Risk of Undiagnosed Dementia and Care-Seeking Behaviors Among Asian Americans with Limited English Proficiency

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A thesis

submitted in partial fulfillment of the

requirements for the degree of

Master of Public Health

University of Washington

2022

Committee:

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Program Authorized to Offer Degree:

Health Systems and Population Health

University of Washington

Abstract

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Objective: This study evaluated the relationship between limited English proficiency (LEP) in Asian Americans (AAs) and risk of undiagnosed dementia, memory-related visits, and cognitive testing. Methods: We conducted secondary analyses of data originally extracted for the Electronic Health Records (EHR) Risk of Alzheimer's and Dementia Assessment Rule (eRADAR) study. The current study included 6,075 AA participants (mean age 69.8 years; 58.5% female) over the age of 65 who were members of Kaiser Permanente Washington from 2013-2019. The exposure variable was LEP or English-preferred language status, which was determined by the individual's preferred language according to electronic health records (EHR). One primary outcome was the risk of undiagnosed dementia as determined by eRADAR scores, a validated method of using routinely collected EHR data to estimate a person's risk of having undiagnosed dementia. Other outcomes were whether the individual had at least one memory-related visit and whether they had at least one cognitive test performed. Results: The LEP group (n = 1,321) had a lower estimated risk of undiagnosed dementia (mean eRADAR score = 0.009; SD = 0.016) than the English-preferred group (n = 4,754; mean eRADAR score = 0.011; SD = 0.016; p-value = < 0.001). The two groups had similar rates of having at least one memory-related visit (LEP group = 4.2%; English-preferred = 5.2%; p-value = 0.079). Fewer individuals in the LEP group had a cognitive test performed (0.7%) as compared to the English-preferred group (1.7%; p-value = 0.006). Conclusions: The study found lower risk of undiagnosed dementia as well as lower prevalence of cognitive testing among AAs with LEP. The results could indicate either a truly lower risk of undiagnosed dementia or an underutilization of healthcare among AAs with LEP.

Background and Significance

In the United States (US), there were an estimated 7.9 million older Americans living with dementia as of the 2014 US Census Data Release, and it is estimated that nearly half of all dementia cases remain undiagnosed (Savva & Arthur, 2015; The Administration for Community Living, 2017). Dementia is a neurodegenerative process that results in progressive and irreversible damage and loss of neurons that impair brain function and is notable for memory disorders, overall decline in cognitive functioning, changes in thought and personality, and impaired logic and reasoning (Moller, 2019). Additionally, dementia often leads to behavioral changes that result in a disruption to activities of daily living (Robinson, 2015). Dementia is a condition that millions of older adults will face, and it has life altering implications that may be greater if it is undiagnosed.

The population of those 65 and above is rapidly growing (WHO, 2021). In the US, the fastest growing ethnic population is Asian Americans (AAs), with growth of 38.6% from 2010 to 2020 (The Administration for Community Living, 2017). It is expected that by 2060 there will be approximately 94.7 million AAs over age 65 in the US (The Administration for Community Living, 2017).

Among the older Asian American population, 60% have limited English proficiency (LEP) (Schafer et al., 2017; Zong & Batalova, 2015). Limited English proficiency is an obstacle to effective healthcare and has been shown to be associated with less favorable health outcomes (Becerra et al., 2015; Berdahl & Kirby, 2019; Fischer et al., 2021; W. Kim & Keefe, 2010). AAs with LEP are less likely to have a medical care home or a routine checkup (Gulati & Hur, 2022; Jang & Kim, 2019). A regular medical care home offers a singular location for most basic healthcare needs and is an environment in which a person sees the same doctor or group of doctors and has an established relationship with provider(s). When patients have an established relationship with their provider(s), they are more likely to trust them when seeking help for memory concerns and the physician is more likely to notice cognitive declines when they have a partnered relationship with their patient (Tilburgs et al., 2018). In the absence of a regular medical care home, AAs with LEP are at risk for missing preventive health services that may help to detect dementia earlier (Gulati & Hur, 2022).

An additional obstacle to receiving a dementia diagnosis among AAs with LEP could be health literacy. Studies have shown that having LEP is associated with higher prevalence of low health literacy (Sentell & Braun, 2012). Health literacy is defined as the skills required to navigate the healthcare system and make informed decisions about one's health; reading, writing, communication and technological ability all contribute to health literacy skills (Hersh, L., Salzman, B., Snyderman, 2015). With low rates of health literacy, this population is at risk of misunderstanding key aspects of aging and dementia-related health information that lead to delays in seeking healthcare support or intervention (W. Kim & Keefe, 2010; Sentell & Braun, 2012). Lacking knowledge of dementia may result in delays in seeking care for dementia-related symptoms or not seeking care at all.

There are additional reasons that may lead Asian Americans to delay seeking care for cognitive impairment and dementia-related symptoms; the foremost of these is the shame and stigma associated with mental illness in some Asian cultures (Jones et al., 2006; Kang & Kang, 1995; Ta Park et al., 2018; Woo, 2017). Studies have found that Asian Americans stigmatize dementia as a mental illness and that this stigma creates a barrier to early diagnosis and optimal care (Ayalon & Areán, 2004; Jones et al., 2006; H. J. Kim et al., 2019; Ta Park et al., 2018; Woo, 2017). In collectivist cultures, such as Asian cultures, there is value placed on "face", which is related to one's ability to maintain positive self-image and good social standing (Kong et al., 2010). In such cultures, losing face is viewed as a personal failure, and this attitude creates a pressure to maintain an outward appearance of being mentally sound; as a result, the value of saving face creates an additional barrier to pursuing evaluation for dementia in the early stages (Jones et al., 2006; Kong et al., 2010). Additionally, other traditional Asian beliefs, like filial piety, may impact the timeliness of a dementia diagnosis. Filial piety is the belief that families are duty-bound to care for their aging loved ones and in that sense of duty, family members may postpone initiation of care for their elderly loved ones in an effort to perform their duties proudly and maintain face for their loved one (Kong et al., 2010; Ta Park et al., 2018; Tsoy et al., 2021; Woo & Mehta, 2017). In summary, cultural factors may inhibit AAs from seeking care for dementia-related symptoms leading to under recognition of dementia and lower rates of reported dementia symptoms.

Very few studies have evaluated dementia incidence among AAs (Hayes-Larson et al., 2022; Mayeda, E.R. et al.,2017; Mayeda, E.R. et al., 2016; Tsoy et al., 2021). Furthermore, there are no studies that evaluate risk of undiagnosed dementia in the AA population, nor is there any literature on risk of undiagnosed dementia among AAs with LEP. Considering the numerous challenges that Asian Americans with LEP face regarding health outcomes, health literacy, and cultural beliefs, understanding the risk of undiagnosed dementia and dementia care-seeking behaviors in AAs with LEP is critical to adequately supporting this underserved population.

Recent methodologies have been developed that seek to estimate risk of undiagnosed dementia using data from electronic health records (EHR). Barnes et al. developed and validated an algorithm called the Electronic Health Records (EHR) Risk of Alzheimer's and Dementia Assessment Rule (eRADAR) which utilizes commonly captured EHR data to estimate people's risk of having undiagnosed dementia (2020). This risk prediction tool may be useful in evaluating the risk of undiagnosed dementia in AAs with and without LEP. The aims of this study are to 1) compare eRADAR risk scores (as indicators for the risk of having undiagnosed dementia) between the LEP group and the English-preferred group; 2) to compare the prevalence of outpatient visits for memory-related concerns between the two groups; and 3) to compare cognitive testing prevalence between groups.

Methods

Study Setting

Study data were collected from Kaiser Permanente Washington (KPWA), a not-for-profit, integrated healthcare system in the Pacific Northwest that provides insurance coverage and medical care, including primary and specialty care services, to approximately 680,000 members in Washington state. The data utilized from the EHR include demographics, diagnosis codes, medication fills, healthcare utilization and vital signs as well as cognitive test information. Institutional Review Board (IRB) approval for using this data was obtained from the KPWA IRB and reviewed and approved by the University of Washington IRB.

Study Design

The study was a retrospective cohort study utilizing secondary data collected for validation studies of the eRADAR algorithm. The primary exposure was an individual's preferred language, identified from EHR data, and the outcomes include eRADAR risk scores, care-seeking behaviors in the primary care environment (as measured through outpatient visits with memory-related concerns) and scores from commonly utilized cognitive tests. Additionally, an index year was assigned to each participant and is defined as the first year that a participant meets criteria for inclusion and the first year in which they contribute to the study; the index date for each participant is January 1st of the index year.

Study Population

The study sample was drawn from the population studied in the eRADAR validation study (Coley et al., 2022). Inclusion criteria for the eRADAR validation study included: age 65 or older, enrolled in KPWA for at least one year prior to index year, has not received a dementia diagnosis or dementia medication in the prior two years, and is not receiving hospice care (Coley et al., 2022). For this study, we restricted the sample to people who identified their primary race as Asian and their preferred language as English or any Asian language.

The original study created a separate cohort for each calendar year, and individuals could be represented in multiple years. To avoid repeated measures, this study only included an individual's first year appearing in the study cohort, so that participants would appear only once.

Exposure

The main independent variable (exposure of interest) was language preference. In this study, preferred language for receiving medical care, as selected by the participant, was considered a proxy for limited English proficiency, whereby a participant who prefers their native language for medical encounters is presumed to have some degree of LEP. Individuals who selected English as their preferred language were assumed to have better fluency and increased comfort speaking English. The group of people preferring English served as the referent group to whom the LEP group was compared.

Primary Outcomes

The primary outcomes included (1) eRADAR risk scores, which were interpreted as representing a person's risk of having undiagnosed dementia; (2) prevalence of having at least one memory-related outpatient visit (identified using International Classification of Disease (ICD), version 9 and 10 codes); and finally, (3) dementia severity determined by cognitive testing scores.

The eRADAR risk score served as a proxy measure to identify the risk of undiagnosed dementia. The eRADAR risk score is calculated with an algorithm that uses routinely collected EHR data to produce a value indicating one's risk of undiagnosed dementia. The algorithm is based on 31 different predictors (see Table 1) including demographic characteristics, diagnoses, medications, vital signs, and healthcare utilization information. All baseline information and characteristics were taken from the EHR data in the two years prior to the index year. For each study year, on January 1st of the index year we evaluated members that met inclusion criteria and looked back two years in the EHR to calculate the eRADAR score. The eRADAR risk score is a continuous variable. Higher eRADAR scores indicate that a person is at higher risk of undiagnosed dementia; scores range from 0-1 and are interpreted as percentages. For example, a risk score of 0.018 can be interpreted as meaning that for a group of people with characteristics yielding this score, 1.8% of them would receive a new diagnosis of dementia in the following 12 months. The risk score has been validated internally using data from a cohort study set within KPWA and externally in both the KPWA and University of California San Francisco health systems (Barnes et al., 2020; Coley et al., 2022). We hypothesize that there will be a higher risk of undiagnosed dementia in the LEP group.

To determine if AAs with LEP present less frequently with memory-related concerns as compared to individuals who prefer English, we examined outpatient visits with diagnosis codes for memory problems or concerns over a three-year follow up period after the index date, following an individual's index date. The list of diagnosis codes can be found in Table 2. We constructed a binary variable in which the presence of one or more visits with any ICD-9/10 code matching our list, was coded as one (1) and the absence of any such visits was coded as zero (0). We hypothesized that AAs with LEP will have a lower prevalence of memory-related visits than the English-preferred group.

We sought to examine cognitive test scores within a three-year follow up period after the index date, because they are markers of cognitive function, in order to determine if LEP participants would present with lower test scores as a proxy measure for more severe dementia. The Montreal Cognitive Assessment (MoCA) is a measure of global cognition that is not routinely performed in the primary care setting but may be used when a patient reports a memory concern. The test has five components that evaluate language, memory, visual and spatial thinking, reasoning, and orientation skills. The maximum total score is 30, and a score ≥ 26 is considered normal. When administered, this test takes approximately 10-15 minutes. The test is available in 35 languages, including Chinese, Korean and Vietnamese. The Mini Mental State Exam (MMSE) is another brief cognitive test that is widely used to evaluate cognitive status. The test has 11 questions that measure five different areas: orientation, registration, attention and calculation, recall, and language. The maximum score is 30, and the cutoff for ruling out dementia is 27; the test takes roughly 5-10 minutes to administer. At KPWA, results from these cognitive tests are documented in a flowsheet from which scores can be readily extracted. This variable is a proxy measure to assess disease progression. We hypothesized that AAs with LEP would present for care later in the course of developing dementia and thus would have lower scores than the English-preferred group. Since this measure is not routinely collected on all patients, we planned to analyze cognitive test scores in a subgroup limited to people who have these scores available.

Data Analysis

Initial analyses included descriptive tables to summarize characteristics of the cohort, including diagnoses that are incorporated in the eRADAR algorithm model as predictor variables. We calculated counts and proportions for categorical variables and mean and standard deviation for continuous variables. For all statistical tests, a p-value of <0.05 was interpreted as indicating statistical significance.

To analyze the relationship between the eRADAR risk score, a continuous variable, and LEP status, we calculated the mean and standard deviation for each exposure group. A two-sided t-test was used to determine the p-value.

We evaluated the outpatient visits by searching for specific diagnosis codes (see Table 2) that pertain to memory loss to evaluate the association between LEP and care-seeking behavior. We calculated the number and proportion of people in each group with at least one visit for a memory concern. To test for statistical significance, we utilized a chi-square test without Yate's correction for continuity.

This study aimed to examine MoCA and MMSE test scores as a proxy for disease severity, assuming that lower scores indicate more advanced dementia. Once data were pulled, we observed that very few people had undergone cognitive testing, and the sample size was too small for detailed analyses. Instead, we chose to analyze the frequency of having any cognitive testing performed. As a result, we changed the third hypothesis and expected to see a lower prevalence of cognitive testing among the LEP sample. To determine statistical significance, we performed a chi-square test without Yates's correction for continuity.

Results

Patient characteristics

The sample baseline characteristics are shown in Table 3. The 6,075 study subjects had a mean age of 70.0 years, and most were between the ages of 60-69 years old (64.3%) or 70-79 (25.3%). The LEP group was slightly younger than the English-speaking group with a mean age of 69.0 and 70.0 years, respectively. The LEP group also included fewer people aged 80 and above (6.6% vs. 11.4% in the English-preferred group). The distribution of gender was similar across groups.

The predominant language spoken in the sample was English, with a total of 4,754 (78.3%) English-speaking people, followed by Vietnamese (7.2%; n = 439), Korean (6.6%; n = 398), Chinese Mandarin (3.7%; n = 224) and Tagalog, a Filipino dialect (2.4%; n = 147). All other Asian languages combined accounted for 1.9% of the total sample (n = 113).

eRADAR Predictor Variables

A total of 17 eRADAR predictor diagnoses were evaluated (Table 4). For most of the variables, the prevalence was similar across the two groups. Six diagnoses, however, showed differences. Among the LEP population, there was a lower prevalence of congestive heart failure, chronic pulmonary disease, solid tumor with metastases, fluid and electrolyte disorders, and gait abnormality. Most notably, renal failure prevalence in the LEP sample was 8.0% compared to 12.7% of the English-preferred group, with a p-value of <0.001. Weight loss was slightly higher among the LEP group (2.0%, compared to 1.2%) in the English-preferred group (p-value = 0.016).

eRADAR Score

The mean eRADAR scores are shown in Table 5. The mean eRADAR score for the English-preferred group was 0.011 (SD = 0.016), while for the LEP group the mean was 0.009 (SD = 0.011; p-value = <0.001). The results indicate that older adults who preferred English had a higher estimated risk for undiagnosed dementia than the LEP group.

Memory-Related Visits

Table 6 shows the prevalence of memory-related visits for the study. There were a total of 113 memory-related visits among the LEP group and 556 in the English-preferred group. Some patients saw a provider multiple times for memory concerns, and the values ranged from one memory-related visit to up to 13. The number of individuals with at least one memory-related visit for the English-preferred sample was 255 (5.4%) and for the LEP group, 55 (4.2%; p-value = 0.079).

Cognitive Testing

Of the English-preferred group, 81 individuals (1.7%) had at least one cognitive test, while 9 individuals (0.7%) of the LEP group had a test performed (p-value = 0.006). The predominant test was the MMSE (91.6% of tests performed).

Discussion

In this study we assessed the relationship between LEP status and the following characteristics in a sample of Asian Americans from an integrated health system: risk of undiagnosed dementia as measured by eRADAR scores; having at least one memory-related visit; and having at least one cognitive test performed.

The results showed that the LEP group had lower mean eRADAR scores as compared to the English-preferred group. We interpret this as suggesting that the AA LEP group has a lower risk of undiagnosed dementia, and this contradicts the hypothesis that the LEP group would have higher scores than the English-preferred group. There was no statistically significant difference in the number of individuals with at least one memory-related visit between groups;

therefore, the findings of the study did not support the hypothesis of the second aim, which presumed a lower rate of memory visits among the LEP group. Finally, there was lower prevalence of cognitive testing among the LEP group, in the context of a low number of total cognitive tests in the full sample, which indicates that the hypothesis for the third aim was supported by the results.

Additionally, we found a lower prevalence of comorbid conditions that are eRADAR predictor variables and lower eRADAR scores in the LEP group. One variable that may be affecting the results is age. Age is a very strong risk factor for dementia. The LEP group was younger than the English-preferred group and had a lower distribution of people above the age of 80 and therefore we might expect to see lower risk scores (Kawas et al., 2000). Additionally, the lower comorbidity burden for six of the predictor diagnosis variables in the LEP group might indicate that the sample is healthier than the English-preferred group as measured by having fewer risk factors for dementia.

An alternative explanation is low healthcare utilization in the LEP group affecting all three aims of this study. Lower utilization of the healthcare system will result in fewer diagnoses (i.e., chronic conditions may not be accurately documented), which would result in lower eRADAR risk scores (aim 1). Additionally, underutilization of the healthcare system could result in having fewer medical encounters and therefore fewer opportunities to discuss memory concerns and to conduct cognitive testing.

Low healthcare utilization is a barrier to effective coding of chronic health conditions, to reporting memory concerns and to receiving cognitive testing (Berdahl & Kirby, 2019; Jang & Kim, 2019; Shi et al., 2009; Ye et al., 2012). All individuals included in the sample had the opportunity to access healthcare within the KPWA system, but the results indicate that there may be differing utilization of the available care. AAs with LEP may be accessing the healthcare system less as a result of their own concerns regarding their language proficiency or due to a lack of knowledge of the American healthcare system (Cook et al., 2017; Ponce et al., 2006).

Underutilization may also be a result of favoring one's own cultural approach to symptoms like alternative and complementary medicine (Mehta et al., 2007; Tsoy et al., 2021). Thus, factors such as language, familiarity with the healthcare system, and personal and cultural beliefs regarding treatment may result in underutilization of healthcare in general, leading to an observed lower risk of undiagnosed dementia, and a lower prevalence of cognitive tests in the LEP group.

Low dementia health literacy may be another explanation for the lower rates of cognitive testing and low rates of memory visits (Ayalon & Areán, 2004; Morhardt et al., 2010). Studies have found that low dementia health literacy impacts individuals' understanding of the early signs of dementia and is associated with a lack of understanding of the progression of the disease (Aihara & Maeda, 2020; Morhardt et al., 2010; Sun et al., 2021). Limited understanding may lead to seeking care less often, or later in the disease process, resulting in fewer documented memory concerns, less opportunity for cognitive testing, and delayed or missing dementia diagnoses.

The lower prevalence of cognitive testing among the LEP sample may indicate a potential difference between groups in how cognitive tests are administered. There are several reasons why clinicians may not be performing cognitive tests equally. It may be that as a result of a patient's LEP status, clinicians are concerned about the patient's understanding the test and that results would reflect decreased comprehension versus decreased cognition (Erdodi et al., 2017). There may also be limitations to performing cognitive tests on patients who do not speak English. Language discordance may be a barrier even though the MoCA and MMSE can be offered in Asian languages. If there is not a language concordant administrator, it may be difficult to conduct the test in a patient's own language. Also, the use of a translator in administering a cognitive test may take up much more appointment time than practitioners desire and instead they prefer to use the time to address other patient health concerns. In addition, most interpreter services are offered over the phone, which would make administration of specific aspects of the test difficult (Casas et al., 2012). Challenges with interpreter services, language concordance, and concerns about test comprehension could be explanations for the apparent disparity in the way in which cognitive tests are administered in the LEP group.

Existing literature has not directly examined LEP status and risk of undiagnosed dementia in Asian Americans. However, one population-based study evaluated LEP status among immigrants and found that the odds of having undiagnosed dementia was higher among immigrants, as compared to US-born individuals, and that LEP status had an odds ratio of 2.95 (95% CI 1.70-5.12; p-value = <0.001) (Franco & Choi, 2020). The findings from the current study are inconsistent with the findings of Franco and Choi (2020) in that this study's LEP sample had lower estimated risk of undiagnosed dementia.

Key differences exist between the two studies that may explain the inconsistent results. Franco and Choi (2020) studied a different population, had a sample of participants that self-selected to participate and LEP was measured differently. Their study did not focus specifically on Asian Americans, and their sample included only a small proportion (6.6%) of "other" races that grouped together Indian, Asian and Native Hawaiian participants and therefore, their Asian American population was likely very small (Franco & Choi, 2020). Their study may also have some selection bias in that their participants opted-in to the study; the current study was a data only study and the sample consisted of all KPWA individuals that met study inclusion criteria. When participants opt-in to studies, they may be more affluent, have higher education, be community-dwelling, generally healthier and have reliable transportation, which may exclude individuals that would be more representative of the US older adult population. Additionally, Franco and Choi (2020) may have had a more accurate measure of LEP status because they questioned each participant about their ability to speak and understand English and assigned LEP status to those who answered, "not well" or "not at all". In contrast, in the current study we defined LEP status based upon the participants' self-reported preferred language for medical encounters. Furthermore, the outcomes were measured differently across studies: in the study by Franco and Choi, they assigned undiagnosed dementia status when a participant or proxy reported a physician determined diagnosis of dementia and in the present study we aimed to estimate a participant's risk of undiagnosed dementia in cases where a diagnosis is absent from the EHR by algorithm (Franco & Choi, 2020). Due to these differences, direct comparison of results is difficult. The findings of the current study are novel and add to the existing literature by looking specifically at Asian Americans and their preferred language for medical encounters in the evaluation of risk of undiagnosed dementia, memory visits and cognitive testing. Further research that builds on the strengths of the two studies may be needed to further elucidate the relationship between LEP and undiagnosed dementia.

Study Limitations

There are limitations to a study of this nature. The main exposure variable, limited English proficiency, is measured from a person's self-selected preferred language for medical encounters and is thereby a proxy measure for LEP. There may be misclassification of this variable. It is possible that a person chooses Korean as their preferred language, but that they are also highly capable of having a medical discussion in English; or that a person selects English as their preferred language but requires an interpreter and are thus technically of limited English proficiency. This measure could therefore be strengthened in future studies if it could be quantified in a standardized way. In the potential misclassification of this variable, the study is at risk for non-differential misclassification which will on average bias results toward the null since we lack a direct and objective measure of an individual's English proficiency.

Additionally, there may be misclassification of one of the outcome variables, visits related to memory concerns. Ideally, for this outcome we would like to know whether a patient comes to any medical provider complaining of memory concerns. If patients and family members bring up the issue, it is possible it could be documented in the visit note but no memory-related diagnosis code is assigned for the visit. The use of the diagnosis codes is an imperfect measure for this outcome and serves as a proxy. The most likely scenario is that this misclassification would be non-differential with respect to memory visits, and if so, it would be expected to bias our results toward the null, meaning that any relationship that may exist is minimized in the results. A future study might consider a mixed methods approach and employ qualitative interviews to gain insights directly from participants about when and how they bring memory concerns to their providers.

Finally, an additional limitation is potential misclassification of the outcome variable for risk of undiagnosed dementia. This study is attempting to understand who is likely to have undiagnosed dementia. In an ideal study, each study participant would be routinely screened for cognitive impairment, providing "gold standard" measures of who actually has dementia. We could then identify those with dementia but missing an EHR diagnosis. Given that there are no routinely performed cognitive assessments in our data, because the data reflect real-world clinical care, this study is instead using the eRADAR risk score as a proxy to measure undiagnosed dementia. Without the presence of a definitive diagnosis, we are merely estimating who may be most likely to have undiagnosed dementia. The result is that we may have non-differential misclassification of the dementia risk variable, which would tend to bias our results to the null, reducing the apparent association between LEP status and risk of undiagnosed dementia. This is a notable limitation to the present study.

Study Strengths

Strengths of the present study include the large sample size, which increases the reliability and precision of our results. Another major strength of this study is the retrospective cohort design. This allows us to look back at EHR patterns in order to determine and calculate individuals' risk of undiagnosed dementia with the eRADAR algorithm, as well as to ascertain memory visit and cognitive testing information that have already been collected in the EHR. This limits the risk of the Hawthorne effect, which is when study participants behave differently because they know that they are being observed, and therefore, this design provides a more accurate picture of normal care-seeking patterns among participants (Sedgwick & Greenwood, 2015). Finally, the fact that our study captures language preference in the context of a medical setting is a strength that enables the study to focus on the encounters where language proficiency would most greatly affect receiving a dementia diagnosis.

Future Research Directions

Future studies are needed to determine if AAs with LEP are truly at lower risk of undiagnosed dementia and generally healthier than their English-preferred counterparts, or if they underutilize the US healthcare system. Studies should aim to quantitatively assess LEP status by utilizing standardized language proficiency tests and to perform routine cognitive testing in order to definitively diagnose dementia. In addition, it would be valuable for future studies to examine through mixed-methods approaches the cultural reasons for why and when AAs with LEP pursue medical intervention for their memory concerns.

Conclusion

In this study, Asian American older adults with LEP had a lower risk of undiagnosed dementia, lower rates of cognitive testing and similar rates of memory-related visits compared with Asian American older adults who prefer to speak English. The study results point to two potential interpretations: either that AA older adults with LEP are a generally healthier population, or that they underutilize the healthcare system. Factors such as language discordance, unfamiliarity with the US healthcare system and practices, a preference for one's own cultural approach to memory-related concerns, and low dementia health literacy may all lead to underutilization of the healthcare system for dementia-related symptoms. This underscores the importance of continued research about language, cultural background and dementia literacy in the increasingly diverse US population and specifically among Asian Americans.

Tables

Table 1: Definitions for eRADAR Score Predictor Variables

Predictor	**Definition**	
Diagnoses, past 2 years	**ICD-9 codes used**	**ICD-10 codes used**
Congestive heart failure	398.91, 402.11, 402.91, 404.11, 404.13, 404.91, 404.93,428.0-428.9	I09.9, I11.0, I13.0, I13.2, I25.5, I42.0, I42.5–I42.9, I43.x, I50.x, P29.0
Cerebrovascular disease	430.x-438.x	G45.x, G46.x, H34.0, I60.x–I69.x
Diabetes, any	250.x	E10.x, E11.x, E12.x, E13.x, E14.x
Diabetes, complex	250.40-250.73, 250.90-250.93	E10.2–E10.8, E11.2–E11.8, E12.2– E12.8, E13.2–E13.8, E14.2–E14.8
Chronic pulmonary disease	490-492.8, 493.00-493.91, 494.x-505.x, 506.4	I27.8, I27.9, J40.x–J47.x, J60.x–J67.x, J68.4, J70.1, J70.3
Hypothyroidism	243-244.2, 244.8, 244.9	E00.x–E03.x, E89.0
Renal failure	403.11, 403.91, 404.12, 404.92, 585.x, 586.x, V42.0, V45.1, V56.0, V56.8	I12.0, I13.1, N18.x, N19.x, N25.0, Z49.0-Z49.2, Z94.0, Z99.2
Lymphoma	200.00-202.38, 202.50-203.01,203.8-203.81, 238.6, 273.3,V10.71,V10.72,V10.79	C81.x-C85.x, C88.x, C96.x, C90.0, C90.2
Solid tumor without metastases	140.0-172.9,174.0-175.9,179-195.8, V10.00-V10.9	C00.x-C26.x, C30.x-C34.x, C37.x-C41.x, C43.x, C45.x-C58.x, C60.x-C76.x, C97.x
Rheumatoid arthritis	701.0, 710.0-710.9, 714.0-714.9, 720.0-720.9, 725.x	L94.0, L94.1, L94.3, M05.x, M06.x, M08.x, M12.0, M12.3, M30.x, M31.0–M31.3, M32.x–M35.x, M45.x, M46.1, M46.8, M46.9

Predictor	Definition	
Weight loss	260-263.9	E40.x-E46.x, R63.4, R64
Fluid and electrolyte disorders	276.0-276.9	E22.2, E86.x, E87.x
Blood loss anemia	280	D50.0
Bipolar disorder and psychoses	295x, 296.0x, 296.1x, 296.4x, 296.5x, 296.6x, 296.7x, 296.8x, 297x, 298x	F20.x, F22.x-F25.x, F28.x, F29.x, F30.2, F31.2, F31.5
Depression	296.2, 296.3, 300.4, 301.12, 309.0, 309.1, 311	F20.4, F31.3-F31.5, F32.x, F33.x, F34.1, F41.2, F43.2
Traumatic brain injury	800-804, 850-854, 905.0, 907.0, 959.01, V15.52	F07.81, S02.x, S06.x, S07.1, S09.8x, S09.90x, Z87.820
Tobacco use (past or current)	305.1, V15.82	F17.2, F17.2x (anything after the 2), Z87.891, Z72.0
Atrial fibrillation	427.3X	I48, I48.x (all codes included under I48)
Gait abnormality	781.2	R26 and all within it
Vital signs		
BMI < 18.5 kg/m^2	Based on most recent measurements of weight and height. Patients without BMI measured in the prior 3 years were assumed to not have BMI < 18.5.	
BMI ≥30 kg/m^2	Based on most recent measurements of weight and height. Patients without BMI measured in the prior 3 years were assumed to not have BMI ≥30.	
High blood pressure (>= 140 mm Hg systolic or >= 90 mm Hg diastolic)	Based on most recent systolic and diastolic blood pressure measurements. Patients without blood pressure measurements in prior 3 years were assumed to not have high blood pressure.	
Health care utilization, past 2 years [a]		
≥ 1 outpatient primary care visit		

Predictor	Definition
≥ 1 emergency department visit	Not portable across health systems
Home health services	Not portable across health systems
≥ 1 physical therapy visit	
≥ 1 cognitive evaluation visit	Not portable across health systems
Medications, past 2 years	
Antidepressants	amitriptyline, amoxapine, bupropion, citalopram, clomipramine, desipramine, desvenlafaxine, doxepin, duloxetine, escitalopram, fluoxetine, fluvoxamine, imipramine, isocarboxazid, maprotiline, milnacipran, nortriptyline, paroxetine, phenelzine, protriptyline, rasagiline, selegiline, sertraline, tranylcypromine, trimipramine, venlafaxine, vilazodone, vortioxetine
Sleep aids	alprazolam, chlordiazepoxide, clonazepam, clorazepate, diazepam, diphenhydramine, eszopiclone, flurazepam, hydroxyzine, lorazepam, meprobamate, midazolam, oxazepam, ramelteon, suvorexant, temazepam, triazolam, zaleplon, zolpidem

[a] In the original study used to develop and validate eRADAR, utilization data for specialty care encounters was used to define these variables. Utilization data was also used for KPWA validation analyses to coincide with the original definitions.

(Coley, et al., 2022)

Table 2: Diagnosis codes for memory concerns

Description	ICD-9 Code	ICD-10 Code
Retrograde amnesia		R41.2
Memory change, memory deficit, memory problem, or other amnesia		R41.3
Age related cognitive decline		R41.81
Subjective memory complaints; cognitive impairment		R41.89
Mild memory disturbance		F06.8
Mild cognitive impairment		G31.84
Neurodegenerative cognitive impairment, also “degenerative disease of nervous system, unspecified”		G31.9
Memory impairment, memory loss	780.93	
Altered mental status	780.97	

Results Tables

Table 3: Summary of Patient Characteristics

	English N = 4754 n (%)[a]	LEP N = 1321 n (%)	Total N = 6075 n (%)	p-value [b]
Age (years)				
Mean (SD)	70.0 (6.7)	69.0 (5.5)	70.0 (6.5)	< 0.001
Age Categories				
65-69	3013 (63.4)	893 (67.6)	3906 (64.3)	< 0.001
70-79	1201 (25.3)	342 (25.9)	1543 (25.4)	
80-89	458 (9.7)	76 (5.8)	534 (8.8)	
≥90	82 (1.7)	10 (0.8)	92 (1.5)	
Gender				
Female	2763 (58.1)	789 (59.7)	3552 (58.5)	0.29
Male	1991 (41.9)	532 (40.2)	2523 (41.5)	
Language				
English	4754 (100)	0 (0.0)	4754 (78.3)	< 0.01
Vietnamese	0 (0.0)	439 (33.2)	499 (7.2)	
Korean	0 (0.0)	398 (30.1)	398 (6.6)	
Chinese, Mandarin	0 (0.0)	224 (17.0)	244 (3.7)	
Tagalog	0 (0.0)	147 (11.1)	147 (2.4)	
Other languages	0 (0.0)	113 (8.6)	113 (1.9)	

Note: The Race/Ethnicity of each participant is Asian American

[a] Values represent n (%), unless otherwise noted.

[b] *p*-values are from comparison of LEP versus English. For continuous variables, group means (Student's *t*-tests).

Table 4: Prevalence of eRADAR Predictor Variables*

Predictor Variable	**Total N = 6075**	**English N = 4754**	**LEP N = 1321**	**p-value [b]**
	n (%)[a]	**n (%)**	**n (%)**	
Congestive heart failure	178 (2.9)	150 (3.2)	28 (2.1)	0.048
Cerebrovascular disease	268 (4.4)	218 (4.6)	50 (3.8)	0.210
Diabetes, any	1613 (26.6)	1250 (26.3)	363 (27.5)	0.388
Diabetes, complex	798 (13.1)	628 (13.2)	170 (12.9)	0.746
Chronic pulmonary disease	736 (12.1)	599 (12.6)	137 (10.4)	0.028
Hypothyroidism	461 (7.6)	359 (7.6)	102 (7.7)	0.837
Renal failure	709 (11.8)	603 (12.7)	106 (8.0)	<0.001
Lymphoma	31 (0.5)	24 (0.5)	7 (0.5)	0.91
Solid tumor without metastases	527 (8.7)	441 (9.3)	86 (6.5)	0.002
Rheumatoid arthritis	158 (2.6)	130 (2.7)	28 (2.1)	0.214
Weight loss	83 (1.4)	56 (1.2)	27 (2.0)	0.016
Fluid and electrolyte disorders	477 (7.9)	396 (8.3)	81 (6.1)	0.009
Psychoses	33 (0.5)	25 (0.5)	8 (0.6)	0.727
Depression	503 (8.3)	406 (8.5)	97 (7.3)	0.162
Traumatic brain injury	108 (1.8)	91 (1.9)	17 (1.3)	0.127
Tobacco use (past or current)	548 (9.0)	415 (8.7)	133 (10.1)	0.133
Gait abnormality	154 (2.5)	131 (2.8)	23 (1.7)	0.038

**Note:* This table includes the 17 diagnoses that are part of the eRADAR predictor algorithm; it presents the prevalence of each diagnosis during the 24 months prior to the index date (January 1 of the year for which the participant was selected.)

[a] Values represent n (%), unless otherwise noted.

[b] *p*-values for comparison of LEP to English. For continuous variables, group means (Student's *t*-test).

Table 5: Mean eRADAR Score in Relation to Preferred Language

	English N = 4754	**LEP N = 1321**	**p-value [b]**
Mean (SD)[a]	0.011 (0.016)	0.009 (0.011)	<0.001

[a] The higher the eRADAR score, the greater the risk of undiagnosed dementia

[b] *p*-values for comparison of LEP to English. For continuous variables, group means (Student's *t*-test).

Table 6: Prevalence of Memory Visits

English **N= 4754**	**LEP** **N= 1321**	**Total** **N = 6075**	**p-value** [b]
Number of people with at least one memory concern visit [a]	Number of people with at least one memory concern visit [a]	Number of people with at least one memory concern visit [a]	
255 (5.4)	55 (4.2)	310 (5.1)	0.079

[a] The results show the total number of people in each group with at least one visit with a diagnosis for a memory concern within three years after the enrollment year.

[b] *p*-values for comparison of LEP to English. For continuous variables, group means (Student's *t*-test).

Table 7: Most Common Diagnosis Codes at First Memory-Related Visit

	English N = 255	LEP N = 55	Total N = 310
	n (%)		
Memory impairment, memory loss [780.93]	139 (54.5)	29 (52.7)	168 (54.2)
Memory change, memory deficit, memory problem, or other amnesia [R41.3]	56 (22.0)	18 (32.7)	74 (23.9)
Altered mental status [780.97]	21 (8.2)	1 (1.8)	22 (7.1)
Mild cognitive impairment [331.83]	17 (6.7)	1 (1.8)	18 (5.8)
Subjective memory complaints; cognitive impairment [R41.89]	14 (5.5)	4 (7.3)	18 (5.8)
Mild cognitive impairment [G31.84]	6 (2.4)	1 (1.8)	7 (2.3)
Neurodegenerative cognitive impairment, also “degenerative disease of nervous system, unspecified” [G31.9]	2 (0.8)	1 (1.8)	3 (1.0)
Retrograde amnesia [R41.2]	0 (0.0)	0 (0.0)	0 (0.0)
Age related cognitive decline [R41.81]	0 (0.0)	0 (0.0)	0 (0.0)
Mild memory disturbance [F06.8]	0 (0.0)	0 (0.0)	0 (0.0)

Note: Diagnosis codes were taken from a participant’s first memory concern-related visit during follow up and totaled for each group. This table is a summary of the most frequently used diagnosis codes among the first memory concern related visits.

Table 8: Prevalence of Cognitive Testing According to LEP Status

Description	English N = 4754	LEP N = 1321	Total N = 6075	p-value
	n (%)			
Number of people with at least one cognitive test[1]	81 (1.7)	9 (0.7)	90 (1.5)	0.006

[1]Count of participants with at least one cognitive test performed in the three-year follow up window for each group

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