARSIPA, U.S. ladder, age, and education entered in step 2, and the interactions of language x ARSIPA, language x U.S. ladder, language x age, and language x education entered in step 3. In step 1, gender was not a significant predictor of MMSE scores, $R^2 = .01, F(1, 57) = .51, p = .48$. In step 2, language, ARSIPA, U.S. ladder, age and education did significantly predict MMSE scores, over and above gender, $R^2 = .40, \Delta R^2 = .395, \Delta F(5, 52) = 6.88, p < .001$. In step 3, the interactions did not explain any variance over and above the variables entered in step 2, $R^2 = .42, \Delta R^2 = .42, \Delta F(4, 48) = .30, p = .87$. The step 1 model with gender explained 1% of the variance in MMSE scores. The step 2 variables explained 40% of the variability in MMSE scores. Finally, the interactions of each predictor variable with language, entered in step 3, accounted for 42% of the variability in MMSE scores. Of all the variables, age was the only significant predictor of MMSE scores, $B = -.05, t = -4.55, p < .001$. The regression models are summarized in Table 2.

A one-way ANOVA was used to examine the relationship between the SDMT and the language condition. The results revealed no significant differences between the English and Farsi group on the SDMT, $F(1, 57) = .81, p = .373$. Not only was there no significant difference between the two groups on the MMSE, a measure that requires English language proficiency, but also there was no difference between the groups on the SDMT, a non-verbal neuropsychological measure of processing speed.

To examine the internal consistency for the English and Farsi versions of the ARSIPA, a Cronbach’s alpha coefficient was calculated for all 23 items on the scale. The alpha coefficients for the English and Farsi ARSIPA were .91 and .92 respectively. The findings support the reliability of the ARSIPA and the Farsi translation of the ARSIPA.

The performance of the English and Farsi groups on the MMSE was compared to the published age- and education-based norms to get an idea of the cognitive function of Iranian Americans compared to Anglo-Americans, as measured by the MMSE. Figure 1 shows the performance of participants in the present study completing the MMSE in English or Farsi compared to the median, age adjusted norms for the MMSE. The data indicate that the
Table 2. Summary of Hierarchical Linear Regression for Gender, Language, ARSIPA, U.S. Ladder, Age, and Education, Language x ARSIPA, Language x U.S. Ladder, Language x Age, and Language x Education Predicting MMSE Scores

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>Step</th>
<th>Predictor variable</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>B</th>
<th>$\beta$</th>
<th>$p$</th>
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</tr>
<tr>
<td>MMSE</td>
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<td>.395</td>
<td>.057</td>
<td>.038</td>
<td>&lt;.001</td>
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<td></td>
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<td>.125</td>
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<tr>
<td></td>
<td></td>
<td>ARSIPA</td>
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<td>.094</td>
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<tr>
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<td>U.S. ladder</td>
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<td>-.068</td>
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<tr>
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<tr>
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</tr>
<tr>
<td>MMSE</td>
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<td>Lang x Ed</td>
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<td>.006</td>
<td>.068</td>
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</table>
Figure 1. Performance on the MMSE in English or Farsi compared to the median, age adjusted norms.

The performance of Iranian Americans on the MMSE fell in the normal range after being age adjusted.

Figure 2 shows the performance of participants completing the MMSE in English or Farsi compared to the median, education adjusted norms for the MMSE. The data indicate that the performance of Iranian Americans on the MMSE was within the normal, education adjusted range.

Figure 2. Performance on the MMSE in English or Farsi compared to the median, education adjusted norms.
CHAPTER 5

DISCUSSION

The current study compared the performance of bilingual Iranian Americans on the English version of the MMSE and on the Farsi version of the MMSE. The study also examined the influence of acculturation, socioeconomic status, age, and education on MMSE scores. In addition, the effects of these variables on the relationship between MMSE scores and the language in which individuals completed the test were assessed.

Neuropsychological measures that are not culturally biased are extremely important for generating an accurate diagnosis. Inconsistent with previous findings and with what Hypothesis 1 postulated, no significant differences were found between the Farsi and English language groups on performance on the MMSE. Iranian Americans performed similarly on the MMSE regardless of whether they completed the test in English or Farsi. Even though the sample of participants was small, after taking into consideration the almost identical means for the English and Farsi groups, it is estimated that a sample of over 1000 participants would have been needed to detect significant group differences. This finding suggests the English and Farsi group are not samples drawn from two different populations, but come from the same population. While this is an important finding of the study, the question still remains regarding whether the performance of Iranian Americans on the MMSE is an accurate reflection of cognitive function. To address this issue, the performance of Iranian Americans completing the MMSE in English or Farsi was compared to published age- and education-based norms for the English MMSE (Crum et al., 1993). Iranian Americans performed comparable to the published norms, indicating normal cognitive function as measured by the MMSE. However, larger scale studies are necessary to strengthen these findings. In spite of this, the MMSE is a brief, singular estimate of cognitive function and should not be the sole measure used when making a diagnosis. A battery of tests is needed to fully assess all aspects of cognition.

In accordance with part of Hypothesis 3, the present results found age to be a significant predictor of MMSE scores, indicating that MMSE scores decreased as a function of increased age. This finding is in accordance with previously published studies (Brayne &
Calloway, 1990; Crum et al., 1993; Kraemer, Mortiz, & Yesavage, 1998; Mungas, Marshall, Weldon, Haan, & Reed, 1996). However, this is the first study to report this finding with Iranian Americans. Nevertheless, poorer performance of older individuals compared to young individuals does not necessarily indicate cognitive dysfunction. Scores on the MMSE need to be interpreted based on where the individual falls within a percentile according to age-adjusted norms.

Contrary to what was hypothesized, there was no evidence to suggest acculturation level, education, or U.S. SSS were significant predictors of scores on the MMSE, nor that they were related to the language condition. Past research has shown acculturation ratings, level of education, and socioeconomic status to be related to performance on neuropsychological measures (Arnold et al., 1994; Brayne & Calloway, 1990; Manly et al., 1998; Mercer, 1973), so these findings are unexpected. However, the average acculturation rating of the sample was 56.42 out of 104, implying the level of assimilation into U.S. culture was generally low across all participants. This might explain the non-significant relationship between acculturation and MMSE scores because most of the acculturation scores were clustered around the mean score. Interestingly, even with the low level of acculturation, participants still scored within the normal range on the MMSE. This finding may suggest that level of acculturation is not a significant factor for performance on the MMSE for Iranian Americans compared to other variables such as age. Also, the sample was well educated, which is a fairly accurate representation of the population of Iranian Americans (Census of Population, 1990). The average participant completed approximately 16 years of education. The high level of education could explain why education level also was not a significant predictor of MMSE scores. The U.S. SSS evaluates an individual’s perception of his/her socioeconomic status relative to the U.S. population. As a result, it is highly subjective and may not be an accurate reflection of his/her actual SES. Therefore, in the present study it is difficult to evaluate the relationship between SES and performance on the MMSE. Future studies should use measures of SES that are less subjective and are a more accurate representation of actual SES.

The SDMT was originally included in the study as a non-verbal measure of cognitive function. Since the MMSE relies so heavily on English language proficiency, this non-verbal measure was included to determine the contribution of language to group differences on the
MMSE. However, no group differences were found between the English and Farsi group on the MMSE or the SDMT.

The study also offers preliminary evidence for good internal consistency of the English version and the Farsi translation of the ARSIPA. Both the English and Farsi versions of the ARSIPA were reliable measures based on the calculated Cronbach’s alpha coefficient. However, the current study did not assess the validity of the ARSIPA. Future studies are needed with larger samples in order to establish the psychometric properties of the ARSIPA. This study also was the first to use the Farsi version of the MMSE and two translated subjective social status scales. Future research with larger samples should continue to evaluate these tests in order to determine their psychometric properties.

A limitation of the present study involved differences between the translated version of the MMSE and the English version. Since this was the first study to use any of the Farsi versions of the tests, some translations did not match the English versions. When comparing the English and Farsi versions of the MMSE, the English version provided participants with two opportunities to obtain the full points on the serial 7’s question. In the English version, if the participant made a mistake counting backwards by 7’s, the participant was asked to spell the word “world” backwards. In the English version, the higher of the two scores was used in the calculation of the overall score. However, in the Farsi version, the participants were not provided a reverse spelling option if the serial 7’s task was not completed correctly. The Farsi MMSE used in the current study is the published translation distributed by Psychological Assessment Resources so its accuracy is imperative. This finding suggests the translated Farsi MMSE may not be entirely analogous to the English MMSE, which may cause issues in assessing cognitive function as measured by the MMSE.

While the findings of the current study add to the literature and may have significant clinical implications, as noted above, many questions still remain and additional research is necessary. Since participants were tested only on the MMSE, future research studies should examine the performance of Iranian Americans on other neuropsychological assessments to examine whether differences emerge as a result of cultural factors. Future studies also should investigate whether individuals from other ethnic minorities that are educationally and economically advantaged perform differently from education and economically matched Anglo-Americans on neuropsychological assessments. This may answer the question of
whether differences among ethnic minorities and Anglo-Americans on neuropsychological assessments are restricted to cultural factors, or if factors such as education and socioeconomic status are responsible for the disparities.

The Iranian American population is one that is rarely the focus of research studies. However, it is a fast growing population of the United States, and similar to other populations within the U.S., seeks medical evaluation for issues such as cognitive dysfunction. According to past research, numerous neuropsychological measures have been shown to be culturally biased in evaluating individuals from different ethnic backgrounds (Boone et al., 2007; Gasquoine, 2009; Gurland et al., 1992; Helms, 1992; Ogden & McFarlane-Nathan, 1997; Mehta et al., 2004; Razani et al., 2007). Contrary to these findings, the current study has shown the MMSE may be an effective measure with Iranian Americans. It was also the first study to find age as a predictor of MMSE scores in an Iranian American population. However none of the other variables examined contributed to differences between the English and Farsi groups. The findings of the current study add to the limited body of research on Iranian Americans; however, future studies involving a larger sample are necessary to validate the present findings.
REFERENCES


