

UCSF

UC San Francisco Previously Published Works

Title

Language Access Systems Improvement initiative: impact on professional interpreter utilisation, a natural experiment.

Permalink

<https://escholarship.org/uc/item/30c4j74c>

Journal

BMJ Open, 14(1)

Authors

Kaplan, Celia

Livaudais-Toman, Jennifer

Pathak, Sarita

et al.

Publication Date

2024-01-04

DOI

10.1136/bmjopen-2023-073486

Peer reviewed

BMJ Open Language Access Systems Improvement initiative: impact on professional interpreter utilisation, a natural experiment

Leah S Karliner ¹, Steven E Gregorich,¹ Sunita Mutha,¹ Celia Kaplan,¹ Jennifer Livaudais-Toman,¹ Sarita Pathak,² Maria E Garcia,¹ Lisa Diamond³

To cite: Karliner LS, Gregorich SE, Mutha S, *et al.* Language Access Systems Improvement initiative: impact on professional interpreter utilisation, a natural experiment. *BMJ Open* 2024;**14**:e073486. doi:10.1136/bmjopen-2023-073486

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2023-073486>).

Received 07 March 2023
Accepted 17 November 2023



© Author(s) (or their employer(s)) 2024. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

¹University of California, San Francisco, California, USA

²Emory University, Atlanta, Georgia, USA

³Memorial Sloan Kettering Cancer Center, New York, New York, USA

Correspondence to

Dr Leah S Karliner;
leah.karliner@ucsf.edu

ABSTRACT

Objectives This study aims to evaluate the Language Access Systems Improvement (LASI) initiative's impact on professional interpreter utilisation in primary care and to explore patient and clinician perspectives on professional interpreter use.

Design Multi methods: Quantitative natural experiment pre-LASI and post-LASI, qualitative semistructured interviews with clinicians and focus groups with patients post-LASI.

Setting Large, academic primary care practice.

Participants Cantonese, Mandarin, Spanish, English-speaking adult patients and their clinicians.

Intervention LASI initiative: Implementation of a clinician language proficiency test and simultaneous provision of on-demand access to professional interpreters via video medical interpretation.

Main outcome measures Quantitative: Proportion of language discordant primary care visits which were professionally interpreted. Qualitative: Salient themes related to professional interpreter use and non-use.

Results The researchers categorised language concordance for 1475 visits with 152 unique clinicians; 698 were not fully language concordant (202 pre-LASI and 496 post-LASI). Professional interpreter utilisation increased (pre-LASI 57% vs post-LASI 66%; $p=0.01$); the visits with the lowest percentage of professional interpreter use post-LASI were those in which clinicians and patients had partial language concordance. In inverse probability weighted analysis, restricting to 499 visits with strict estimated propensity score overlap (100% common support), post-LASI visits had higher odds of using a professional interpreter compared with pre-LASI visits (OR 2.39; 95% CI 1.04 to 5.48). Qualitative results demonstrate video interpretation was convenient and well liked by both clinicians and patients. Some partially bilingual clinicians reported frustration with patient refusal of interpreter services; others reported using the video interpreters as a backup during visits. Views of the care-partner role differed for clinicians and patients. Clinicians reported sometimes having family interpret out of convenience or habit, whereas patients reported wanting family members present for support and advocacy, not interpretation.

Conclusions LASI increased utilisation of professional interpreters; however, this was least prominent for partially language concordant visits. Health systems wishing

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Detailed categorisation of patient English and clinician non-English language skills to determine no, partial or full language concordance at primary care visits.
- ⇒ Use of inverse probability weighting to evaluate the impact of the Language Access Systems Improvement intervention natural experiment.
- ⇒ Qualitative investigation of patient and clinician perspectives and experiences with language concordance and professional interpreters to add context to the quantitative results.
- ⇒ High professional interpreter utilisation prior to the intervention may lead to underestimation of potential for improvement in health systems with lower utilisation.

to implement LASI or similar interventions will need to support clinicians and patients with partial bilingual skills in their efforts to use professional interpreters.

Trial registration number HSRP20153367.

INTRODUCTION

Language concordance and professional interpreter use are vital for the more than 25 million individuals in the USA who speak English less than very well^{1 2} as well as the many immigrants and migrants around the world who find themselves in need of medical care in a new language.³⁻⁶ These individuals tend to have less access to preventive services and worse healthcare outcomes because of language barriers, including less access to preventive services and mental healthcare, poorer diabetes control, more vulnerability to medical errors and more medication complications.^{5 7-11} Language concordance between patients and clinicians has been shown to improve patient outcomes, including patient satisfaction and empowerment, understanding of diagnosis, and objective measures of disease control.¹² Similarly, the use of

professional interpreters during language discordant clinical encounters has been demonstrated to improve communication, promote appropriate use of resources and significantly increase¹⁰ patient and clinician satisfaction.^{13–16} Assessment of clinician language proficiency can help determine whether a professional interpreter is needed to ensure adequate communication during a clinical encounter, or whether the patient and clinician can communicate effectively without an interpreter.

The most common approach in the USA for determining patients' English language ability is self-report of preferred language for medical care.¹⁷ However, there is no common approach either in clinical care or research for determining clinicians' non-English language proficiency.^{18–20} The three most frequently used methods include a single patient's assessment of the clinician's language skills, the clinician's self-assessment of their language skills using a standardised measure or results of a formal clinician language proficiency test. Clinician self-assessment tools tend to be easier and less expensive for health systems to administer, and multiple studies have shown that they have high agreement with other types of assessment within high-proficiency and low-proficiency response categories, but lower agreement in the middle-proficiency response categories (eg, 'good' or 'very good' self-reported language skills).^{21–23} This research suggests that clinicians who self-rate themselves somewhere in the middle of a language proficiency measure are a heterogeneous group: some may, and some may not, have sufficient skills to communicate with non-English-speaking patients without an interpreter during a clinical visit, indicating the need of more formal assessment.

When language concordance with clinicians with sufficient skills is not available, professional interpretation is critical for effective communication and the delivery of high-quality care to patients with non-English language preference for medical care.^{24–26} Professional interpreters improve communication, promote appropriate use of resources and significantly increase patient and clinician satisfaction.¹³ The use of professional interpreters also results in fewer errors in communication,²⁷ reduced disparities in the use of services²⁸ and improved clinical outcomes.¹³ In addition, professional interpreters help bridge not only linguistic but also cultural gaps that can challenge communication between patients and providers.^{29 30}

However, access to professional interpreters poses its own challenges. These include the complexities of having to meet the needs of patients speaking many different languages, hiring and maintaining a highly qualified staff or paying for professional vendor services in the setting of widespread lack of reimbursement for interpreter services, and deploying interpreters to often physically distant clinical settings with varied clinical needs.^{31–34} Multiple studies have documented underutilisation of professional interpretation due to time pressures, perceptions of variable necessity based on clinical content and inadequate documentation of a language barrier in the

medical record.^{35–37} While some individual health systems have reported on their quality improvement efforts to increase access to professional interpreters—including the use of medical interpreter services where interpreters join the clinic visit remotely—there is a gap in evidence about the impact of these efforts on professional interpreter use.³⁸ Similarly, there is little published on health system efforts to assess clinician non-English language proficiency.^{22 39}

We set out to answer the following research question: does implementing a language proficiency assessment for clinicians combined with increasing access to professional interpreters via video conferencing improve appropriate utilisation of professional interpreters?

METHODS

Study overview

In this manuscript, we report on one health system's effort to address the dual challenge of assessing clinician non-English language proficiency and increasing easy access to professional interpreters (the Language Access Systems Improvement initiative, LASI). We conducted a multimethod⁴⁰ evaluation of the initiative's effectiveness, including a natural experiment study of its impact on professional interpreter utilisation in primary care, and subsequent qualitative exploration of patient and clinician perspectives on reasons for using and not using professional interpretation.

Study context and setting

The LASI study was designed as a natural experiment to evaluate the impact of the LASI quality improvement initiative put into place by the University of California San Francisco (UCSF) health system. The LASI initiative consisted of two simultaneous improvements aimed at increasing appropriate utilisation of clinician non-English language skills and of professional interpreters dubbed the LASI Initiative: (1) certifying bilingual clinicians to use their non-English language skills directly with patients and (2) simultaneously increasing easy access to professional interpreters by instituting on-demand video-medical interpretation (VMI) services within ambulatory practices.

All study research took place in a single large academic general internal medicine (GIM) practice at UCSF between 2014 and 2017. This practice had three sites and served approximately 26 000 diverse patients, about 12% of whom had a non-English preferred language for medical care. The top non-English language groups served were Cantonese, Mandarin and Spanish, which is similar to the top non-English language groups in the USA.² Clinicians in this practice were faculty attending physicians, resident physicians and nurse practitioners (NP). The number of clinicians fluctuated during the study period with approximately 60 faculty, 70 resident physicians and 5 NPs at any one time; new clinicians were allowed to enter the study when they joined the practice, with an influx of resident

physicians joining each July as others left. While the LASI initiative took place across ambulatory practices at UCSF, the LASI study focused on this single practice allowing for a layered investigation into multiple aspects of communication and care processes while maintaining a single sampling frame for the patient and clinician population. The multiple aims of the LASI Study are available on the website of the Patient-Centered Outcomes Research Institute.⁴¹

Patient and public involvement

This LASI study had a stakeholder advisory board which was created to ensure that the implementation of the study was centred on the values of patient and stakeholder partners. The group was cochaired by a primary patient stakeholder and a clinician stakeholder, with members including two additional patients, leaders from two regional patient advocacy groups and a member of the UCSF Health Language and Interpreter Services management team. Members of the advisory board participated early on in the development of research design, survey design and translations, patient recruitment planning, data interpretation and dissemination planning. Further details of patient and public involvement in this study are available on the website of the Patient-Centered Outcomes Research Institute.⁴¹

The LASI initiative

Certifying bilingual clinicians in December 2013, UCSF Health sent a survey to all clinicians in the health system based on the modified International Language Roundtable language proficiency measure²²; this survey asked about their use of non-English language skills with patients. All respondents who indicated that they used a non-English language to communicate clinical information with patients and that their skills in that language were good/very good/excellent were then offered a standardised oral proficiency test in that language (the Clinician Cultural and Linguistic Assessment, CCLA)³⁹ to become certified as a bilingual clinician. If they indicated that their skills were fair or poor, they were reminded to access a professional interpreter in-person, by video or by telephone for communicating with patients preferring medical care in that language. All clinicians were reminded to access a professional interpreter for communication in any language for which they were not certified.

Easy access to professional interpreters via video conferencing in May 2014, UCSF Health began rolling out VMI access to ambulatory practices. Before the roll-out, patients and clinicians had access to in-person professional interpreter services by scheduling them in advance of the target clinical visit, and on-demand over regular telephones on exam room walls. When visits started or ran late, in-person interpreters often had to leave midway through the visit to travel to another appointment. Telephone interpretation was difficult due to poor audio quality and the fixed position of the telephone on the wall. While keeping scheduled in-person interpreter

access in place, UCSF Health opted to make professional interpreters easily available via video conferencing. The VMI units were placed on carts and could be wheeled into the room, the language selected on a screen, and a visual and audio connection made to a professional interpreter working remotely. As with telephonic interpreters, these interpreters were not scheduled; rather, they were available on demand when the clinician and patient were ready to start the visit and could stay connected as long as they were needed. Frequently, medical assistants would set up the VMI cart when they roomed a patient with a non-English language preference; this served as a visual cue to clinicians to access an interpreter for that visit. There were no additional reminders during LASI initiative implementation.

Study design rationale

After carefully considering alternative study designs, we chose a quasi-experimental preintervention versus postintervention comparison using inverse probability weights (IPW) to help balance potential confounders. This design had several strengths. LASI is a long-term, system-wide intervention that was funded and implemented by a healthcare system. Practices, clinicians and clinical staff within the system regard the LASI intervention as a permanent mandate, which promotes corresponding practice-level workflow changes as well as individual buy-in. We also considered randomised controlled (RCT) trial designs where the units of randomisation were healthcare systems, practices within systems, clinicians within practices or patients within clinicians. Whereas RCT designs generally provide a stronger basis for drawing causal inferences, in this context, they would entail several disadvantages related to logistics as well as internal and external validity. Regardless of the chosen units of randomisation, an experimental LASI intervention likely would be perceived as temporary, that is, not to be maintained past completion of the RCT, which would be expected to negatively impact intervention uptake, buy-in and fidelity. Additionally, an RCT would require the research budget to cover VMI-related expenses, which are beyond the scope of typical grant mechanisms. RCT designs would face additional challenges specific to the chosen units of randomisation. For example, randomising healthcare systems would require identifying sufficient numbers agreeable to system-level randomisation, while randomising clinicians or patients would present VMI-related workflow issues, including potential confusion and intervention contamination. On balance, we chose the quasi-experimental design, which allows investigation of the impact of actual system change. The incorporation of IPW in the analysis helped to bolster the basis for drawing causal inferences.

Study participants

Clinician participants

While most clinicians in the study GIM practice participated in the language survey as part of the LASI initiative,

for those who had not yet participated, the study team asked UCSF Health to resend it to them. For those who were eligible for language proficiency testing based on the language survey, but had not yet completed the CCLA test, the study incentivised them to complete the test through UCSF Health with a US\$100 restaurant gift certificate. We then sent an email to all of the GIM practice's primary care clinicians explaining the LASI Study, and giving them the option to opt out of either having the study use their UCSF Health language proficiency data or allowing the study to recruit their patients to participate in postclinic visit telephone interviews. If they opted out of either, or if we did not have their proficiency language data, they were excluded from the study. All other clinicians were included in the study.

Patient participants

We recruited Chinese (Cantonese and Mandarin) and Spanish-speaking primary care patients (PCP) from the GIM practice during two time frames (pre-LASI January 2014–March 2014; post-LASI February 2016–June 2017). To leverage the natural experiment opportunity created by the implementation of the LASI initiative, the study team recruited pre-LASI participants during the initial part of the bilingual certification roll-out and prior to VMI roll-out and did not include English speakers at that time. Pre-LASI recruitment ended at the time of VMI roll-out in the practice. All pre-LASI patients were older than 40 and most were older than 50, reflecting the older of age of patients with non-English language preference in the study practice. Post-LASI recruitment added ethnically Chinese and Latino/a/x (hereafter Latino) English-speaking patients in addition to the Chinese-speaking and Spanish-speaking patients for comparison of some of the communication and clinical outcomes (not reported on here).⁴¹ Since the pre-LASI patients were all >40 years old, and to avoid having a much younger English-speaking post-LASI sample, we set an age limit for recruitment of the entire post-LASI sample of 40. We allowed any given patient to participate up to twice: once in the pre-LASI period and once in the post-LASI period.

At the beginning of each week, we pulled a list of new visit and follow-up GIM patient appointments scheduled for the following week with participating clinicians. The study then mailed an introductory letter and information sheet to each potentially eligible participant to be delivered prior to the scheduled visit. The letter and information sheet were mailed in the patient's preferred language as recorded in the electronic medical record (EMR), although all information sheets also included English (ie, Chinese and English, or Spanish and English). Bilingual-bicultural trained research assistants (RAs) then called potential participants with the goal of interviewing each participant 1–3 days (and no more than 1 week) after their primary care visit. Once reached, the RA consented the patient verbally on the telephone prior to the interview; the interview itself was conducted in the patient's preferred language, took approximately 10 min,

and included questions specific to the most recent GIM clinic visit (the 'index' visit) and the clinician they saw during that visit.

Inclusion and exclusion criteria

Patient inclusion: age ≥ 40 ; English (post-LASI, only), Chinese or Spanish preferred language; self-identified as ethnically Chinese or Latino; PCP in GIM study practice with a primary care clinician who had taken the UCSF Health clinician language survey; a working telephone number and current address in the EMR. Patients were excluded if: their primary care clinician opted out of having either their language data or their patients included in the study; during the first part of the telephone interview, the patient's hearing was too impaired to participate in a telephone interview; and the patient was unable to cognitively follow and answer an interviewer's questions on the telephone.

Quantitative measures

Language proficiency measures

Patient English proficiency

We considered patient participants to have limited English proficiency (LEP) based on a combination of their non-English language preferred for healthcare and self-reported ability to speak English using our previously validated algorithm.⁴² These data were collected from the telephone survey.

Patient report of clinician non-English language proficiency

We asked patient participants if their clinician spoke to them at the index visit in their non-English preferred language; if they indicated 'yes', then we asked them to rate the clinician's non-English language ability ('excellent'=5, 'very good'=4, 'good'=3, 'fair'=2, 'poor'=1 and 'none'=0).

Patient report of interpretation during the index visit

Finally, we asked patient participants whether anyone interpreted during their visit and, if so, who did the interpreting (professional in-person, professional over video, professional over telephone, family/friend, clinic staff).

Clinician self-assessed non-English language proficiency

As part of the LASI Initiative UCSF Health language survey, clinicians self-reported language ability in each non-English language they used to discuss clinical information with patients. The study categorised as monolingual English speakers all clinicians who reported no/poor/fair ability to communicate in the targeted non-English languages (Cantonese, Mandarin or Spanish). Those clinicians who reported good/very good/excellent ability to communicate in one of the target languages qualified for language proficiency testing through UCSF Health.

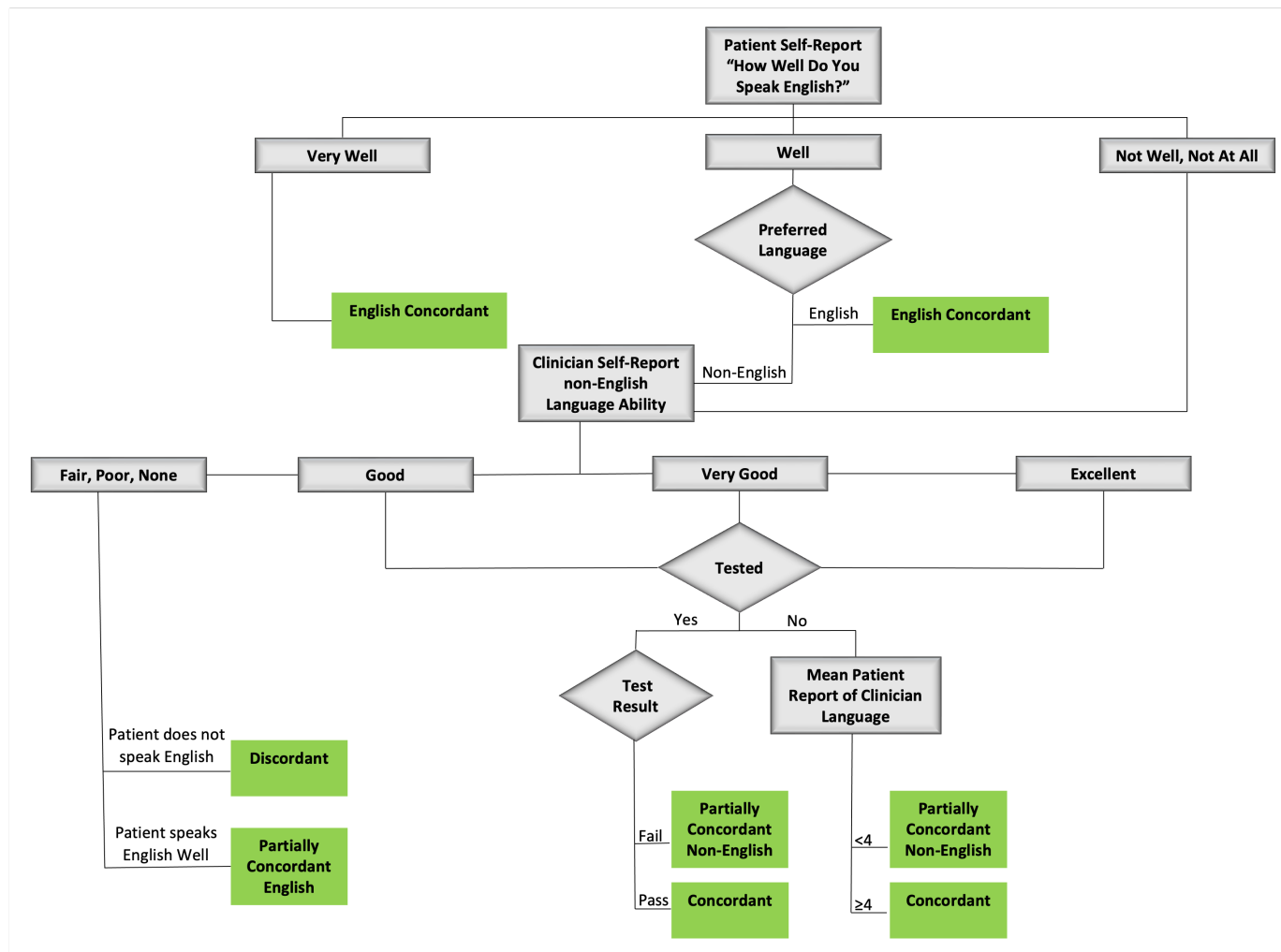


Figure 1 Visit language concordant classification using patient and clinician report and proficiency test results.

Clinician results of language proficiency testing

We considered any clinician who took and passed the CCLA³⁹ in Cantonese, Mandarin or Spanish to be bilingual in English and the tested language.

Combined clinician self-assessment and patient report of clinician non-English language proficiency

If a clinician qualified for testing in one of the targeted languages but did not take the CCLA in that language, we used the mean patient report of that clinicians' language skills in Cantonese, Mandarin or Spanish to categorise their proficiency when at least three unique patient reports were available. We considered clinicians with a mean patient report of ≥ 4 ('very good') to be proficient in that language, those with a mean >2 to <4 to be partially proficient in that language; and those with a mean 1–2 to be without any proficiency.

Visit-level language concordance classification leveraging multiple proficiency measures

We defined each visit classification based on the proficiency measures described above and displayed in figure 1. The five visit classifications included English concordant (patient English proficient—any clinician—described in

figure 1 but not otherwise reported on in this manuscript), non-English concordant (patient with LEP and clinician fully proficient in the patient's preferred language), partially concordant non-English (patient with LEP and clinician partially proficient in the patient's preferred language), partially concordant English (patient with LEP self-reported speaking English 'well' and clinician was a monolingual English speaker) and discordant (patient with LEP who self-reported speaking English 'not well' or 'not at all' and clinician was a monolingual English speaker). We considered all of the partially concordant and discordant visits to need professional interpretation during the visit to ensure good-quality communication.

Primary predictor: LASI time period

Pre-LASI interviews took place between 22 January 2014 and 25 March 2014. Post-LASI interviews took place between 1 February 2016 and 9 June 2017.

Primary outcome: professional interpretation

The primary outcome was the proportion of language discordant primary care visits which were professionally interpreted at the index visit.

Potential confounding variables

We collected the following variables from the patient-participant survey: age, gender, educational attainment (less than high school, high school diploma, associate degree or some college, bachelor's college degree or higher), and whether clinician seen at visit was patient's usual PCP (yes/no). We collected the following variables from manual chart review or the EMR: patient insurance status (private, Medicare, Medicaid), comorbidities (measured using the Elixhauser Comorbidity Index),⁴³ frequency of clinic visits in prior 12 months, length of time as a patient in the practice, number of problems listed in the assessment and plan of the note, type of clinician seen at the index visit (attending, resident, NP), gender of clinician seen at the visit.

Quantitative analyses

In unadjusted analyses, we compared the characteristics of the pre-LASI and post-LASI samples. We then identified those visits eligible to have a professional interpreter present, excluding those determined to be fully concordant using the method described above; and, we limited our analysis of interpreter utilisation to those visits. We described unadjusted differences in professional interpreter utilisation between pre-LASI and post-LASI samples separately for discordant, partially concordant English and partially concordant non-English visits, as well as for all of the non-concordant visit types combined.

In an adjusted analysis of all non-concordant visit types combined, a weighted mixed logistic model regressed the professional interpreter utilisation indicator onto the pre-LASI versus post-LASI indicator. The model included random intercepts for physicians and patients to account for clustering of patients within clinicians and for multiple observations per patient (ie, patients with both a pre-LASI and a post-LASI study visit). Estimated IPW weights were incorporated to help balance confounders across the pre-LASI and post-LASI groups and bolster the basis for drawing causal inferences.⁴⁴ In a preliminary analysis step, IPW calculation began with estimation of the propensity for a visit to be in the post-LASI (vs pre-LASI) sample via a generalised boosted regression model including the full set of potential confounders as x variables (Rand Corporation TWANG toolkit).⁴⁵ An average absolute standardised effect size <0.20 was chosen as the model-selection criterion, IPWs for an average treatment effect were estimated and IPW values were stabilised. In addition, overlap of estimated propensity score distributions across the pre-LASI and post-LASI samples was assessed. In the event that complete overlap (100% common support) was not obtained, planned analyses refit the mixed logistic model after removing patients from the data who were not within the estimated propensity score overlap range.

Qualitative methods

Clinician semistructured interviews

We conducted semistructured interviews with clinician participants with the goal of interviewing approximately equal numbers of clinicians from the following language groups: monolingual English; fully bilingual (in English and Cantonese, Mandarin or Spanish); partially bilingual (in English and Cantonese, Mandarin or Spanish) and reaching saturation of themes where no new concepts emerge in the interviews.⁴⁶ We recruited clinicians by email who had patients in the quantitative post-LASI survey sample and who were still working in the practice, starting with the fully and partially bilingual clinicians due to their limited numbers, and randomly selecting among the monolingual English speakers. Topics covered included most recent visits with a patient whose preferred language was non-English, reasons to choose/not choose to work with an interpreter, interpreter types and modalities, language proficiency assessment. All participants were provided with a written information sheet in advance by mail, and then consented verbally at the beginning of the interview. Each interview lasted 30–45 min and took place in person or over video conferencing. All interviews were audiorecorded and transcribed for analysis.

Patient focus groups

We recruited patient participants from among the post-LASI survey participants who agreed to participate in future research and were still patients in the practice for four focus groups with a goal of 8–10 participants in each: two in Spanish, one in Cantonese and one in Mandarin. In order to elicit a diversity of experience, we aimed to limit the number of participants with the same PCP to two per focus group. We ended recruitment once we had filled each focus group. A bilingual/bicultural researcher consented all participants at the beginning of the focus group by reviewing a written consent form and answering any questions the participants had before signing it. Topics covered included preferred language for communication, interpretation in general, family members/caregiver participation in visits, most recent visit with their PCP communication and interpretation, non-PCP visits, suggestions for improvement. The focus groups each lasted 1.5 hours and were audiorecorded, translated and transcribed for analysis.

Qualitative coding and analysis

We used inductive and deductive coding to analyse the transcribed clinician interviews and focus groups.^{47 48} The research team created an initial codebook for the clinician interviews using three interviews chosen at random to create data-driven themes and codes. Two researchers then double-coded an additional two transcripts to confirm the definitions and application of the codes. If any discrepancies arose, the research team met to reconcile codes and review additional themes that may have emerged. We used a similar process to develop the final focus group codebook. Using an updated codebook, the

two researchers coded remaining transcripts, addressing any coding discrepancies and resolving with consensus of the research team. To provide context to our quantitative results of interpreter utilisation, qualitative analysis for this study focused on use of and continued barriers to professional interpretation, comparing and contrasting experiences and perceptions of clinicians and patients where relevant.

RESULTS

Quantitative results

PCP clinicians' participation and language skills

No clinicians opted out from allowing us to use their language data or from contacting their eligible patients. However, 9 (5.6%) of 161 potentially eligible clinicians did not complete the UCSF Health language survey and so they and their patient visits were excluded.

Among the 152 unique clinicians included in the study (table 1), 52 were eligible for the proficiency testing programme in Cantonese, Mandarin or Spanish (self-reported language ability as 'good', 'very good' or 'excellent'), with two clinicians eligible for testing in more than one language (although neither of these two clinicians completed a language test in either eligible language). Out of the 52 PCPs who were eligible for testing, 21 completed tests (40%) and 17 passed (81% pass rate). Testing was higher among those whose self-reported language ability was 'very good' (10/15; 67%) or 'excellent' (5/5; 100%), compared with those whose self-reported language ability was 'good' (6/34; 18%).

Patient participation

In the pre-LASI study period, we called 660 patients and reached 494 within 1 week of their index visit: 340 were eligible and 294 participated (46 refusals) for participation of 87% among those reached and eligible. In the post-LASI study period, we called 2467 patients and reached 1840 within 1 week of their index visit: 1697 were eligible and 1181 participated (516 refused) for participation among those reached and eligible of 70%. Participation in the post-LASI period among those reached and eligible was higher for patients with LEP (Cantonese speakers 83%; Mandarin speakers 76%; Spanish speakers 71%) than for English speakers (63%).

Patient and visit characteristics pre-LASI versus post-LASI

In our overall sample, there were 1475 visits: 446 English Concordant visits (30%; post-LASI included for descriptive purposes here only) as well as, combined across pre-LASI and post-LASI, 331 concordant non-English visits (22%), 106 partially concordant non-English visits (7%), 56 partially concordant English visits (4%) and 536 discordant visits (36%). Distribution of the LEP visit types pre-LASI and post-LASI was similar ($p=0.11$).

We display patient and visit characteristics in the two study periods in table 2 for the participants with LEP only. Participants in the pre-LASI and Post-LASI samples were

very similar. However, they did differ in the following ways: compared with the pre-LASI sample, a higher proportion of sampled post-LASI patients graduated from high school and college, and a lower proportion had private insurance. While the mean count of comorbidities in the two groups was the same, those in the post-LASI sample had, on average, fewer primary care visits in the prior year.

Utilisation of professional interpreters

We included only partially concordant non-English, partially concordant English and discordant visits as eligible for professional interpreter utilisation (N=698). In table 3, we present the unadjusted results of interpreter use by study period and visit classification. Overall professional interpreter utilisation increased after LASI implementation (pre-LASI 57% vs post-LASI 66%). Compared with pre-LASI visits, post-LASI visits had greater than twice the odds of including a professional interpreter when considering all 698 interpreter-eligible visits (OR 2.02, 95% CI 0.99 to 4.14) and when restricting data to the 499 visits with strict estimated propensity score overlap (OR 2.39; 95% CI 1.04 to 5.48). In both analyses, the 95%CI lower bound of the OR estimate was close to unity. An adjunct analysis found no significant interaction between patient preferred language and study period within the sample including all eligible visits (N=698) or the sample restricted based on estimated propensity score overlap (n=499).

While utilisation increased for all types of eligible visits, 24% (n=94) of discordant visits in the post-LASI period remained without professional interpretation. Most (n=59; 63%) of these 94 interpreted discordant visits had a family/friend present who, by the patient's report, spoke both their preferred language and English 'well' or 'very well' and interpreted during the visit for the patient (ad hoc, non-professionally interpreted). Compared with the discordant professionally interpreted visits, these discordant ad hoc interpreted visits were with patients who were on average older (ad hoc interpreted 75.0 ± 1.3 years vs professionally interpreted 69.3 ± 0.5 years) and who had more comorbidities (ad hoc interpreted 3.2 ± 0.2 vs professionally interpreted 2.5 ± 0.1). Other patient and visit characteristics were similar.

Qualitative results

Clinician semistructured interview participants

We reached out to 32 clinicians to participate in semistructured qualitative interviews; after conducting 16 interviews, we reached thematic saturation. Of the 16, 5 were monolingual English, 5 fully bilingual (1 English-Cantonese, 2 English-Mandarin, 2 English-Spanish) and 6 partially bilingual (3 English-Mandarin, 3 English-Spanish). Fifteen were attending MDs and one was an NP.

Patient focus group participants

We reached out by telephone to 98 post-LASI participants with LEP to invite participation in focus groups. We spoke with 76 potential participants. Half (n=39;

Table 1 Primary care clinician participant characteristics overall and comparing preimplementation and postimplementation of the Language Access Systems Improvement (LASI) initiative

	Total unique clinicians (N=152)	Pre-LASI clinicians (N=83)*	Post-LASI clinicians (N=109)*
Clinician gender			
Female	91 (59.9)	53 (63.9)	64 (58.7)
Male	61 (40.1)	30 (36.1)	45 (41.3)
Faculty status			
Attending	49 (32.2)	33 (39.8)	43 (39.5)
NP	7 (4.6)	4 (4.8)	5 (4.6)
Resident	96 (63.2)	46 (55.4)	61 (55.9)
Spanish skills (self-report)			
None	102 (67.1)	54 (65.1)	72 (66.1)
Poor	2 (1.3)	0	2 (1.8)
Fair	13 (8.6)	8 (9.6)	10 (9.2)
Good	22 (14.5)	13 (15.7)	16 (14.7)
Very good	9 (5.9)	4 (4.8)	8 (7.3)
Excellent	4 (2.6)	4 (4.8)	1 (0.9)
Cantonese skills (self-report)			
None	143 (94.1)	76 (91.6)	103 (94.5)
Poor	2 (1.3)	1 (1.2)	1 (0.9)
Fair	1 (0.7)	1 (1.2)	1 (0.9)
Good	4 (2.6)	4 (4.8)	2 (1.8)
Very good	1 (0.7)	0	1 (0.9)
Excellent	1 (0.7)	1 (1.2)	1 (0.9)
Mandarin skills (self-report)			
None	135 (88.8)	73 (88.0)	96 (88.1)
Poor	2 (1.3)	1 (1.2)	1 (0.9)
Fair	2 (1.3)	1 (1.2)	2 (1.8)
Good	8 (5.3)	5 (6.0)	6 (5.5)
Very good	5 (3.3)	3 (3.6)	4 (3.7)
Excellent	0	0	0
CCLA testing results			
Did not test	131 (86.2)	72 (86.7)	91 (83.5)
Fail (Spanish)	2 (1.3)	0	2 (1.8)
Fail (Cantonese)	0	0	0
Fail (Mandarin)	2 (1.3)	1 (1.2)	2 (1.8)
Pass (Spanish)	9 (5.9)	6 (7.2)	6 (5.5)
Pass (Cantonese)	3 (2.0)	2 (2.4)	3 (2.8)
Pass (Mandarin)	5 (3.3)	2 (2.4)	5 (4.6)
Patient participants per clinician			
Mean±SD (range)	9.6±13.7 (1–122)	3.4±4.0 (1–20)	10.8±12.3 (1–102)
Median (IQR)	6 (2–10.5)	2 (1–4)	7 (4–13)

*40 clinicians had patients in both pre-LASI and post-LASI periods.
CCLA, Clinician Cultural and Linguistic Assessment.

51%) declined to participate, 6 agreed but no-showed to a group and 31 (41%) participated (n=11 Spanish speakers, n=11 Mandarin speakers, n=9 Cantonese speakers).

Salient themes related to use and remaining barriers to use of professional interpreters

Here, we summarise salient themes related to use and remaining barriers to use of professional interpreters

Table 2 Characteristics of primary care patients (PCPs) and their visit clinicians: patients with limited English proficiency (LEP) by pre-LASI and post-LASI periods (N=1029)*

	Patients with LEP	
	Pre-LASI N=294 n (%)	Post-LASI N=735 n (%)
Preferred non-English language		
Spanish	90 (30.6)	190 (25.9)
Cantonese	130 (44.2)	388 (52.8)
Mandarin	74 (25.2)	157 (21.4)
Ethnicity		
Latino	90 (30.6)	189 (25.7)
Chinese	204 (69.4)	546 (74.3)
Age, years (mean±SE)	71.0±0.8 (range: 40–97)	70.2±0.8 (range: 40–97)
Gender		
Female	208 (70.7)	483 (65.7)
Male	86 (29.3)	252 (34.3)
Education		
Less than high school	152 (51.7)	356 (48.4)
High school diploma	39 (13.3)	153 (20.8)
Associates degree or some college	46 (15.6)	72 (9.8)
College degree or higher	44 (15.0)	149 (20.3)
Refused/DK/missing	13 (4.4)	5 (0.7)
Insurance status		
Private	54 (18.4)	86 (11.7)
Medicare	193 (65.6)	501 (68.2)
Medi-Cal	47 (16.0)	148 (20.1)
Comorbidity count (mean±SE)	2.6±0.1 (range: 0–9)	2.6±0.1 (range: 0–9)
No of primary care visits in prior 12 months (mean±SE)	4.4±0.2 (range: 0–14)	3.4±0.1 (range: 0–16)
Length of time (months) in practice† (mean±SE)	28.1±1.1 (range: 0–35.5)	30.7±0.7 (range: 0–35.5)
No of problems in visit note assessment and plan (mean±SE)	5.6±0.3 (range: 1–16)	5.1±0.3 (range: 1–21)
Type of clinician		
Faculty MD	182 (61.9)	426 (57.9)
Resident MD	91 (31.0)	268 (36.5)
Nurse practitioner	21 (7.1)	41 (5.6)
Language concordance		
Concordant, non-English	92 (31.3)	239 (32.5)
Partially concordant, non-English	46 (15.7)	60 (8.2)
Partially concordant, English	11 (3.7)	45 (6.1)
Discordant	145 (49.3)	391 (53.2)
Saw own PCP at visit	226 (76.9)	532 (72.4)
Visit clinician gender		
Female	193 (65.6)	440 (59.9)
Male	101 (34.4)	295 (40.1)

*1029 visits for 859 unique patients: 124 in pre-LASI only, 565 in post-LASI only and 170 patients with LEP in both pre-LASI and post-LASI periods.
 †35.5 months was the maximum amount of retrospective patient information available in the EMR for the pre-LASI patients. Therefore, length of time as a patient in the practice was truncated at 35.5 months for all groups.

ANOVA, analysis of variance; EMR, electronic medical record; LASI, Language Access Systems Improvement.

from the clinician interviews and patient focus groups. Representative quotes are included below with more displayed in [table 4](#).

VMI interpretation was convenient and well liked by both clinicians and patients. While some preferred in-person interpreters, most clinicians and patients

Table 3 Unadjusted comparison of professional interpreter utilisation in the pre-LASI and post-LASI periods (N=698)

	Professional interpreter Utilisation	
	Pre-LASI (N=202)* n/N (%)	Post-LASI (N=496)† n/N (%)
Discordant	104/145 (71.7)	297/391 (76.0)
Partially concordant English	2/11 (18.2)	11/45 (24.0)
Partially concordant non-English	10/46 (21.7)	19/60 (31.7)
All	116/202 (57.4)	327/496 (65.9)

*Among the 116 professionally interpreted visits pre-LASI, 83 were with in-person interpreters, 38 via telephone.

†Among the 327 professional interpreted visits post-LASI, 49 were with in-person interpreters, 240 via video, 35 via telephone.
LASI, Language Access Systems Improvement.

were very happy with the access and quality of the VMI interpreters.

It is so convenient and I really appreciate how the nurse has already brought in the video interpreter. It's easy to pick the different languages and you can immediately get a video or an audio interpreter, and patients actually really like it—Monolingual English speaking MD

Views of the care-partner role differed for clinicians and patients. Clinicians reported sometimes having family interpret out of convenience or habit. Whereas patients

reported wanting their family members at the visit for support and advocacy, not to interpret.

There are a subgroup of patients who we've gotten into, I would say maybe a habit where they always come with usually the same one or two family members and they interpret.—Bilingual Spanish speaking MD

I have gone with my children but not so they interpret for me but so they know the doctor.—Cantonese Focus Group participant

Table 4 Clinician interview and patient focus group salient themes and representative quotes

VMI interpretation is convenient and well-liked by both clinicians and patients	<p><i>'I think it's become my default is just to assume I'm going to have a video interpreter. I think it's absolutely fantastic. It is so convenient and I really appreciate how the nurse has already brought in the video interpreter. It's easy to pick the different languages and you can immediately get a video or an audio interpreter, and patients actually really like it'—Monolingual English MD</i></p> <p><i>'The video interpreter interprets quite well. He is similar to the on-site interpreter. I can see him clearly. He could even see my throat from the camera. Both of us can see each other and understand each other.'</i>—Mandarin Focus Group participant</p>
View of care-partner role differs for clinicians and patients	<p><i>'There are a subgroup of patients who we've gotten into, I would say maybe a habit where they always come with usually the same one or two family members and they interpret. At some point I would have offered an in-person or a video interpreter and it was declined, but I don't make the practice of always offering it.'</i>—Bilingual Spanish speaking MD</p> <p><i>'Yeah, but you know, things happen right? We all know we have to do things that don't meet our ideals. In that situation, you're trying to meet a patient care need, and what's available to you is his girlfriend, and he's saying it's okay. Let's at least do this option.'</i>—Monolingual English speaking NP</p> <p><i>'I have gone with my children but not so they interpret for me but so they know the doctor.'</i>—Cantonese Focus Group participant</p> <p><i>'...sometimes you're left thinking, 'But what do I actually have?' So my wife is the one who focuses on that. 'But what does he actually have? Are there medications for it? Cures or not?' So, she's the one to dig deep.'</i>—Spanish Focus Group participant</p>
Partially bilingual skills add complexity to interpreter use and communication	<p><i>"One of the things that I really struggle with is that since I do speak Spanish, some of my patients think that I don't need an interpreter and will refuse an interpreter at the front desk."</i>—Partially bilingual Spanish speaking MD</p> <p><i>'I will sometimes say to the interpreter at the beginning, I'll tell them, 'I do speak some Mandarin, so I may speak some Mandarin to the patient during the visit, but I will definitely need your help to interpret something along the way.' I'll let them know so that they're not wondering why they're there.—Partially bilingual Mandarin speaking MD</i></p> <p><i>'They ask, 'Do you want an on-site interpreter or a video?' I say I prefer a video. When I arrive and the video is turned on, I tell the interpreter that he does not need to interpret and I just want him to be a backup and that if I need help I will let him know.'</i>—Mandarin Focus Group participant</p> <p><i>'The vocabulary that I have doesn't allow me to express myself in all the aspects and in all its magnitude about the issues that I need to talk about and that I want to talk with her about. Because I don't have that vocabulary yet. So she uses a mechanical interpreter, and we use the interpretation of the interpreter to go deeper into the issues that we are going to talk about.'</i>—Spanish Focus Group participant</p>

VMI, video-medical interpretation.

Partially bilingual skills added complexity to interpreter use and communication. Some partially bilingual clinicians reported frustration with patient refusal of interpreter services. Others reported using the VMI interpreters as a backup during the visit. Patients also reported this backup use of interpreters for their partial English skills. There was also acknowledgement of a certain amount of 'getting by' with partial non-English and partial English skills. Still, patients with partial English skills largely stressed the importance of having a professional interpreter present to support clear and in-depth communication.

One of the things that I really struggle with is that since I do speak Spanish, some of my patients think that I don't need an interpreter and will refuse an interpreter at the front desk.—Partially bilingual Spanish speaking MD

The vocabulary that I have doesn't allow me to express myself in all the aspects and in all its magnitude about the issues that I need to talk about...we use the interpretation of the interpreter to go deeper into the issues that we are going to talk about.—Spanish Focus Group participant

DISCUSSION

In this natural experiment mixed-methods study, we found that the LASI initiative successfully increased utilisation of professional interpreters. However, post-LASI there remained a number of discordant visits in which a family member served as an ad hoc interpreter. This is consistent with results from other improvement efforts which, despite successes, also found persistent use of ad hoc interpreters for some encounters.^{49 50} In our study, ad hoc interpreter use was most often for older patients with multiple comorbidities. In qualitative interviews, clinicians reported sometimes having family interpret for reasons of both convenience and habit. Clinicians may find this approach particularly convenient with older patients in which the family member interpreting is also a primary caregiver for the patient.⁵¹ However, patients who participated in focus groups reported preferring family members to be present at visits for support and advocacy and not as interpreters, demonstrating a disconnect between patient preference and clinician practice.

Prior studies have not usually distinguished between partially and fully language concordant visits as we did in this study.^{12 20} Our use of multiple inputs to determine language proficiency, and thus concordance, allowed us to identify those fully concordant visits not requiring interpretation, and also to identify partially concordant visits, which might otherwise have been misclassified as either discordant or fully concordant. This partially concordant group is largely driven by clinicians whose non-English language skills, falls in the middle of the proficiency spectrum^{21–23 52} and is of particular interest. Frequency of professional interpreter use for partially

language concordant visits, while improved from the pre-LASI period, remained low, post-LASI. Our qualitative interviews and focus group data illuminate the complexity and challenges of partially concordant visits, particularly when patients speak some English or when patients decline professional interpreters in favour of speaking directly with clinicians who are partially bilingual in their language.

While other health systems have published on pilots or roll-outs of video medical interpreting,^{38 53 54} few have highlighted the specific challenges faced by partially bilingual clinicians.⁵⁵ Health systems wishing to provide universal language access for patients with LEP will need to support clinicians and patients with partial bilingual skills in their efforts to use professional interpreters. This could include framing professional interpreter use as a 'back-up' to partially language concordant communication. It may also include workflow approaches to have the VMI equipment available in the exam room for all patients with LEP so the clinician can offer interpretation even to patients who have declined at the front desk or with the medical assistant. This could increase partially bilingual clinician use of professional interpretation. A similar approach could be taken with the VMI in the exam room regardless of whether a family member helped to interpret at the front desk or with the medical assistant. This will again remind the clinician to offer a professional interpreter each time they see a patient and allow the family member's role to be similar to the role for family members of English-speaking patients—participant, caregiver, advocate—without complicating that with a role as interpreter. Given physicians' frequent use of non-English languages,¹⁹ it will be important to study the most effective approaches to partial language concordance in clinical care.

This study had some limitations. First, this was a single-site study in one diverse academic PCP in an urban US setting, limiting its generalisability. The sampled practice may differ from other large and smaller practices without regular access to in-person interpreters, as its use of professional interpreters (in-person and telephone) was quite high at baseline. In fact, LASI might be even more effective in a setting with lower baseline use. Second, this was an observational study, which, despite our best efforts at rigorous natural experimental methods, limits our ability to infer causality. Third, for both methodological and logistical reasons, we only included the most common non-English languages in the practice; it remains to be seen if LASI has similar, less or greater impact on patients speaking less prevalent languages. However, a remote approach such as VMI may increase access to less commonly available language services even more than to commonly available language services, and so it is possible VMI would lead to an even greater increase in professional interpreter use for patients in these language groups.

In summary, we leveraged a natural experiment design to evaluate the impact of a systems intervention



to simultaneously increase access to professional interpreters and certify clinicians to use their non-English language skills directly with patients (LASI intervention) on PCPs with LEP. We found that LASI did increase utilisation of professional interpreters; however, this was least prominent for partially language concordant visits. Health systems wishing to implement LASI or similar interventions will need to support clinicians and patients with partial bilingual skills in their efforts to use professional interpreters.

Contributors LSK is responsible for the overall content as guarantor, and as such accepts full responsibility for the finished work and the conduct of the study, had access to the data, and controlled the decision to publish. LSK conceived of the study, obtained funding, oversaw data collection and result interpretation, and drafted the manuscript. LD participated in study conception, result interpretation, and manuscript writing and review. SEG advised on study design and data collection, oversaw quantitative data analysis, and participated in manuscript writing and review. SM oversaw qualitative data analyses, participated in result interpretation and manuscript writing and review. CK advised on data collection, participated in qualitative analyses, result interpretation and manuscript writing and review. JL-T supported quantitative data analyses, participated in result interpretation and manuscript review. SP supervised data collection, participated in qualitative analyses and participated in result interpretation and manuscript review. MG participated in qualitative analyses and manuscript writing and review.

Funding Research reported in this article was funded through a Patient-Centered Outcomes Research Institute (PCORI) Award AD-1409-23627.

Competing interests LSK has grant funding from the National Institute on Aging and was a consultant for a research project at the University of Illinois Chicago. SM is on the Board of Directors of Insure the Uninsured Project (unpaid). MG has grant funding from the National Institute of Minority Health and Health Disparities. LD receives book royalties from Multilingual Matters and is on the Board of Directors of the National Association of Medical Spanish (unpaid). SEG, CK, JL-T and SP have no declared competing interests.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and this study was approved by the Human Research Protection Program, University of California San Francisco, IRB number, 15-16762. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. A deidentified quantitative dataset is available on reasonable request to corresponding author.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iD

Leah S Karliner <http://orcid.org/0000-0003-2204-5114>

REFERENCES

- Zeigler K, Camarota SA. 67.3 Million in the United States Spoke a Foreign Language at Home in 2018. Center for Immigration Studies, 2019. Available: https://cis.org/sites/default/files/2019-10/camarota-language-19_0.pdf
- Dietrich S, Hernandez E. *Language Use in the United States: 2019*. US Census Bureau, 2022. Available: <https://www.census.gov/library/publications/2022/acs/acs-50.html>
- Mangrio E, Sjögren Forss K. Refugees' experiences of Healthcare in the host country: a Scoping review. *BMC Health Serv Res* 2017;17:814.
- Lebano A, Hamed S, Bradby H, et al. Migrants' and refugees' health status and Healthcare in Europe: a Scoping literature review. *BMC Public Health* 2020;20:1039.
- Pandey M, Maina RG, Amoyaw J, et al. Impacts of English language proficiency on Healthcare access, use, and outcomes among immigrants: a qualitative study. *BMC Health Serv Res* 2021;21:741.
- Pollard T, Howard N. Mental Healthcare for asylum-seekers and refugees residing in the United Kingdom: a Scoping review of policies, barriers, and Enablers. *Int J Ment Health Syst* 2021;15:60.
- DuBard CA, Gizlice Z. Language spoken and differences in health status, access to care, and receipt of preventive services among US Hispanics. *Am J Public Health* 2008;98:2021-8.
- Fernandez A, Schillinger D, Warton EM, et al. Language barriers, physician-patient language Concordance, and Glycemic control among insured Latinos with diabetes: the diabetes study of Northern California (DISTANCE). *J Gen Intern Med* 2011;26:170-6.
- Kandula NR, Lauderdale DS, Baker DW. Differences in self-reported health among Asians, Latinos, and non-Hispanic whites: the role of language and nativity. *Ann Epidemiol* 2007;17:191-8.
- Divi C, Koss RG, Schmaltz SP, et al. Language proficiency and adverse events in US hospitals: a pilot study. *Int J Qual Health Care* 2007;19:60-7.
- Gandhi TK, Burstin HR, Cook EF, et al. Drug complications in outpatients. *J Gen Intern Med* 2000;15:149-54.
- Diamond L, Izquierdo K, Canfield D, et al. A systematic review of the impact of patient-physician non-English language Concordance on quality of care and outcomes. *J Gen Intern Med* 2019;34:1591-606.
- Karliner LS, Jacobs EA, Chen AH, et al. Do professional interpreters improve clinical care for patients with limited English proficiency? A systematic review of the literature. *Health Serv Res* 2007;42:727-54.
- Lee JS, Pérez-Stable EJ, Gregorich SE, et al. Increased access to professional interpreters in the hospital improves informed consent for patients with limited English proficiency. *J Gen Intern Med* 2017;32:863-70.
- Silva MD, Genoff M, Zaballa A, et al. Interpreting at the end of life: A systematic review of the impact of interpreters on the delivery of palliative care services to cancer patients with limited English proficiency. *J Pain Symptom Manage* 2016;51:569-80.
- Kerrigan V, McGrath SY, Majoni SW, et al. "From "stuck" to satisfied: aboriginal people's experience of culturally safe care with interpreters in a Northern territory hospital". *BMC Health Serv Res* 2021;21:548.
- The Joint Commission. Medical record - preferred language. 2016. Available: <https://www.jointcommission.org/standards/standard-faqs/hospital-and-hospital-clinics/record-of-care-treatment-and-services-rc/000001373/>
- Diamond L, Toro Bejarano M, Chung S, et al. Factors associated with accuracy of self-assessment compared with tested non-English language proficiency among primary care providers. *Med Care* 2019;57:385-90.
- Ortega P, Felida N, Avila S, et al. Language profile of the US physician workforce: a descriptive study from a national physician survey. *J Gen Intern Med* 2023;38:1098-101.
- Ortega P. Spanish language concordance in U.S. medical care: A Multifaceted challenge and call to action. *Acad Med* 2018;93:1276-80.
- Chaufan C, Karter AJ, Moffet HH, et al. Identifying Spanish language competent physicians: the diabetes study of Northern California (DISTANCE). *Ethn Dis* 2016;26:537-44.
- Diamond L, Chung S, Ferguson W, et al. Relationship between self-assessed and tested non-English-language proficiency among primary care providers. *Med Care* 2014;52:435-8.
- Rosenthal A, Wang F, Schillinger D, et al. Accuracy of physician self-report of Spanish language proficiency. *J Immigr Minor Health* 2011;13:239-43.
- Betancourt JR. *Improving Quality and Achieving Equity: The Role of Cultural Competence in Reducing Racial and Ethnic Disparities in Health Care*. Commonwealth Fund, 2006. Available: <https://www.commonwealthfund.org/publications/fund-reports/2006/oct/improving-quality-and-achieving-equity-role-cultural-competence>
- Eliminating R, Institute of Medicine Committee on U. Ethnic disparities in health C. In: Smedley BD, Stith AY, Nelson AR, eds. *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care*. Washington, DC: National Academies Press (US) Copyright 2002 by the National Academy of Sciences, 2003.
- Tawara D, Goode MCD, Bronheim. SM. The evidence base for cultural and linguistic competency in health care. *Commonwealth Fund* 2006. Available: <https://www.commonwealthfund.org/>

- publications/fund-reports/2006/oct/evidence-base-cultural-and-linguistic-competency-health-care
- 27 Flores G, Laws MB, Mayo SJ, *et al.* Errors in medical interpretation and their potential clinical consequences in pediatric encounters. *Pediatrics* 2003;111:6–14.
 - 28 Jacobs EA, Lauderdale DS, Meltzer D, *et al.* Impact of interpreter services on delivery of health care to limited-English-proficient patients. *J Gen Intern Med* 2001;16:468–74.
 - 29 Tocher TM, Larson E. Quality of diabetes care for non-English-speaking patients. A comparative study. *West J Med* 1998;168:504–11.
 - 30 Dohan D, Levintova M. Barriers beyond words: cancer, culture, and translation in a community of Russian speakers. *J Gen Intern Med* 2007;22:300–5.
 - 31 Chen AH, Youdelman MK, Brooks J. The legal framework for language access in Healthcare settings: title VI and beyond. *J Gen Intern Med* 2007;22:362–7.
 - 32 Hasnain-Wynia R, Yonek J, Pierce D, *et al.* Hospital language services for patients with limited English proficiency: results from a national survey. *Health Research and Educational Trust National Health Law Program* 2006. Available: <https://healthlaw.org/wp-content/uploads/2018/09/HRET.Language.Services.pdf>
 - 33 Regenstein M, Trott J, Huang J. In any language: improving the quality and availability of language services in hospitals. *Robert Wood Johnson Foundation* 2008. Available: https://hsr.himmelfarb.gwu.edu/sphhs_policy_facpubs/484/
 - 34 Wilson-Stronks A, Galvez E. Hospitals, language, and culture: A Snapshot of the nation: exploring cultural and linguistic services in the nation's hospitals. *The Joint Commission and The California Endowment* 2007. Available: <https://www.kyha.com/assets/docs/QualityDocs/EffectiveCommunications/jointcommissionpaper.pdf>
 - 35 Diamond LC, Schenker Y, Curry L, *et al.* Getting by: Underuse of interpreters by resident physicians. *J Gen Intern Med* 2009;24:256–62.
 - 36 Lion KC, Gritton J, Scannell J, *et al.* Patterns and predictors of professional interpreter use in the pediatric emergency Department. *Pediatrics* 2021;147:e20193312.
 - 37 van Rosse F, de Bruijne M, Suurmond J, *et al.* Language barriers and patient safety risks in hospital care. A mixed methods study. *Int J Nurs Stud* 2016;54:45–53.
 - 38 Taira BR, Kim K, Mody N. Hospital and health system-level interventions to improve care for limited English proficiency patients: A systematic review. *Jt Comm J Qual Patient Saf* 2019;45:446–58.
 - 39 Tang G, Lanza O, Rodriguez FM, *et al.* The Kaiser Permanente clinician cultural and linguistic assessment initiative: research and development in patient-provider language Concordance. *Am J Public Health* 2011;101:205–8.
 - 40 Anguera MT, Blanco-Villaseñor A, Losada JL, *et al.* Revisiting the difference between mixed methods and Multimethods: is it all in the name *Qual Quant* 2018;52:2757–70.
 - 41 Karliner L, Diamond L, Toman J, *et al.* Testing a program to improve patient-clinician communication for patients who speak limited English. *Patient-Centered Outcomes Research Institute (PCORI)* 2021. Available: <https://doi.org/10.25302/02.2021.AD.140923627>
 - 42 Karliner LS, Napoles-Springer AM, Schillinger D, *et al.* Identification of limited English proficient patients in clinical care. *J GEN INTERN MED* 2008;23:1555–60.
 - 43 Elixhauser A, Steiner C, Harris DR, *et al.* Comorbidity measures for use with administrative data. *Medical Care* 1998;36:8–27.
 - 44 Rosenbaum PR. Model-based direct adjustment. *J Am Statist Associat* 1987;82:387–94.
 - 45 Griffin BA, Ridgeway G, Morral AR, *et al.* Toolkit for weighting and analysis of nonequivalent groups (TWANG). 2014. Available: <http://www.rand.org/statistics/twang>
 - 46 Hennink MM, Kaiser BN, Marconi VC. Code saturation versus meaning saturation: how many interviews are enough *Qual Health Res* 2017;27:591–608.
 - 47 Boyatzis RE. *Transforming Qualitative Information: Thematic Analysis and Code Development*. Thousand Oaks, CA: SAGE Publications, Inc, 1998.
 - 48 DeCuir-Gunby JT, Marshall PL, McCulloch AW. Developing and using a Codebook for the analysis of interview data: an example from a professional development research project. *Field Methods* 2011;23:136–55.
 - 49 Paradise RK, Hatch M, Quessa A, *et al.* Reducing the use of ad hoc interpreters at a safety-Net health care system. *Jt Comm J Qual Patient Saf* 2019;45:397–405.
 - 50 Dowbor T, Zerger S, Pedersen C, *et al.* Shrinking the language accessibility gap: a mixed methods evaluation of telephone interpretation services in a large, diverse urban health care system. *Int J Equity Health* 2015;14:83.
 - 51 Semere W, Nápoles AM, Gregorich S, *et al.* Caregiving for older adults with limited English proficiency: Transitioning from hospital to home. *J Gen Intern Med* 2019;34:1744–50.
 - 52 Reuland DS, Frasier PY, Olson MD, *et al.* Accuracy of self-assessed Spanish fluency in medical students. *Teach Learn Med* 2009;21:305–9.
 - 53 Marshall LC, Zaki A, Duarte M, *et al.* Promoting effective communication with limited English proficient families: implementation of Video remote interpreting as part of a comprehensive language services program in a children's hospital. *Jt Comm J Qual Patient Saf* 2019;45:509–16.
 - 54 Kletečka-Pulker M, Parrag S, Doppler K, *et al.* Enhancing patient safety through the quality assured use of a low-tech Video interpreting system to overcome language barriers in Healthcare settings. *Wien Klin Wochenschr* 2021;133:610–9.
 - 55 Maul L, Regenstein M, Andres E, *et al.* Using a risk assessment approach to determine which factors influence whether partially bilingual physicians rely on their non-English language skills or call an interpreter. *Jt Comm J Qual Patient Saf* 2012;38:328–36.