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Low Health Literacy, Limited English Proficiency, and Health Status in Asians, Latinos, and Other Racial/Ethnic Groups in California

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Abstract

We estimated health status by low health literacy and limited-English proficiency alone and in combination for Latinos, Chinese, Korean, Vietnamese, and Whites in a population-based sample: 48,427 adults from the 2007 California Health Interview Survey, including 3,715 with limited-English proficiency, were studied. Multivariate logistic models examined self-reported health by health literacy and English proficiency in the full sample and racial/ethnic subgroups. Overall, 44.9% with limited-English proficiency reported low health literacy versus 13.8% of English speakers. Among the limited-English proficient, Chinese respondents had the highest prevalence of low health literacy (68.3%), followed by Latinos (45.3%), Koreans (35.6%), Vietnamese (29.7%), and Whites (18.8%). In the full sample, respondents with both limited-English proficiency/low health literacy reported the highest prevalence of poor health (45.1%), followed by limited-English proficiency-only (41.1%), low health literacy-only (22.2%), and neither (13.8%), a hierarchy that remained significant in multivariate models. However, sub-analyses revealed limited-English proficient Latinos, Vietnamese, and Whites had equal or greater odds of poor health compared with low health literate/limited-English proficient respondents. Individuals with both limited-English proficiency and low health literacy are at high risk for poor health. Limited-English proficiency may carry greater health risk than low health literacy, though important racial/ethnic variations exist.

Low health literacy is defined in Healthy People 2010 as the “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services for appropriate health decisions” (US Department of Health and Human Services, 2000). Low health literacy has been associated with poor self-reported health status in many diverse populations, including Latinos and Asian Americans, even when education and other well-established predictors of health status are controlled (Berkman et al., 2011; Sentell et al., 2011).

Limited English Proficiency (LEP) is another key barrier to health care, also associated with poorer health status in Latinos, Asian Americans and other racial/ethnic groups (Jacobs et al., 2005; Gee & Ponce, 2010; Pippins et al., 2007; Shi et al., 2009; Wilson et al., 2005). LEP may contribute to and exacerbate the health consequences of low health literacy (Leyva et al., 2005; Shaw et al., 2009). Individuals who are isolated from both oral and written materials are uniquely unable to obtain, process, and fully understand basic health information and/or access preventive services (Andrulis & Branch, 2007).

Although LEP and low health literacy are co-occurring barriers to health, they often are studied in isolation from one another. Their combined health contributions are not well specified empirically or theoretically, particularly across diverse racial/ethnic groups (Sudore et al., 2009). Despite widespread discussion of the importance of LEP in health literacy, many major national health literacy studies, as well as many ones, operationalize health literacy as the ability to understand English health information (Kutner et al., 2006; Kirsh et al., 1993; Nielsen-Bohlman et al., 2004).

Health literacy instruments designed for Spanish speakers are in widespread use, however, and many health literacy studies have included Spanish speakers with LEP (Weiss et al., 2005; Parker et al., 1995; Lee et al., 2006). Using these measures, higher proportions of Spanish-speaking individuals have been found to have lower health literacy than English speakers (Williams et al., 1995; Brice et al., 2008). Spanish-speaking individuals with low health literacy have been found to have a poorer understanding of health information than those with higher health literacy (Bennett et al., 2007; Fang et al., 2009; Leyva et al., 2005) as well as lower utilization of cancer screening (Garbers & Chiasson, 2004).

However, many gaps remain in the literature. It has not been established if poor health literacy is associated with many types of poor health outcomes, including self-reported health status, among those with LEP generally. Also, prevalence of low health literacy in LEP populations besides Latinos has not been well studied. Asians Americans with LEP, in particular, have not been well represented in this work, despite the fact that Asian American populations have a high prevalence of LEP, including 58% of Chinese speakers, 66% of Vietnamese speakers, and 60% of Korean speakers (Tu et al., 2008; US Census Bureau, 2003). This compares to about 40% of Hispanics and 2% of non-Hispanic whites (Shi et al., 2009). Asian Americans are one of the fastest growing racial/ethnic groups in the US (US Census Bureau, 2010), indicating that non-English speaking Asian Americans are likely to become an increasing part of the US health care system.

One reason that Asian Americans with LEP have not been as well studied as Spanish speaking residents is the need to interview in multiple Asian languages. In the past, Asian Americans have often been discussed and analyzed as a cohesive group; however, the Asian American label encompasses at least 50 different ethnic groups with distinct cultures and languages (US Census Bureau, 2002). Creating a survey that can interview across multiple Asian languages is expensive and fraught with complexities. Although health literacy tests have been used to investigate associations between low health literacy and health outcomes for Korean speakers in Korea and Japanese speakers in Japan, to our knowledge neither test has been used in the US (Lee et al., 2009; Tokuda et al., 2009).

Low health literacy and limited English proficiency are distinct, but related, barriers to health communication. To determine how these factors work together and separately to impact health, it is important consider the relationships between LEP, low health literacy, and health status generally and across diverse racial/ethnic groups, including Asian Americans. This will ultimately improve our understanding of the pathways by which low health literacy and LEP impact health across diverse groups, and also to help us to better identify, target, and design effective interventions and materials for populations in need.

This study addressed knowledge gaps about LEP and health literacy by: 1) establishing if the prevalence of low health literacy by LEP varies across diverse racial/ethnic groups, including Latinos and Asian American subgroups, and 2) quantifying the combined health impact of LEP and low health literacy generally and across these diverse racial/ethnic groups specifically.

We used the model in Table 1 to generate hypotheses about the relationship of low health literacy by LEP. We hypothesized that (1) the worst health status would be among those with both LEP and low health literacy and (2) the best health status would be among those with neither LEP nor low health literacy. We did not specifically hypothesize which of the two middle groups (LEP-only or low health literacy-only) would have poorer health status, but we considered the relative health status of these two middle groups in general, and across racial/ethnic subgroups, to see if we could determine which communication challenge appeared to have a stronger association with health status.

Methods

The California Health Interview Survey (CHIS) is a random-digit-dial telephone survey that is representative of the non-institutionalized, adult population of California. The sample is large, including 51,048 participants in 2007. Unlike most population-based samples that do not disaggregate Asian American subgroups, the CHIS collects data from a representative sample of California (CHIS, 2010a), home to 40% of Asian Americans in the US. California also is home to a substantial number of US Latinos. The 2007 CHIS interview was administered in five languages (English, Spanish, Mandarin, Cantonese, Korean, and Vietnamese), allowing for participation of individuals with LEP.

Race/ethnicity

The CHIS oversamples underrepresented ethnic/racial groups, including Asian Americans (CHIS, 2010b). Chinese, Korean, and Vietnamese represent three of the five largest Asian subgroups in California and have substantial numbers of LEP individuals. These groups are considered in individual analyses. Black, Japanese, and Filipino individuals are included in the full 2007 CHIS sample, but lacked sufficient numbers with LEP (<100) to analyze separately. Whites, who do have sufficient numbers of those with LEP (>100), were included as the reference group. All other racial/ethnic groups are combined together within the “Other” racial/ethnic group. The study sample included 466 Vietnamese, 622 Koreans, 1,234 Chinese, 5,724 Latinos, 8,042 Other race/ethnicity (including Black, Japanese, Filipino, and other), and 32,339 Whites.

Limited English Proficiency

Respondents who spoke any language(s) at home besides English were asked: “Since you speak a language other than English at home, we are interested in your own opinion of how well you speak English. Would you say you speak English (well, very well, not well, not at all).” Limited-English proficiency (LEP) was defined as self-reporting speaking English “not well” and “not at all.”

Health Literacy

The health literacy items in the 2007 CHIS were taken from the Commonwealth Fund’s 2006 Quality of Care Survey (The Commonwealth Fund, 2007) and are associated with other health-related communication variables (Health Research for Action, 2009). Health literacy in the 2007 CHIS was assessed by two questions: (1) “When you get written information at a doctor’s office, would you say that it is very easy, somewhat easy, somewhat difficult, or very difficult to understand?” and (2) “When you read the instructions on a prescription bottle, would you say that it is very easy, somewhat easy, somewhat difficult, or very difficult to understand?” Low health literacy in this study was defined as responding that (1) written information at the doctor’s office is “somewhat difficult” or “very difficult” to understand or (2) instructions on a prescription bottle are “somewhat difficult” or “very difficult” to understand. This definition was chosen based on previous research (Health Research for Action, 2009) and is the most inclusive option for

measuring low health literacy. Respondents who refused to answer a health literacy question or were interviewed by proxy (<1% of the sample) and respondents who reported not getting written information (<3%) or not using prescription medicine (<2%) were excluded from our study, as their self-reported health literacy could not be determined. Thus, 48,427 (95%) of the 51,048 participants in the 2007 CHIS provided valid responses to literacy items, including 3,715 with LEP.

Health Status

Self-reported health status was measured by answering “fair” or “poor” to the question “Would you say your health in general is... Excellent, Very good, Good, Fair, or Poor?”

Control Variables

For multivariate models, control variables included: Age (continuous 18–85), sex (male or female), education (less than high school, high school graduate, college graduate, more than college), poverty (100% of poverty vs. not), living in a rural area (vs. not), current insurance (vs. none), being born in the US (vs. elsewhere), and marital status (married vs. other). These variables are associated with health literacy and self-reported health status in other studies (Berkman et al., 2011).

Statistical Methods

The 2007 CHIS public-use data file was used for all analyses. All data were analyzed in Stata 11 (Stata, 2009) using appropriate weighting methods to both correct for the complex sample design and to provide population-level estimates (CHIS, 2011). We first compared differences in prevalence of low health literacy across racial/ethnic groups by LEP with chi-square analysis. We then compared self-reported health by LEP and literacy combinations in the full sample and in each of the 6 individual racial/ethnic groups (Latinos, Chinese, Vietnamese, Korean, White and Other) using a chi-square analysis. Based on the hypotheses drawn from Table 1, we compared four groups: 1) individuals with both LEP and low health literacy, 2) individuals with only LEP, 3) individuals with only low health literacy, and 4) individuals with neither LEP nor low health literacy. We then ran multivariate logistic regression models predicting poor self-reported health status in the full sample, as well as within individual racial/ethnic groups using these groups, controlling for other factors. In multivariate analyses, group 4— individuals with neither LEP nor low health literacy—served as the reference group.

Results

As shown in Table 2, 44.9% of 3,715 LEP respondents reported low health literacy, compared to 13.8% of those without LEP. However, the percentage with LEP varied by subgroup, including 39.3% of Koreans, 38.5% of Vietnamese, 37.3% of Latinos, 27.4% of Chinese, 15.2% of Other race/ethnicity, and <1% of Whites.

Among those with LEP, Chinese reported the highest prevalence of low health literacy (68.3%) followed by Latino (45.3%), Other race/ethnicity (44.2%), Korean (35.6%), Vietnamese (29.6%), and White (18.8%). Among those without LEP, Latinos had the highest percentage of low health literacy (17.9%), followed by Chinese (17.8%), Korean and Other race/ethnicity (both 15.1%), Whites (12.0%), and Vietnamese (8.1%).

Those with LEP were significantly more likely to report poor health status compared to those with English proficiency (42.9% vs. 14.9%). Looking across racial/ethnic groups, adults with LEP were significantly more likely to be born outside the US, live below 100%

of poverty level, have less than a high school education, and (except among the Vietnamese) to lack health insurance.

Although 98% or more of the Latino and Asian respondents with LEP were born outside of the US, education varied greatly across racial/ethnic groups generally (not shown in table). Among Latinos, 38.9% had less than a high school degree compared to 19.9% of all Vietnamese, 9.8% of all Chinese, 7.6% of all Koreans, and 6.0% of all Whites. Over 50% of Chinese and Korean respondents had a college degree, compared to 41.1% of Whites, 29.0% of Vietnamese, and 11.1% of Latinos.

Among those with LEP (Table 2), 73.4% of Latinos had less than a high school degree, followed by Other race/ethnicity (67.3%), Vietnamese (39.4%), White (33.8%), Chinese (28.0), and Korean (14.2%). However, 30.4% of Chinese and 46.1% of Koreans with LEP had a college degree, compared to 22.5% of Whites and <10% of Vietnamese and Latinos.

English Proficiency and Health Literacy by Race/Ethnicity

Table 3 shows bivariate comparisons for health status by health literacy and English proficiency based on the arrangement in Table 1. In the full sample, it is possible to see the hypothesized direction of the relationships for health, specifically that those with both LEP and low health literacy reported the highest rates of poor health status (45.1%), followed by those with LEP and adequate health literacy (41.1%), those with low health literacy and English proficiency (22.2%) and finally those with adequate literacy and English proficiency (13.8%) (Chi2 292.86; $p < .0001$). A similar pattern was seen in Latino, Chinese, Korean, and Other respondents, but not among the Vietnamese or Whites. Among the Vietnamese and Whites, adults with LEP who self-reported adequate health literacy had the greatest prevalence of poor self-reported health status. In both of these two racial/ethnic groups, individual with both LEP and low health literacy had the second highest percentage of individual with poor health status, followed by those with low health literacy only. As expected, those with neither LEP nor low health literacy reported the best health status in all groups except the Vietnamese.

In the full sample, and in all specific racial/ethnic groups, these differences in health status by literacy and LEP groupings are statistically significant ($p < .01$). Of note, while poorer health status is seen by low health literacy among those with LEP in most racial/ethnic groups (except Vietnamese and Whites), the magnitude of difference in percent with poor health status by health literacy among those with LEP is far less than the difference of the same outcome by health literacy among those with English proficiency. In other words, it appears that having LEP-only is associated with greater vulnerability than having low health literacy-only. Among Vietnamese and Whites, having LEP with adequate health literacy was associated with the worst health status.

Multivariate Models

Table 4 shows the multivariate models predicting poor health status in the full sample and for each racial/ethnic group comparing three groups—1) individuals with LEP and low health literacy, 2) individuals with LEP-only and 3) individuals with low health literacy-only — to the reference group (individuals with neither LEP nor low health literacy).

In the full sample, the same relative health disadvantage hierarchy— (worst) LEP and low health literacy, followed by LEP-only, low health literacy-only, to (best) neither low health literacy nor LEP— remained significant in the multivariate model. Compared to those with English proficiency and adequate health literacy, the odds ratios of poor health were 2.28 (95% CI: 1.85–2.81) for those with LEP and low health literacy, 2.10 (95% CI: 1.70–2.58) for LEP-only, and 1.45 (95% CI: 1.29–1.64) for low health literacy-only. This hierarchy of

odds ratios supports descriptive findings of greater vulnerability among those with LEP-only compared to those with low health literacy-only.

This relationship was only partially replicated in racial/ethnic subgroup analyses. The pattern seen in the full sample also was seen in the Other racial/ethnic group, with all three variables significant and with the odds ratios in the expected direction. Among the other five specific racial/ethnic groups, only some of three LEP and low health literacy combination variables were significantly different from the reference group (adequate English proficiency and adequate health literacy).

Among Latino, Chinese, and Vietnamese populations, respondents with both LEP and low health literacy had significantly poorer health status (compared to those with neither LEP nor low health literacy). The magnitude of this relationship varied, with odds ratios ranging from 4.00 in Vietnamese to 1.98 among the Chinese. This variable did not differ significantly from the comparison group among Koreans or Whites.

LEP-only was also significantly associated with poorer health status vs. the reference (neither LEP nor low health literacy) among Latinos (OR: 2.01; 95% CI: 1.51–2.69), Vietnamese (OR: 5.46; 95% CI: 2.47–12.05), Whites (OR: 2.05; 95% CI: 1.03–4.08), and Other race/ethnicity (OR: 2.05; 95% CI: 1.34–3.12). In fact, among Latinos, the odds ratio of this factor was identical to the odds ratio of those with LEP and low health literacy. Among Vietnamese and Whites, the odds ratio of the LEP-only group (vs. the reference group) was higher than it was for those with LEP and low health literacy (vs. the reference group).

While low health literacy-only was associated with its own health disadvantage in the full sample, among individual racial ethnic groups, low health literacy-only was not significantly associated with poor health status in the Latino, Chinese, Korean or Vietnamese samples. It was only significantly associated with poor health status in Whites and Other racial/ethnic groups. In fact, among the Korean subgroup analyses, no significant relationship was seen comparing those with English proficiency and adequate health literacy to the other three groups.

Other significant predictors of poor health in the full sample were having less education, older age, living below poverty, not being married, and being any racial/ethnic group besides White (except Korean, which was not significant). Among specific racial/ethnic groups, the relative influence of these variables was not consistent.

Education had a particularly strong association with health in multivariate models within all racial/ethnic groups except Vietnamese. In Koreans, no LEP and/or health literacy combination significantly predicted health status, but all three levels of education had large and significant odds ratios. When we ran multivariate models without the education variable (results not shown), the odds ratios for the LEP and/or low health literacy variables were stronger, and more likely to be significant. For example, in the models without education, the LEP and low health literacy combination was significant in the full sample (OR: 3.45) and in each racial/ethnic group except Whites, odd ratios from 2.02 (Korean) to 4.58 (Vietnamese). Without education, the LEP-only variable became significant in the Chinese subgroup as did the low health literacy + LEP variable for Koreans.

Discussion

This study has four key findings: 1) Low health literacy was prevalent among those with LEP across diverse subgroups, though actual percentages varied across subgroups; 2) individuals with both LEP and low health literacy appeared to be a particularly vulnerable

group, with the highest prevalence of poor health status; 3) adults with LEP-only appeared more vulnerable than people with low health literacy-only; and 4) the specific relationship of low health literacy and LEP to health status varied by racial/ethnic group.

Low health literacy was prevalent among LEP adults in our sample, with more than 40% of LEP adults reporting low health literacy. However, the specific percentages of LEP adults with low health literacy ranged widely, from 68.3% among Chinese to 18.8% among Whites. Among those without LEP, percentages with low health literacy ranged from 17.9% among Latinos to 8.1% among Vietnamese. Todd & Hoffman-Goetz (2011) found a similar prevalence of low health literacy among older Chinese immigrants in Ontario (61.8%). For US Spanish speakers, however, our estimate of low health literacy prevalence was higher than the 30% found by Garbers and Chiasson (2004), but lower than those found by Sudore et al. (2009, 51%), Williams et al. (1995, 62%), and Brice et al. (2008, 74%). However, these prevalence findings are not directly comparable with ours, which were derived from self-reported results from a population-based sample. Other studies were conducted in specific settings, such as the ER, and/or for specific age groups, such as the elderly.

Although our prevalence of low health literacy is high, it is notable that large percentages of some racial/ethnic subgroups with LEP did not report that challenges with health information. This may indicate the success of existing efforts to provide in-language materials for LEP audiences in California, formal interventions using translators, or educating friends and family members to make materials comprehensible. Alternatively, this may represent the fact that many individuals with significant health communication challenges either do not recognize or are not willing to admit their limitations in understanding health information to survey interviewers or others (Parikh et al., 1996). This deserves further inquiry.

In our second key finding, as hypothesized, individuals with both LEP and low health literacy appeared to be a particularly vulnerable group, with almost half reporting poor health. In the descriptive analyses, prevalence of poor health was three times higher in individuals with both LEP and low health literacy than those in the reference group (neither LEP nor low health literacy). In the multivariate models, individuals with both LEP and low health literacy had odds of reporting poor health status that were twice those of the reference group, after controlling for US nativity, insurance, poverty, education, age, gender, marital status, and rurality. The findings of extreme health vulnerability among those with LEP is supported by a large body of literature (Jacobs et al., 2005; Gee & Ponce, 2010; Pippins et al., 2007; Shi et al., 2009; Wilson et al., 2005) as is the health risk of low health literacy (Berkman et al, 2011; Nielsen-Bohlman et al, 2004). Despite many notable successes in California and other locations in providing in-language materials and outreach to populations with health communication challenges (Snowden et al., 2011), the high rates of poor health among individuals with dual health communication vulnerabilities indicates that considerable needs and challenges remain.

We also hypothesized that individuals with neither LEP nor low health literacy (the reference group) would report the best health. This was seen in bivariate analyses in the full sample and all racial/ethnic subgroups except the Vietnamese (for which LEP-only was associated with the highest percentage of poor health). However, only in the full sample and the Other racial/ethnic group did the reference group report significantly better health than all 3 of the other tested LEP/health literacy combinations. While this may be due, in part, to the small samples of some racial/ethnic subgroups, it may also be differences in these groups by culture, access to English-speaking family/friends, and availability of in-language services/supports.

In our hypotheses, we did not make a priori assumptions about the relative impact of LEP-only and low health literacy-only, as we lacked empirical or theoretical justification about the relative impact of these two factors. However, as one of our key findings, we provide some empirical support to the notion that LEP-alone carries a greater disadvantage than low health literacy alone. Compared to the reference group, those with LEP-only were significantly more likely to report poor health in the full sample and among the Latino, Vietnamese, White, and Other subgroups.

The high prevalence of low health literacy across groups with LEP has important implications for clinical practice and intervention, as does the dramatic self-reported health difference between those with LEP and those with English proficiency, regardless of health literacy status. Language-concordant providers have been found to reduce confusion about health information among those with LEP, though they do not fully mitigate language barriers (Wilson et al., 2005). Among Spanish speakers, language-discordant relationships with providers resulted in the poorest health communication (Sudore et al., 2009), regardless of health literacy. Policy and clinical efforts to address English proficiency barriers will only become increasingly more important as the percentage of the US population with LEP grows.

Our fourth key finding is that the relationship of low health literacy and LEP to health status varies by racial/ethnic subgroup. Some of these differences could be related to small samples sizes in the Asian subgroups (particularly the Vietnamese group) and in LEP groups specifically. Differences also could represent varying availability of health outreach, trained clinical staff, and materials for specific racial/ethnic and cultural groups. These factors could influence the relative importance of LEP and/or health literacy to health in different ways among distinct racial/ethnic and language-group combinations. Qualitative approaches may be particularly useful to further our understanding on these matters. For example, Vietnamese and Chinese immigrants with LEP have been found to have unique health care quality concerns and distinct health-information-seeking patterns that impact their health behaviors (Ngo-Metzger et al, 2003; Nguyen et al, 2010; Woodall et al, 2006).

Other studies using CHIS data (e.g., Kim et al, 2010; Pourat et al, 2010) may also help shed light on important factors contributing to these differences within California's racial/ethnic populations, including possible interactions between distance to care and LEP (Cordasco et al, 2011). However, currently, the 2007 CHIS is the only CHIS sample that includes health literacy variables. National studies across diverse racial/ethnic groups and studies comparing findings with racial/ethnic subgroups in California with those in other states and in other countries (such as Hill et al's (2006) consideration of health behavior among Koreans in California and Korea), may be helpful to sort through what is unique to this sample, to the California setting, to the US health care context, and to these racial/ethnic groups specifically, but these studies also typically lack health literacy measures.

As expected (Mirowsky and Ross, 2003; Cutler and Lleras-Muney, 2006), education was a particularly important predictor of health status in the multivariate models for the full sample and for most individual racial/ethnic groups. Also as expected (Kimbrow et al, 2008, Walton et al, 2009), the strength of the education variable varied by racial/ethnic group and may also vary by location of education, which was not available in this data. Although high percentages of LEP Koreans and Chinese in the sample had college degrees, they may have completed primary and secondary school in their home countries, and neither written language is based on the Roman (Latin) alphabet (as are English, Spanish, and Vietnamese). Thus, to read in English requires learning a new alphabet, as well as vocabulary, grammar, and pronunciation. This may explain some of the observed variations.

One fundamental product of education is literacy. However, literacy skills and educational attainment are not synonymous, as education can dramatically underestimate literacy (Baker et al, 1996). People also can lose literacy skills, particularly individuals who do not read very often or experience mental illness or cognitive impairment (Manly et al, 2005). Someone can learn to read without any formal schooling and some who never learn to read as children do so as adults (Smith, 1994). Discrepancies between literacy and educational attainment may also be due to differences in educational quality, individual motivation, or a number of other factors (Smith, 1994). Nor is literacy identical to health literacy, which also includes health specific context and a constellation of skills that may draw upon general literacy but include other domains (Nielsen-Bohlman et al, 2003). Because of the complexity of the educational variable, some have argued that health literacy may be a better measure of many skills relevant to health that the educational attainment variable is meant to capture (Sentell & Halpin, 2006).

In this study, removing education from the full model decreased the strength of the relationship of low health literacy and LEP to health status, but only changed the significance of the health literacy variables in two cases: LEP-only Chinese and Koreans with both low health literacy and LEP. Education, health literacy, and LEP all appear to be playing unique explanatory roles in health status. In building theoretical models of the relationships between LEP and low health literacy, education should also be considered, as well as variations in these three factors and their relationships, across diverse racial/ethnic groups.

Limitations

This study has many strengths, including a population-based sample of individuals with and without LEP, including those of Latino and Asian descent. However, although the 2007 CHIS health literacy measures have been used previously (The Commonwealth Fund, 2007; Health Research for Action, 2009; Sentell, in press), they are self-reported and, thus, subjective. Yet a self-reported communication variable provides insight into individuals' own sense of the complexity of health information given them and research shows that individuals' self reports of comprehension difficulties with written health communication are associated with health status (Chew et al, 2004; Chew et al, 2008). But respondents may not be fully aware of their limitations or may not want to admit them. Also, the validity and meaning of the subjective health literacy (as well as self-reported health status) could vary across racial/ethnic groups, particularly when LEP is considered (Kandula et al., 2007).

As in-person, objective measures of health literacy are not available in population-based health studies at this time, we feel it is important to use this rich dataset to provide baseline evidence about a topic that is not easily studied, particularly in population-based samples, due to the challenges of getting strong samples of non-native English speakers across diverse racial/ethnic and language groups. Ideally, this study will be the first step towards more detailed health literacy measures in population-based health surveys, including those with substantial Asian American samples.

CHIS interviewers did not ask in which language the respondents received their written/prescription materials. In the US, California has been at the vanguard of service delivery in languages other than English. However, access to such materials could vary by racial/ethnic group, language preference, and location. Doctors' sensitivity to the needs of individuals with LEP, and their ability to address those needs, also could vary. Research suggests that doctor-patient language concordance and doctor-patient communication may play important roles in ameliorating the impact of LEP and health literacy respectively, but that relationships among these factors are complex (Sudore et al., 2009). Further research with sufficient sample sizes to address these issues could provide important insight.

Conclusions

Latinos and Asian are heavily represented in the US LEP populations (US Census Bureau, 2000). We found that low health literacy was prevalent among Californians with LEP, although prevalence varied widely by racial/ethnic group. Individuals with both LEP and low health literacy comprise a particularly vulnerable group, with high prevalence of poor health status. Although the relationship of low health literacy and LEP to health status varied by racial/ethnic group, it appears that having LEP alone may carry a greater health risk than low health literacy alone. The findings demonstrate the importance of disaggregating Asian American (Ghosh, 2010) and other racial/ethnic subgroups in studies of health, as well as the value of disentangling the effects of low health literacy and LEP on health status.

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TABLE 1

Model Predicting Independent and Combined Contributions of Low Health Literacy and LEP

	Health Literacy	
	Poor	Adequate
English Proficiency		
No	Worst health	Poor health
Yes	Poor Health	Best Health

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Table 2

Demographics in 2007 California Health Interview Survey overall and for racial/ethnic groups with significant LEP populations (Unweighted N=48,427)^{1,2}

Race/Ethnicity	Total	Latino	Chinese	Korean	Vietnamese	White	Other ³
Unweighted N	48,427	5,724	1,234	622	466	32,339	8,042
Weighted % Total	100%	21.6%	3.5%	1.2%	1.5%	49.0%	23.1%
	LEP English Proficient	LEP English Proficient	LEP English Proficient	LEP English Proficient	LEP English Proficient	LEP English Proficient	LEP English Proficient
Unweighted N	3,715	1,913	304	329	215	126	828
	LEP English Proficient	LEP English Proficient	LEP English Proficient	LEP English Proficient	LEP English Proficient	LEP English Proficient	LEP English Proficient
Weighted % within race/ethnicity	14.0	37.3%	27.4%	39.3%	38.5%	<1%	15.2%
	%	%	%	%	%	%	%
Low Health Literacy	44.9	45.3	68.3	17.8	15.1	18.8	12.0
	44.2	44.2	44.2	44.2	44.2	44.2	44.2
Self-Reported Poor Health	42.9	43.3	38.9	11.8	13.1	12.9	18.6
Education							
Less than HS	64.3	73.4	28.0	2.9	14.2	33.8	67.3
High School Grad	28.0	23.6	41.6	32.3	39.7	43.7	27.2
College Grad	6.0	2.6	21.4	29.4	39.0	12.5	3.9
More than College Degree	1.8	<1.0	9.0	35.4	7.1	10.0	1.6
	11.5	11.5	11.5	11.5	11.5	11.5	11.5
Age Group							
Young (18-24)	6.7	8.1	6.4	23.4	<1	11.7	4.5
Middle (25-64)	81.5	84.1	62.2	66.7	79.3	55.4	84.3
Older (65-84)	11.8	7.7	31.3	9.9	20.5	32.9	11.2
	11.6	11.6	11.6	11.6	11.6	11.6	11.6
Control Variables							
Not Born in USA	97.7	98.3	100	70.1	100	86.0	96.2
Female	51.5	49.5	58.1	52.1	59.2	56.3	53.3
	51.1	51.1	51.1	51.1	51.1	51.1	51.1
	31.7	31.7	31.7	31.7	31.7	31.7	31.7

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Race/Ethnicity	Total	Latino	Chinese	Korean	Vietnamese	White	Other ³
100% Fed Poverty Level	41.5	17.9	28.8	16.2	43.7	22.1	43.5
Rural	8.3	7.7	1.1	2.9	<1.0	5.8	10.1
Insured	52.7	72.8	80.8	56.8	80.2	74.9	51.0
Married	63.3	45.0	74.9	78.4	79.5	59.9	64.5

¹ Within only those with LEP, all chi-square comparisons of study factors across the 6 racial/ethnic groups are significant at the p<.05 level except female, which does not significantly vary across racial/ethnic groups. Similarly, within only those who have English proficiency, all chi-square comparisons of study factors across the 6 racial/ethnic groups are significant at the p<.05 level except female which does not significantly vary across racial/ethnic groups.

² Numbers are weighted to account for the complex survey design and to present a representative sample of the California population.

³ Includes all racial/ethnic groups who lack sufficient LEP sample sizes (<100) to analyze separately, including Black, Japanese, and Filipino respondents.

Table 3

Percent Poor Self-Reported Health Status by English Proficiency and Health Literacy overall and for racial/ethnic groups with substantial proportions of those with LEP in the 2007 CHIS⁴

Race/Ethnicity	English Language Proficiency	Health Literacy	
		Low	Adequate
Full Sample	No	45.1%	41.1%
	Yes	22.2%	13.8%
Latino	No	44.5%	42.4%
	Yes	22.6%	17.3%
Chinese	No	44.1%	27.7%
	Yes	12.4%	11.7%
Korean	No	37.4%	25.4%
	Yes	16.4%	12.5%
Vietnamese	No	53.8%	69.7%
	Yes	7.8%	12.4%
White	No	29.7%	31.5%
	Yes	20.7%	11.8%
Other	No	47.4%	37.9%
	Yes	27.1%	17.1%

⁴ All group comparisons are significant at the level of $p < 0.001$ from chi-square analyses.

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Table 4
 Logistic Models Predicting Poor Health by Health Literacy and LEP in 2007 California Health Interview Survey, for various race/ethnic groups

	All	Latino	Chinese	Korean	Vietnamese	White	Other
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Low Health Literacy and LEP							
Low Health Literacy and LEP	2.28 (1.85–2.81)	2.01 (1.51–2.69)	1.98 (1.09–3.59)	1.82 (0.86–3.84)	4.00(1.53–10.44)	1.47 (0.44–4.83)	3.10 (1.85–5.18)
LEP Only	2.10 (1.70–2.58)	2.01 (1.47–2.75)	1.89 (0.83–4.31)	1.10 (0.48–2.51)	5.46 (2.47–12.05)	2.05 (1.03–4.08)	2.05 (1.34–3.12)
Low Health Literacy Only	1.45 (1.29–1.64)	1.24 (0.88–1.73)	0.98 (0.47–2.06)	1.47 (0.38–5.60)	0.49 (0.15–1.62)	1.57 (1.37–1.81)	1.48 (1.11–1.97)
Neither							
Education							
Less than HS	4.09 (3.38–4.93)	4.50 (2.40–8.44)	4.50 (1.21–16.71)	11.07 (2.60–47.20)	2.36 (0.50–11.22)	4.22 (3.32–5.36)	3.53 (2.40–5.20)
High School Grad	2.38 (2.10–2.71)	2.26 (1.26–4.07)	2.28 (0.88–5.91)	8.89 (2.74–28.79)	2.37 (0.59–9.56)	2.32 (2.01–2.66)	2.48 (1.80–3.52)
College Grad	1.28 (1.07–1.53)	1.07 (0.52–2.19)	1.36 (0.51–3.60)	5.78 (1.65–20.17)	1.96 (0.43–8.82)	1.09 (0.90–1.31)	1.68 (1.13–2.51)
More than College Degree							
Control Variables							
Born in USA	1.05 (0.89–1.23)	1.01 (0.74–1.36)	0.99 (0.48–2.02)	0.50 (0.07–3.37)	0.44 (0.06–3.22)	1.07 (0.82–1.40)	1.09 (0.85–1.39)
Age	1.03 (1.03–1.04)	1.03 (1.02–1.04)	1.04 (1.02–1.06)	1.06 (1.03–1.08)	1.05 (1.03–1.07)	1.03 (1.03–1.04)	1.03 (1.03–1.04)
Female	0.98 (0.89–1.07)	1.10 (0.91–1.33)	0.77 (0.47–1.23)	1.63 (0.77–3.47)	2.06 (1.07–3.97)	0.79 (0.70–0.89)	1.17 (0.96–1.43)
100% Fed Poverty Level	1.72 (1.49–1.98)	1.34 (1.05–1.72)	1.61 (0.75–3.46)	2.03 (0.90–4.59)	1.98 (0.84–4.65)	2.37 (1.91–2.95)	1.73 (1.34–2.22)
Rural	1.06 (0.94–1.19)	0.93 (0.70–1.22)	0.29 (0.06–1.31)	5.30 (0.86–32.64)	4.61 (0.96–22.27)	1.07 (0.95–1.22)	1.17 (0.83–1.64)
Married	0.67 (0.61–0.74)	0.65 (0.53–0.79)	0.93 (0.37–2.39)	0.49 (0.23–1.07)	0.48 (0.20–1.11)	0.73 (0.64–0.83)	0.60 (0.50–0.73)
Insured	0.97 (0.85–1.12)	1.04 (0.83–1.30)	1.09 (0.49–2.39)	0.62 (0.29–1.32)	1.22 (0.53–2.82)	0.87 (0.69–1.09)	0.95 (0.73–1.23)
Race/Ethnicity							
Latino	1.61 (1.36–1.90)						
Chinese	1.55 (1.20–2.02)						
Korean	1.45 (0.99–2.11)						
Vietnamese	2.59 (1.93–3.49)						

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	All	Latino	Chinese	Korean	Vietnamese	White	Other
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Other	1.60 (1.43–1.79)						
White							