Limited English Proficiency, Postoperative Complications, and Interpreter Use in Vascular Surgery Patients in Hawai‘i

Uliana Kostareva PhD, RN; Katie Pe‘a (Varik) RHIT, CPHRM; Chathura Siriwardhana PhD; Min Liu PhD; Kristine Qureshi PhD, RN, CEN, PHNA-BC, FAAN

Abstract

A retrospective cohort analysis of inpatient and outpatient vascular surgery cases from 2014 to 2018 was conducted to analyze the relationship between limited English proficiency (LEP) and undesirable postoperative outcomes, and to evaluate interpreter use as part of culturally and linguistically appropriate services (CLAS). Propensity score matching and logistic regression models were used to examine the association of English proficiency with postoperative outcomes and chart review was done to examine CLAS provision. Of the 959 cases, 57 (6%) were LEP and had noticeably worse health status before surgery than non-LEP. The 57 cases include 51 patients who had a single vascular surgery and 3 patients who had 2 vascular surgeries (different medical encounter/visit). There was no statistically significant difference in postoperative outcomes between patients with LEP and without LEP. Males with LEP were significantly less likely than females to receive CLAS (P= .008). On the day of vascular surgery and/or the day informed surgical consent was obtained, 16% of patients with LEP received access to interpreters; 25% had no documentation about interpreter provision, and 59% had mixed language access (family, staff, or interpreter). The provision of interpreters might be influenced by providers' perceived ability to communicate with patients with LEP without an interpreter, ease of obtaining an interpreter, availability of family or ad-hoc interpreters, and patients' preferences. Future research should examine reasons for frequent use of untrained individuals and inform strategies to implement language services in line with national standards.

Keywords

health literacy, health disparities, language barrier, surgery, health communication, quality of care, interpreters, cultural competency

Abbreviations

CLAS = culturally and linguistically appropriate services
CPR = cardiopulmonary resuscitation
CVA = Cerebrovascular Accident
DHHS = US Department of Health and Human Services
EMR = electronic medical record
GI = gastrointestinal
LEP = limited English proficiency
NSQIP = National Surgical Quality Improvement Program
SIRS = systemic inflammatory response syndrome
SSI = surgical site infection
UTI = urinary tract infection

Introduction

The state of Hawai‘i has the fourth-highest share of residents with limited English proficiency (LEP) in the nation.[1] In 2019, almost a quarter of Hawai‘i's population was foreign-born, primarily from Asia (77%) and Oceania (12%), and 12% self-reported speaking English less than "very well."[2] As a result, health care providers in Hawai‘i care for diverse populations speaking more than 20 languages,[3] and frequently encounter patients with LEP.

LEP is associated with lower personal health literacy.[4,5] Personal health literacy is defined as the "ability to find, understand, and use information and services to inform health-related decisions and actions."[6] It is influenced by organizational health literacy which is the degree to which health organizations enable personal health literacy.[6] Researchers have found associations between lower personal health literacy and worse health among Native Hawaiians, Pacific Islanders, and Asians as well as persons with LEP and worse health status among Pacific Islanders and Asians.[7–9] Low health literacy and LEP are co-occurring barriers to effective care, contribute to lower medical comprehension, and can influence health outcomes.[5,9,10]

Per the US Department of Health and Human Services (DHHS), culturally and linguistically appropriate services (CLAS) are necessary to advance health equity, improve health care quality and patient satisfaction, respond to demographic changes, meet accreditation standards, and decrease liability.[11] Provision of CLAS through language assistance via qualified interpreters is critical to patient safety and effective communication between clinicians and individuals with LEP.[11–14] While DHHS requires that a covered entity take the necessary steps to ensure effective communication through the use of qualified interpreters, many patients with LEP do not receive interpreter services, receive them inconsistently, or are assisted by ad-hoc interpreters (staff whose linguistic skills have not been assessed) and family members, including minors.[15–25] Prior research shows the use of qualified interpreters, rather than family members, is associated with more effective communication, increased patient satisfaction, improved quality of care, and better health outcomes.[26,27] Compared to ad-hoc or no interpreters, professional and trained medical interpreters provide better quality interpretation with a similar length of dialogue but fewer interpretation errors of potential clinical consequence.[27,28] Qualified interpreters also help to establish a clear line of communication, rapport, and trust between patient and provider.[29]

National and international studies on care for patients with LEP have been documented in the literature.[26,30,31] Multiple studies

identified performance gaps in language assistance programs and focused on the impact of interpreters in primary care rather than a hospital setting.[26,31] A review by Al Shamsi and colleagues focused on articles that examined implications of language barrier on access to care, communication, and satisfaction found that while interpreter services can improve satisfaction with care, they can also increase costs and length of interactions.[30] The authors suggested translation applications as a potential cost and time-saving measure.[30] Several investigators explored the relationship between qualified interpreter use and surgical outcomes. Four recent studies examined the provision of interpreter services for patients with LEP who received surgical care; 3 were from the US and 1 from Australia.[32–35] Three of these studies focused on orthopedic surgery and 1 was an assessment of the process surgeons use for obtaining informed consent from patients with LEP and considered CLAS standards.[35] Semere et al looked at caregivers of Chinese- and Spanish-speaking patients and found that caregivers often had LEP themselves and experienced notable caregiving-related stress.[32] Greene et al examined access to qualified interpreters at orthopedic surgeons' offices for Spanish speakers and found that 80% were asked to bring a friend or a family member to interpret for them.[33] Xue et al examined post-discharge surveillance of surgical outcomes among LEP patients in Australia and found the use of ad-hoc interpreters to be an acceptable alternative to qualified interpreters, but this was specifically for completing self-reported follow-up post-arthroplasty surveys.[34] Patel et al surveyed surgeons about consenting LEP patients and found multiple suboptimal practices such as the use of ad-hoc (untrained staff) interpreters, family (including minors), and the surgeons' own non-fluent language skills when obtaining informed consent.[35]

Understanding communication dynamics between vascular surgery patients with LEP and their clinical providers is of utmost importance for identifying potential disparities in health care and informing CLAS, including the role of family members. To address the paucity of research on the relationship between LEP and postoperative vascular surgery outcomes and evaluate the provision of CLAS, this study investigated 3 questions: (1) Is there a significant difference in postoperative vascular surgery outcomes between patients with LEP and those without LEP? (2) Do vascular surgery patients with LEP receive interpreter services per policy during vascular encounters, specifically to obtain informed consent? (3) Who interprets during these visits?

Methods

This study examined the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) inpatient and outpatient vascular surgery cases performed between 2014 and 2018 (n=959) at a large medical facility on O'ahu, Hawai'i. The retrospective cohort analysis included a chart review of data from electronic medical records (EMR) in EPIC, version 2020 (Epic Systems Corporation, Verona, WI). Each EPIC record was matched with each NSQIP vascular surgery case and included demographic (eg, race/ethnicity, sex, age, primary language) and clinical characteristics (eg, operative procedure, occurrence of undesirable surgical events). The study was approved by the Institutional Review Board at the University of Hawai'i at Mānoa CHS number 24348 that ceded to the facility's Institutional Review Board study number 2018-134.

Statistical Analyses

There were 26 possible undesirable NSQIP postoperative outcomes within 30 days after vascular surgery procedure (**Appendix, Table 1)**. These were condensed into 11 categories: surgical site infection (SSI) minor, SSI serious, embolic, pulmonary, renal, cardiovascular, urinary tract infection (UTI), gastrointestinal (GI), transfusion, serious medical, and very serious medical outcomes. Health status modifiers present at the time of surgery were removed from the analysis. For the statistical analysis, each event of interest was used as a binary variable per each patient, such as "1 – event observed", and "0 – not observed." Propensity score matching was performed based on multiple health-related confounders to obtain matched sets for minimizing confounder effects on the marginal group comparison (**Appendix, Figure 1)**.

Patient variables were descriptively summarized using means and standard deviations for continuous variables and proportions for categorical variables. Two-sample *t* tests and Fisher's exact tests were applied for examining associations among patient characteristics and the LEP category (ie, patients with LEP vs. patients without LEP) on continuous and categorical outcomes, respectively. The association of the LEP category on the binary outcomes of interest was initially examined using logistic regression. To balance covariate distributions between the 2 groups, the 1:1 nearest propensity score matched LEP and non-LEP patients was used for the primary analysis of the study.[36] For the propensity score matched pairs, the LEP grouping association with outcomes was examined using the Generalized Estimating Equations based logistic regression, utilizing a compound symmetric correlation structure to account for the paring effect. A 2-sided P value < .05 was considered as the criteria for statistical significance for all hypothesis tests. Contingency tables were used to examine differences between LEP cases. Analyses were performed using R software, version 3.51 (R Foundation for Statistical Computing, Vienna, Austria), SPSS, version 26 (IBM Corp, Armonk, NY), and Excel, version 16 (Microsoft Corporation, Redmond, VA).

Interpreter Use

The facility's policy refers to requirements by DHHS for reasonable accommodation via language access services to ensure effective means of communication for patients, family members, and visitors who have LEP.[37] The policy defines effective communication as the successful joint establishment of

meaning wherein patients and health care providers exchange information enabling patients to participate actively in their care (eg, interpreters, translators).[37] The policy also recognizes that patients with LEP maintain the right to request a friend or family to interpret; however, the EMR record should include documentation that a qualified interpreter was offered and the patient declined interpreter services.[38] In such instances, the facility's policy recommends the use of "shadow interpreters" also referred to as "stand-by interpreters." In stand-by interpreting, an interpreter silently observes, listening in to the conversation to verify that the information is accurately and completely interpreted and communicated. If an omission or inaccuracy is identified in the interpretation, the qualified interpreter would intervene to correct the inaccuracy, then step out of the interpretation encounter and continue to observe.

The interpreters at the facility are provided free of charge to the patient as follows: (1) professional medical interpreters available in-person, via phone, or online video conferencing through third-party vendors for all languages; (2) 2 dedicated employed (in-house) professional medical interpreters (Mon-Fri 8 AM – 5 PM) for the Japanese language; and, (3) bilingual staff whose primary job is not to interpret, but whose linguistic and comprehension skills have been assessed via an independent medical interpreter exam and reassessed every 2 years. In this study, both professional medical interpreters and staff who passed the medical interpreter exam were considered qualified interpreters.

The LEP status of vascular patients was confirmed by 2 steps. First, the EMR was reviewed for answers to standardized questions asked in the clinical setting: "What language do you speak at home?" (asked by non-clinical staff; eg, registrar or clerk); and "In what language do you wish to receive health care information?" (asked by clinical staff; eg, physician or nurse). Patients who answered either question with a language other than English were classified as LEP. Second, a retrospective EMR chart review of each LEP case was conducted. Two authors discussed each case for LEP status and the provision of CLAS until concordance was reached. An additional reviewer was available for consultation when a disagreement could not be resolved.

To determine the type of interpreter, notes from the date(s) of the vascular procedure(s) and/or the date(s) when the vascular procedure consent form(s) were obtained. Although notes related to interpretation were reviewed across several touchpoints of the vascular encounter (eg, consultation, procedure preparation, post-surgical recovery), the focus of the study was around informed consent interaction(s) because it is considered a critical care conversation and the EMR should include note(s) about the use of qualified interpreter or documented declination of interpreter services. Interpreter use was categorized in alignment with the National Language Access Plan and CLAS Standards as follows: (1) No interpreter, meaning that no EMR notes indicated that an interpreter was provided; (2) Mixed interpreters, meaning that interpretation was provided by more than 1 person, such as family, staff, and/or a qualified interpreter; and (3) CLAS-provided, meaning that the visit was either attended only by a qualified interpreter, or attendance by a qualified interpreter was offered to the patient and the patient's declination was documented per the facility's policy requirements. Notes pertaining to the use of family members as interpreters were also reviewed.

Results

Of the 959 total patients, 57 (6%) were confirmed to have LEP via 2-step EMR review **(Table 1).** Patients with LEP and those without LEP were of similar age and had similar proportions of females to males **(Table 2).** However, patients with LEP were significantly more likely to have insulin-and non-insulin-dependent diabetes, hypertension, sepsis, an open wound, be on dialysis, and be partially or totally dependent in their functional health status.

Initial analysis without propensity score matching indicated that patients with LEP faced significantly increased risks for embolic (OR = 3.45, 95% CI 1.13-10.49) and cardiovascular (OR = 3.64, 95% CI 1.19-11.15) event categories **(Table 3).** However, analysis with propensity score matching showed no significant difference in postoperative vascular outcomes between patients with LEP and those without LEP for any adverse outcome.

During the retrospective EMR chart review to examine CLAS, the sample size changed from 57 to 56 because in 1 case the patient with LEP became incapacitated during the encounter. A sub-analysis was performed with contingency tables of patients with LEP between those who received and did not receive CLAS

Table 1. Limited English Proficiency (LEP) Case Identification

Language Identification Method	Identified By	Quantity
What language do you speak at home? (patient demographics)	Non-clinical staff and asked only once when EMR is first created	73 LEP (72 in the system and 1 case identified though random screen)
In what language would you like to receive health care information? (patient intake flowsheet)	Clinical staff and asked at every encounter (ie, emergency department, same day surgery, hospital admission)	41 LEP
Manual chart review of patient notes relevant to English language proficiency	Research team	57 confirmed LEP

Table 2. Patient Characteristics Used in the Propensity Score Model)				
Variable		**Non-LEP (n = 887)**	**LEP (n = 57)**	***P* value**
Age mean (Standard Deviation)		67.5 (13.6)	70.1 (11.8)	.11
		%	%	
Sex	Female	40.1	45.6	.41
	Male	59.9	54.4	
Patient status	Inpatient	64.8	77.2	.06
	Outpatient	35.2	22.8	
Diabetes Mellitus	No	69.2	42.1	**< .001**
	Yes: Non-Insulin	15	28.1	
	Yes: Insulin	15.8	29.8	
Current smoker (within the past 1 year)	Yes	18.7	10.5	0.15
Dyspnea	At Rest	0.8	0	> .99
	Moderate Exertion	4.4	3.5	
	No	94.8	96.5	
Functional health status	Independent	87.2	71.9	**.003**
	Partially Dependent	11.5	22.8	
	Totally Dependent	0.8	5.3	
	Unknown	0.5	0	
Ventilator dependent	Yes	0.8	0	> .99
History of severe Chronic Obstructive Pulmonary Disease	Yes	6.7	5.3	> .99
Ascites within 30 days prior to surgery	Yes	0.1	0	> .99
Congestive heart failure within 30 days prior to surgery	Yes	2.7	3.5	.67
Hypertension requiring medication	Yes	67.8	87.7	**.001**
Acute renal failure	Yes	2.3	7	.051
Currently requiring or on dialysis	Yes	8.9	24.6	**.001**
Disseminated cancer	Yes	0.3	0	> .99
Steroid immunosuppressant use for chronic condition	Yes	3.6	1.8	.72
Loss of body weight in the 6 months prior to surgery	Yes	0.2	0	> .99
Bleeding disorder	Yes	24.5	28.1	.53
Preoperative Red Blood Cells transfusion within 72 hours prior to surgery start time	Yes	2.3	7	.051
Sepsis in 48 hours	None	93.1	82.5	**< .001**
	Sepsis	2.1	10.5	
	Septic shock	0.7	5.3	
	SIRS	4.1	1.8	
Emergency case	Yes	7.3	10.5	.43
Open wound with or without infection	Yes	21.8	38.6	**.005**
Wound classification	Clean	89.8	77.2	**.02**
	Clean/Contaminated	1.2	1.8	
	Contaminated	0.7	0	
	Dirty/Infected	8.2	21.1	

Variables are summarized using percentages (%), unless specified. Total percent may not add up to 100% exactly due to rounding. *P* values reported correspond to the group differences. LEP (limited English proficiency). SIRS (Systemic Inflammatory Response Syndrome).

(n = 56). Males were significantly less likely than females to receive CLAS ($\chi 2 = 7.11$, df = 1, $P = .008$) **(Table 4).** There was no significant difference between surgical outcomes among patients who received CLAS compliant standard of service and those who did not ($\chi 2 = 1.01$, df = 1, $P = .32$).

The top 3 languages spoken by patients with LEP were Ilocano (26%), Marshallese (16%), and Chuukese (12%) (**Table 5**). A quarter (25%) of patients with LEP had no notes in the EMR that documented interpreter support, 59% received mixed support, which included family, non-qualified staff, and/or qualified interpreters, and 16% received CLAS, meaning either a qualified interpreter attended the visit or there was documentation that a qualified interpreter was offered and declined. Among 9 patients with LEP who received CLAS, 2 (1 Chuukese, 1 Marshallese) were offered interpreters multiple times but declined interpreter services and in most cases chose to use family member(s) instead. During the entire vascular episode, including touchpoints outside of informed consent, two-thirds (68%) of vascular patients had family involved with interpreting. Japanese was the most frequent language spoken among patients with LEP who received CLAS (44%), followed by Marshallese (22%), Chuukese (22%), and Ilocano (11%). The majority of surgical and associated anesthesia consents were complete, but a few (4%) did not have consent form scanned into the EMR (consent missing) or were incomplete (9%) due to missing dates and/or signatures. Notably, 11% of consents were signed by a surrogate (family member) when not indicated (the patient with LEP had decisional capacity and did not require a surrogate).

Table 3. Estimated Odds-Ratios for Observing Postoperative Complications and Patients with and without Limited English Proficiency (LEP)

Postoperative Events Categories	Odds-Ratio (95% CI)	*P* value	Odds-Ratio (95% CI)	*P* value
	Unmatched Comparisons		Matched Comparison	
SSI Minor (Superficial incisional SSI)	0.42 (0.06, 3.13)	.40	0.32 (0.03, 3.18)	.33
SSI Serious (Deep incisional, organ space, wound disruption)	2.24 (0.27, 18.56)	.46	1.001 (0.06, 16.41)	> .99
Embolic (Postoperative pulmonary embolism, vein thrombosis requiring therapy, cerebrovascular accident)	3.45 (1.13, 10.49)	**.03**	4.23 (0.46, 39.0)	.20
Pulmonary (Pneumonia, unplanned intubation)	0.91 (0.21, 3.89)	.90	0.48 (0.09, 2.74)	.41
Renal (Progressive renal insufficiency, acute renal failure)	1.96 (0.24, 15.96)	.53	1.0 (0.061, 16.41)	> .99
Cardiovascular (Cardiac arrest requiring CPR, myocardial infarction)	3.64 (1.19, 11.15)	**.02**	4.23 (0.46, 39.0)	.20
UTI	*	*	<0.001 (<0.001, >100)	> .99
GI Category (Clostridioides difficile)	3.15 (0.36, 27.38)	.30	1.001 (0.06, 16.41)	> .99
Transfusion (Transfusion intraoperative, postoperative, 72 hours of surgery start time)	2.243 (0.27, 18.56)	.45	>100 (<0.001, >100)	> .99
Serious Medical (Septic shock)	0.701 (0.09, 5.30)	.73	1.0 (0.06, 16.41)	> .99
Very Serious Medical (Postoperative death within 30 days of procedure)	1.366 (0.69, 2.71)	.37	0.81 (0.33, 1.99)	.65

Log-Odds-Ratio > 0 shows that LEP had higher odds of observing the event, compared to non-LEP. SSI (Surgical Site Infection). CPR (Cardiopulmonary Resuscitation). UTI (Urinary Tract Infection). * Postoperative UTI category was removed because it did not have sufficient events to make a reliable estimation.

Table 4. Crosstabulation of CLAS Provision by Surgical Complications and Sex among patients with Limited English Proficiency (LEP)

Surgical Complications	CLAS (n = 56)*		Pearson $\chi 2$	df	*P* value**
	Provided	Not Provided			
No	5 (expected 6.3)	34 (expected 32.7)	1.01	1	.32
Yes	4 (expected 2.7)	13 (expected 14.3)			
Sex	**CLAS (n = 56)***		**Pearson $\chi 2$**	**df**	***P* value****
	Provided	**Not Provided**			
Female	8 (expected 4.3)	19 (expected 22.7)	7.11	1	**.008**
Male	1 (expected 4.7)	28 (expected 24.3)			

CLAS (Culturally and Linguistically Appropriate Services). * In the analysis of interpreter use (CLAS), the sample size was changed from 57 to 56 because in one case the patient became incapacitated during the encounter. ** Asymptotic Significance (2-sided).

Table 5. Summary of Languages, Interpreter Use (CLAS), and Consent Documentation	
Variable	**Percent (n)**
Language (n = 57)	
Ilocano (Filipino language)	26 (15)
Marshallese (Micronesian language)	16 (9)
Chuukese/Trukese (Micronesian language)	12 (7)
Japanese	11 (6)
Korean	7.0 (4)
Cantonese (Chinese language)	5 (3)
Mandarin (Chinese language)	4 (2)
Chamorro (Guam and Mariana Islands in Micronesia)	4 (2)
Samoan (Polynesian language)	4 (2)
Tagalog (Filipino language)	4 (2)
Vietnamese	4 (2)
Spanish	2 (1)
Ulithian (Micronesian language)	2 (1)
Visayan (Filipino language)	2 (1)
Type of Interpreter Used on the Day of Procedure and/or During Informed Consent (n = 56)*	
No interpreter	25 (14)
Mixed (one family member (n = 10), several family members (n = 14), staff & family (n = 3), interpreter & family (n = 5), interpreter & non-qualified staff (n = 1))	59 (33)
Qualified interpreter used/offered & policy requirements met = CLAS-provided	16 (9)
Family Involvement with Interpreting During Vascular Encounter (n = 56)*	
Family not involved in interpreting	32 (18)
Family involved in interpreting	68 (38)
CLAS-provided by Language (n = 9)	
Japanese	44 (4)
Marshallese	22 (2)
Chuukese	22 (2)
Ilocano	11 (1)
Vascular-related Consent Documentation (n = 57)	
Complete	68 (39)
Signed not by a patient while patient had decisional capacity	19 (11)
Missing dates and/or signatures	9 (5)
Not on file	4 (2)

Total percent may not add up to 100% exactly due to rounding. CLAS (Culturally and Linguistically Appropriate Services).
* In the analysis of interpreter use (CLAS), the sample size was changed from 57 to 56 because in one case the patient became incapacitated during the encounter.

Discussion

This exploratory study analyzed the relationship between LEP and undesirable postoperative vascular surgery outcomes and evaluated the provision of CLAS at a large medical facility in Hawai‘i. The initial analysis indicated significantly increased risks for embolic and cardiovascular event categories for patients with LEP. The follow-up analysis addressed the high heterogeneity of vascular cases via propensity score matching and found no significant differences in postoperative outcomes. Within the LEP group, there was a significant difference by sex with males being less likely to receive CLAS than females.

The retrospective EMR chart review enabled identification of patients' language needs and examination of various types of interpreters that were used. Ilocano was the most prevalent language among patients with LEP but only 1 out of 15 had documented CLAS provision. This finding should be viewed in light of Hawai‘i's nursing workforce which includes a substantial number of people of Filipino background, some of whom speak Ilocano and/or Tagalog.[38] In comparison, 2 out of 4 patients with LEP who spoke Japanese received CLAS, a language for which there were in-house interpreters available.

A concerning finding was that a quarter of patients with LEP had no notes in the EMR that documented interpreter support on the day of surgery and/or for informed consent, and that only 16% received CLAS. Inconsistent EMR documentation of language barriers and language needs could have contributed to suboptimal CLAS provision. Although regulatory obligations discourage the use of family and friends (especially minors, or those whose English proficiency has not been assessed) as medical interpreters, almost two-thirds of patients in this study with LEP had EMR note(s) indicating that family member(s) were involved with interpretation during a vascular encounter. Furthermore, several consents were signed by a surrogate instead of a patient with LEP when not indicated. Notes indicating that the English language proficiency of family or ad-hoc interpreters was assessed prior to using them as interpreters were not found.

Frequent involvement of family members as interpreters might be partially explained by Hawai‘i demographics. Hawai‘i residents speak many languages, some of which are rare and for which it may be difficult to obtain qualified interpreters, and represent cultures that place more emphasis on the involvement of family in their medical care.[40–42] A local study that explored perspectives of Chuukese patients and their health providers found that both preferred the in-person mode of interpretation and most often used family members as interpreters; thus, challenging national standards that promote professional medical interpreters.[43] Research shows that in addition to cultural factors, an interpreters' sex, the majority of whom are female, may contribute to less CLAS provision among male patients.[24,40,44] Overall, the use of interpreters was highly variable and not in alignment with the national CLAS standards.

This study illuminated the difficult balance between family involvement in medical decision-making, cultural preferences and beliefs of patients, and policy. As reported in prior research, this study also found that it was not the facility's policy but rather the circumstances of the encounter and clinicians' perceived ability to communicate with LEP patients that appeared to guide their choice to request an interpreter.[35,45] There could have been a lack of awareness or understanding of the facility's policy and national guidelines among staff leading to the selection of more convenient or patient preferred sources for interpretation. It is possible that some patients may not have been aware of their right to request a qualified interpreter. Additionally, providers may not have been aware of the stand-by interpreter option, which could have been employed to verify the accuracy and completeness of communicated information in case patient with LEP insisted to use a family member as an interpreter.

Based on the findings, EMRs should have clear documentation of language needs, and the language access services policy should be strengthened. There is a need for sustained clinician training and support with interpreter services, especially for such critical conversations as obtaining consent for procedures. The health literacy of all patients, including those with LEP, should be considered in all medical encounters to facilitate effective communication since providers tend to overestimate patients' health literacy.[46] Clinicians should also consider the complexity of the US health care system and the difficulties Hawai‘i's foreign-born and people with LEP may experience while trying to make health-related decisions and navigate the health care system.[47] Hawai‘i's health care facilities may benefit from encouraging training and assessing the linguistic and comprehension skills of their diverse multilingual staff via an independent medical interpreter exam to ensure they are qualified to interpret. It is also important to meet regulatory obligations to provide language services without disrupting or delaying care, and to consider potential issues associated with care quality as well as autonomy, accuracy, and confidentiality of communication when a friend or family member is used for interpreting.[11]

The findings of this study should be interpreted considering their limitations. The vascular surgery population was heterogeneous and generally complex. The sample size for LEP patients was small, which reduced the statistical power of detecting small-scale effects between the LEP and non-LEP groups and limited the conclusions that could be drawn. Propensity score matching method strictly assumes the validity of the propensity score methodology. There could have been other imbalanced covariates that were not identified. The EMR may have included erroneous entries and may not have captured all patient data. Patients' overall burden from multiple chronic conditions and social determinants of health were not accounted for. The length of stay, survival of cases, patient satisfaction (availability was limited and the survey was only in English), or 30-day readmission rates were not included in this analysis of postoperative outcomes.

Finally, the interpreter-use categorization was based on the available EMR documentation and definition articulated in the National Language Access Plan and CLAS Standards to assure health equity by promoting effective communication via linguistic services.[37,38] These define CLAS compliance in 2 ways: (1) patient with LEP received interpreter services or (2) interpretation services were offered but declined.[38] Thus, both patients with LEP who received interpreters and those who declined them were included in the CLAS-provided category. The EMR documentation of language barriers and language needs appeared to depend on the staff's perception and circumstances of interaction with a patient with LEP.

Future research should examine the health care experiences of patients, interpreters, and providers to understand reasons for the frequent use of untrained individuals and develop strategies to implement language services in line with national standards, potentially with the use of stand-by interpreters. Also, future research should consider a comparison between patients who received qualified interpreter support to those who declined it or had only family help with interpreting and the role of cultural factors. It could also include larger sample size and variables such as satisfaction with care and the cost of care (eg, 30-day readmission rates, type of health insurance). The next steps should focus on ways to turn observations into interventions that can improve patient-provider communication with patients with LEP.

Conclusion

Effective communication is essential for safe, high quality, and equitable health care. Considering many people with LEP live in Hawai'i and represent diverse cultures and unique languages, CLAS is needed to advance health equity, respond to demographic changes and health literacy needs of individuals, and to provide better care. This exploratory study found a need for more accurate EMR documentation of language barriers and language needs and more consistent provision of CLAS via language services for patients with LEP. Given the high variability in interpreter use, the study highlighted the need to further explore the application of national standards and interpreter guidelines as they are being challenged by patients' preference to use family members instead of professional medical interpreters. One potential solution could include the use of shadow interpreters or stand-by interpreters. More efforts should be taken to provide trainings for health providers about language services and meaningful communication with patients with LEP. There is an opportunity to capitalize on meeting interpreter needs by assessing multilingual staffs' linguistic and comprehension skills via an independent medical interpreter exam so they could help with communication with patients with LEP. Furthermore, all staff who may have impact on patient communications could benefit from language access and cultural competency trainings. Bilingual community health workers knowledgeable about Hawai'i's immigrant/migrant diasporas could also disseminate health knowledge. The findings of this study would be useful for health care providers, those who study immigrant health, and stakeholders involved in CLAS policy development and implementation.

To help increase awareness of the importance of the provision of interpreters, when to provide them, and required EMR documentation, a one-page decision-tree flowsheet was created by the authors to use as a visual aid for clinicians and other allied health care workers **(Appendix, Figure 2).**

Authors' Affiliations:
- Nancy Atmospera-Walch School of Nursing (NAWSON), University of Hawai'i at Mānoa, Honolulu, HI (UK)
- Risk Management, Hawai'i Pacific Health, Honolulu, HI (KP)
- Biostatistics Core, John A. Burns School of Medicine, University of Hawai'i at Mānoa, Honolulu, HI (CS)
- College of Education, University of Hawai'i at Manoa, Honolulu, HI (ML)
- Pacific Island Health Officers Association, Honolulu, HI (KQ)

Corresponding Author:
Uliana Kostareva PhD, RN Email: uliana@hawaii.edu

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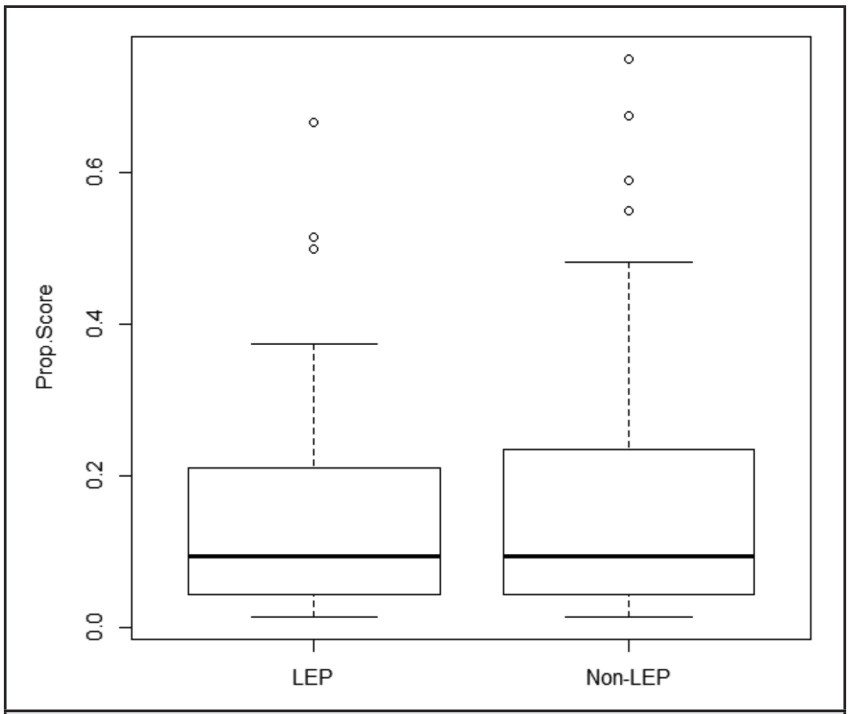
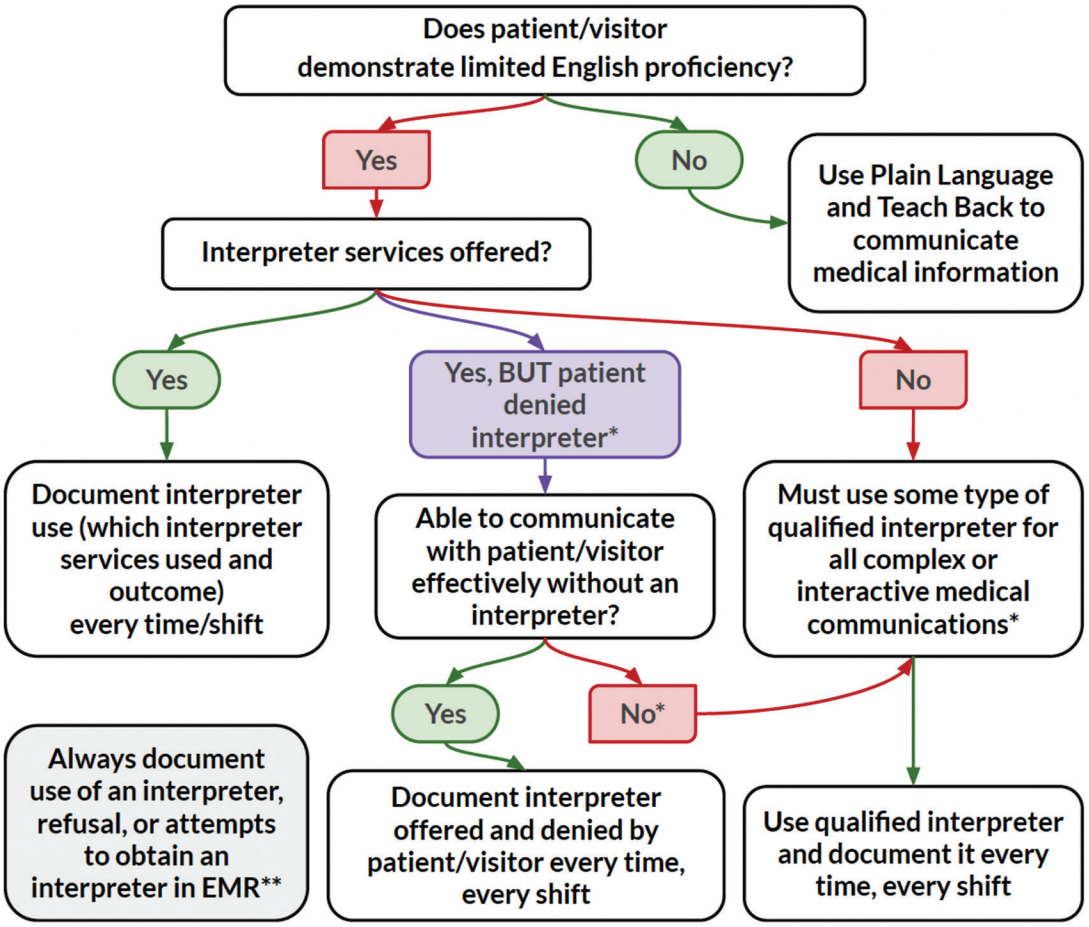
Appendix

Appendix, Table 1. Undesirable National Surgical Quality Improvement Program (NSQIP) Postoperative Outcomes	
Superficial Incisional SSI	**Superficial Incisional SSI is an infection that involves only skin or subcutaneous tissue of the surgical incision.**
Deep Incisional SSI	Deep Incisional SSI is an infection, which involves deep soft tissues. Deep soft tissues are typically any tissue beneath skin and immediate subcutaneous fat, for example fascial and muscle layers.
Organ/Space SSI	Organ/Space SSI is an infection that involves any part of the anatomy (eg, organs or spaces), other than the incision, which was opened or manipulated during the primary procedure.
Wound Disruption	The spontaneous reopening of a previously surgically closed wound.
Pneumonia	Pneumonia is an infection of one or both lungs caused by bacteria, viruses, fungi, or aspiration of gastric content or saliva.
Unplanned Intubation	The placement of an endotracheal tube or other similar breathing tube [Laryngeal Mask Airway (LMA), nasotracheal tube, etc.] and ventilator support.
Pulmonary Embolism	Lodging of a blood clot in the pulmonary artery with subsequent obstruction of blood supply to the lung tissue.
On Ventilator > 48 Hours	Total cumulative time of ventilator-assisted respirations exceeding 48 hours.
Progressive Renal Insufficiency/Acute Renal Failure	Progressive Renal Insufficiency: the reduced capacity of the kidney(s) to perform its function in comparison to the preoperative state. Acute Renal Failure Requiring Dialysis: A clinical condition associated with significant decline of kidney function in comparison to the preoperative state.
Urinary Tract Infection	An infection in the urinary tract (kidneys, ureters, bladder, and urethra).
Stroke/ (CVA)	An interruption or severe reduction of blood supply to the brain resulting in severe dysfunction.
Cardiac Arrest Requiring CPR	The absence of cardiac rhythm or presence of a cardiac rhythm requiring the initiation of cardiopulmonary resuscitation.
Myocardial Infarction	Reduction of blood flow to the heart causing damage or death to part of the heart muscle.
Blood Transfusion	Transfusion of red blood cells, whole blood, autologous blood, and cell-saver products.
Vein Thrombosis Requiring Therapy	New diagnosis of blood clot or thrombus within the venous system (superficial or deep), which may be coupled with inflammation and requires treatment.
Clostridium Difficile (C. diff)	C. diff. colitis is diarrhea of varying severity, from mild to fulminant and life-threatening.
Sepsis	Sepsis takes a variety of forms and spans from relatively mild physiologic abnormalities to septic shock.
Septic Shock	Septic shock is more severe than sepsis as it is associated with organ and/or circulatory dysfunction.

SSI (Surgical Site Infection). CVA (Cerebrovascular Accident).



Appendix, Figure 1. A Boxplot of Propensity Scores Distributed Between 2 Groups (limited English proficient (LEP) vs non-LEP)



USE QUALIFIED INTERPRETERS FOR ALL COMPLEX OR INTERACTIVE MEDICAL COMMUNICATIONS

- On admission
- Per patient or family request
- Prior history of interpreter use
- Change in status/reassessment
- Important/lengthy/sensitive communication (e. g. provider rounds)
- Informed consent, treatment/procedure/discharge instructions***
- To discuss symptoms, medical condition, medical history, diagnosis, prognosis, medications, tests, treatment options, surgery
- Mental health services

*While the patient may choose to use a friend or family member as an interpreter, the provider reserves the right to use a qualified medical interpreter to provide "shadow interpretation" in order to ensure the accuracy of the information being relayed.

**Including, but not limited to: Flowsheets, Notes (using smart phrase ".interpret"), Appointment Desk, Telephone encounter

***Ensure all consents are obtained with completed fields, dates, and signatures.

Appendix, Figure 2. Flowsheet Describing Interpreter Use and Complex/Interactive Medical Communications