Technology-Based Medical Interpretation for Cross-Language Communication: In Person, Telephone, and Videoconference Interpretation and Their Comparative Impact On Limited English Proficiency (LEP) Patient and Doctor

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Abstract. Health care organizations face challenges in providing language services for Limited English proficiency (LEP) clients. Supported by a grant from the National Science Foundation, we have been working to develop a technology for proximate simultaneous medical interpretation. In an effort to understand the relative importance of physical proximity, audio cues and visual cues to effective interpretation, we conducted two controlled trials of the comparative impact on patient and provider satisfaction of four conditions which represent the interpretation circumstances with LEP patients and monolingual providers in hospital settings; a certified interpreter present in the consultation room ("In Person"); at a remote location mediated by audio only ("Telephone"); at a remote location mediated by audio and video ("Videoconference"), and no interpreter present ("No Interpreter). In study 1, dyads of a medical student and a standardized patient were randomly assigned to In Person or No Interpreter condition on a rotating basis, producing a total of 25 encounter sessions. In Study 2, four interpretation communication modes including Videoconference and Telephone condition simulated 25 encounters. Repeated measure one-way analyses of variance (ANOVA) showed preferences of patients and physicians for four different methods of interpretation. Patients expressed high satisfaction for their doctors regardless of the communication mode. Doctors' perception of the interpretation quality was also as desirable in remote communication as onsite human interpretation. Patients reported significantly greater feelings of being guarded for their privacy and were more satisfied with the interpretation quality in the remote communication via telephone over in-person interpretation.

Keywords: Limited English Proficiency, Medical Interpretation, Controlled Trial.

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1 Introduction

Limited English proficiency (LEP) affects the health care of millions of Americans, many of whom are Hispanic/Latino. In 2000, 18 percent of the total population aged 5 and over, or 47.0 million people, reported they spoke a language other than English at home. This was up from 14% and 11%, according to census data from the 1990 and 1980 surveys, respectively. More significant is the fact that of the 21.4 million who had trouble communicating in English, 13.8 million were Spanish speakers.

There are serious consequences for health care when individuals with LEP do not have access to adequate translation. One undesirable side effect of the increasing diversity of the U.S. population is the presence of significant barriers to health care delivery and access for the LEP segment of the population, predominantly minority women, children and elders. Numerous clinical and public health studies have documented the multiple facets of this problem, including lack of regular primary care, limited or no access to preventive care, high incidence of medical errors, and poorer health outcomes. For example, Tchen, Bedard et al. (2003) found trends for LEP patients who did not receive interpretation or consultation from a bilingual provider to have less accurate understanding of their disease status and to be more unrealistic in expectations of a cure.

There have been regulatory efforts to improve access to health care for persons with LEP. Recognizing this problem, the U.S. Congress mandated establishing the Office of Minority Health (under the Department of HHS) in 1994, a part of which was the creation of the Center for Linguistic and Cultural Competency in Health Care in 1995 with a mission to develop and evaluate models, conduct research, and provide technical assistance to providers on removing language barriers to health care services. In 2003 an issuing guidance went into effect (Guidance to Federal Financial Assistance Recipients Regarding Title VI Prohibition against National Origin Discrimination Affecting Limited English Proficient Persons) addressing mechanisms and organizational practices that impact cultural and linguistic competence. Hispanic/Latino parents of cancer patients in California, for example, now have the right to an interpreter, at least by telephone, from their commercial health and dental plans, made possible by a first-in-the nation law that intends to eliminate language-related obstacles to effective care in medical settings. This new regulation of the California Department of Managed Health Care – Senate Bill 853 - went into effect in January, 2009. Doctors' orders now need to be translated at least orally into Spanish, Mandarin, Hmong, Russian and other spoken languages. Nevertheless, through the years individuals with limited English proficiency have not fully benefited from these laws and regulations as their enforcement and implementation have been inconsistent across medical facilities.

Health care organizations face challenges in providing language services for LEP clients. The building of language capacity has been a major challenge for the health care system in states with large numbers of limited English proficient individuals. In many facilities there are insufficient numbers of interpreters for the total number of LEP patients or parents of pediatric Hispanic/Latino patients being treated. A study of sixty-seven hospitals in New Jersey (Flores, Torres, Holmes, Salas- Lopez,

Youdelman, & Tomany-Korman, 2008) reported that only 3% of hospitals had full-time interpreters, and 80% did not provide training to staff on working with interpreters.

Currently, the language needs of LEP patients and their families for whom bilingual providers are not available are addressed with a variety of solutions, including certified professional interpreters, language lines, and incidental interpretation from bilingual staff or family members. However, it was difficult to argue that hiring and training more interpreters makes "business sense," and that while the demand for interpreter services could be expected to grow, it would be difficult to attract more people to the field because the job was generally low-paying (Wu, et al., 2007). This tremendous need for interpreter services cannot be fully met with human interpreters alone, or be of acceptable cost. Costs for such services, particularly telephone translation, are often prohibitive for routine medical care. Additionally, while mandated by law for health care providers, most insurance companies will not cover human interpretation services.

Existing approaches include onsite ad hoc interpreting, onsite certified interpreting, language lines, videoconferencing, and remote simultaneous medical interpretation (RMSI). These approaches vary with respect to several factors: whether or not the interpreter is trained or remote or proximate; whether interpretation is simultaneous or asynchronous; whether or not the patient's privacy is preserved; whether the interpreter has access to the patient's (and provider's) nonverbal cues and/or family dynamics (cues to context); scalability (i.e.., whether the method can be easily and inexpensively scaled up for multiple simultaneous patient encounters); and 24-hour availability assuming no onsite competition for services. Each approach has advantages and disadvantages.

Much of the research conducted on the effects of interpretation methods has focused on the undesirable consequences of incidental (ad hoc) interpretation. One of the most egregious examples is the reliance on children to translate diagnosis and treatment plan to their LEP parents. Family members who translate for patients, even well intentioned ones, may not have appropriate medical knowledge. They may also be reluctant to provide information on a life-threatening diagnosis or a particularly difficult but necessary regimen of care; further, they may fail to explain the side effects and risks of particular medications or treatments due to embarrassment or fear of upsetting the patient or parents. Incidental translation of this sort may also compromise the confidentiality of information provided during a consultation. Furthermore, the use of incidental interpreters resulted in lower patient satisfaction than trained interpreters or bilingual providers, and that errors and distortions were commonplace when incidental translation was used (Flores, 2005; Gany et al., 2007; Laws et al., 2004) Medical errors obviously compromise patient safety and expose health care organizations to legal risk.

Hsieh (2006) summarizes available research on patient satisfaction, understanding, and physician supportiveness and facilitation and finds that there are conflicting results which may be attributable to the type of interpretation that prevailed in a particular study. There is probably general consensus that trained and certified translators make fewer errors and have more satisfied patients than incidental or ad hoc interpreters. There is some lack of consensus on whether interpreted provider-patient

encounters take longer (although probably general agreement that there is wasted time spent waiting for interpreters to arrive), or whether they create new problems. Davidson (1998) noted that interpreters function as "co-diagnosticians," often ignoring patients' questions or answering them without translating them first for the provider and obtaining an answer, engaging in side conversations, or acting as co-conversationalists.

Telephone interpretation has been available for a number of years as an alternative to onsite interpretation when patient and providers are not language-concordant. Although telephone interpretation been criticized by some as failing to provide nonverbal and contextual cues, such as seeing the patient interact with the provider and other family members (Hsieh, 2006), not being well-accepted by providers (Wu, Ridgely, Escarce, & Morales, 2007), and not very useful with children or the hard of hearing, Lee, Batal, Maselli, and Kutner (2002) reported that patients in a walk-in clinic who were provided with AT&T telephone interpretation had identical (and high) levels of satisfaction with the visit to language-concordant patients. Newer methods of remote interpretation including videoconferencing and RMSI have received less study, although they appear to offer advantages over telephone interpretation with respect to the lack of nonverbal and contextual cues in the case of the former and near-simultaneous (as opposed to consecutive) interpretation in the case of the latter.

A serious shortcoming of the comparative research on interpretation methods, which Flores (2005) noted in his review article, has been the paucity of randomized controlled trials (only 1 of 36 papers met the review criteria). Since that time a few papers have appeared which have attempted to address the issue more systematically. Ganey, Kapelusznik, et al. (2007) conducted a randomized controlled trial of RSMI, proximate trained interpreters, proximate untrained bilingual staff, and telephone interpretation with respect to interpretation speed and medical errors, using standardized scripts and doctor-patient volunteer pairs reading the scripts in English and Spanish, respectively. RSMI encounters were nearly fifty percent faster than the next fastest method (proximate untrained) and contained a fraction of the number of errors of the non-RSMI encounters. Similar results were obtained by Ganey, Leng, et al. (2007) in their comparison of RSMI to "usual and customary" interpretation methods. Patients who were randomized to RSMI reported greater feelings of being respected by the provider, were more satisfied with provider communication, and felt as if their privacy was more carefully guarded, although the effects were small and the levels of satisfaction did not rise to those of patients in language-concordant encounters.

Technology-based interpretation solutions offer tremendous promise for addressing the problem of cross-language communication, especially in structured, non life-threatening medical interactions. In particular they allow for scaling-up interpretation services at an incremental cost and thereby are useful to a much larger population. Supported by a grant from the National Science Foundation, we have been working to develop a technology for proximate simultaneous medical interpretation (PSMI) which will provide real-time, computer-mediated Spanish-English medical interpretation for providers and patients who are language-discordant. (Narayanan et al, 2004). As part of our efforts to learn, store and recognize from vocal input a wide array of terms from medical domains of interest including words for treatments, medications (including herbal remedies), and symptoms, as well as the euphemisms or acronyms by which they are commonly denoted in the target languages, and how

these may vary by country of origin of the LEP patient and family (e.g. Mexico, El Salvador, Guatemala), and in an effort to understand the relative importance of physical proximity, audio cues and visual cues to effective interpretation, we have been able to conduct controlled trials of the comparative impact on patient and provider satisfaction of four conditions which represent the interpretation circumstances typically found in hospitals and clinics today: a certified interpreter present in the consultation room with the provider and patient ("In Person"); a certified interpreter at a remote location mediated by audio only ("Telephone"); a certified interpreter at a remote location mediated by audio and video ("Videoconference"), and no interpreter present ("No Interpreter).

Our review of the relevant literature on the comparative advantages of currently available methods of interpretation leads us to propose the following hypotheses:

H1: Type of interpretation (In Person, Telephone, Videoconference, and No Interpreter) is associated with the patient's rating of the provider

H2: Type of interpretation (In Person, Telephone, Videoconference) is associated with the patient's rating of the interpreter.

H3: Type of interpretation (In Person, Telephone, Videoconference) is associated with the providers's rating of the interpreter.

2 Method

2.1 Participants and Procedure

The project on which we report here used standardized patients (SPs) in simulated medical encounters. SPs can accurately and consistently portray a 'case,' for example a patient presenting with chest pain, in a "standardized" way, and they can evaluate the behavior of the provider in a "standardized" manner, accurately recalling and recording provider behaviors. For the present study, SPs were trained to enact standard scripts used at a teaching hospital with which the researchers were affiliated for evaluation of medical students' communicative and diagnostic competence. Six scripts were used in the study, which addressed a range of health conditions encountered during medical consultations including diabetes, depression, lymphoma, and lower back pain. The scripts were revised to include appropriate cultural content reflecting health-related beliefs and attitudes likely to be encountered during consultations with Hispanic/Latino patients.

Standardized patients and a core group of trained interpreters were recruited between January and March 2010 for two experiments. Participants were drawn from the pool of standardized patients as well as from a snowball sampling. Provider participants were third and fourth year medical students from the university with which the researchers were affiliated. Providers spoke English as their primary language. All participants, including standardized patients, interpreters and providers were compensated $20 per hour plus lunch for their participation.

In Study 1, five providers, five standardized patients and three professional medical interpreters participated. The medical interpreters were sufficiently trained and

experienced in consecutive interpretation in a medical setting. Dyads of a provider and a patient were randomly assigned to one of two interpretation communication methods on a rotating basis, producing 15 interpreted and 10 uninterpreted sessions.

In Study 2, five providers, five standardized patients, and four professional medical interpreters participated in a total of 25 encounters. Responses from one standardized patient who had inadvertently participated in both experiments were later excluded from the analysis. Participants were randomly assigned to one of four interpretation communication modes. Data were collected from a total of 5 In Person, 4 Telephone, 10 Videoconference, and 6 uninterpreted encounters.

The sample consisted of 19 participants, including 9 males and 7 females. Median age for patients and interpreters was 41 to 54 years old. Providers' ages were between 26 and 40 years old. Among the 19 participants, 4 were multilingual, 7 reported English as their primary language, 3 were predominantly Spanish speakers, and 1 reported 'other' as a primary language. All providers identified themselves as White. Among 11 patients and interpreters, 5 were Latino/Hispanic.

2.2 Measures

A 10-item demographic survey was administered to all participants prior to the experiments. Patients completed a 9-item survey to evaluate their provider and a 7-item survey to rate the quality of interpretation. Providers responded to a 9-item questionnaire about interpretation quality after each encounter. The survey items about quality of and satisfaction with the clinical encounter and method of interpretation were informed by previous studies on medical interpretation satisfaction (Gany et al., 2007). Surveys for providers and patients had core items nearly identical to each other but used different phrases from their perspectives. In addition to the scales, we held a semi-structured group discussion separately for providers, interpreters, and patients, providing an opportunity to reflect on the experience and voice their opinions on the interpretation methods.

2.3 Statistical Analysis

The primary test of within-subject differences in ratings was a repeated measure one-way analysis of variance (ANOVA). The statistical package R (ver. 12.2.1) was used. We also conducted multiple pairwise comparisons using the statistical software SPSS (ver. 17).

Composite measures were created using factor analyses on satisfaction items. Three factors were identified, including patient's satisfaction with providers, patient's satisfaction with interpretation, and provider's satisfaction with interpretation. The Chronbach's alpha for the three factors were .89, .76, and .82 respectively. A confirmatory factor analysis showed that a three-factor solution (Non-Normed Fit Index [NNFI] = .87, Comparative Fit Index [CFI] = .89, Incremental Fit Index [IFI] = .76) was superior to a one-factor solution (NNFI = .63, CFI = .76, IFI = .64), $\Delta\chi = 812.6$, $p < .05$, which did not differentiate patients' satisfaction versus providers and satisfaction of providers and interpreters.

2.4 Results

In order to understand the overall satisfaction level across interpretation conditions in two studies, as noted above we created three indices for patients' and providers' evaluation of the satisfaction provided by the encounters. The means and standard deviations of patient and provider ratings of encounter quality are shown in Table 1. Patient and provider's ratings for interaction quality were generally high across the interpretation conditions in the two studies.

Table 1. Satisfaction Rating Means and Standard Deviations for Interpretation Conditions

		Patient's Rating of Provider			Patient's Rating of Interpretation			Provider's Rating of Interpretation		
		Mean	SD	N	Mean	SD	N	Mean	SD	N
Study 1										
	In Person	23.7	3.46	15	16.6	.68	15	19.1	1.31	15
	No Interpreter	21.69	3.06	10	--	--	10	--	--	10
	Average	22.9	3.39	25	16.6	.68	15	19.1	1.31	15
Study 2										
	In Person	24.95	1.12	10	16.45	.89	10	20.58	.90	12
	Telephone	25	1.73	3	17	0	3	18.75	.5	4
	Videoconference	22.67	2.52	3	14	2.65	3	14.5	3.79	4
	No Interpreter	25.2	1.5	4	--	--	4	--	--	5
	Average	24.68	1.64	20	16.09	1.59	20	19	2.94	25
Overall										
	In Person	24.2	2.8	25	16.51	.76	25	19.76	1.36	27
	Telephone	25	1.73	3	17	0	3	18.75	.5	4
	Videoconference	22.67	2.52	3	14	2.65	3	14.5	3.79	4
	No Interpreter	22.71	3.12	14	--	--	14	--	--	5
	Average	23.69	2.87	45	16.32	1.24	45	19.04	2.36	40

In Study 1, patients' rating for the providers was uniformly high in the two treatment conditions, $F(1, 21) = .21$, $p=.65$, although it was slightly higher in the In Person than in the No Interpreter condition. In Study 2, patients provided the highest evaluation for providers in the No Interpreter condition followed by the Telephone, In Person, and Videoconference conditions. However, the ANOVA results indicated that the association between patients' ratings for providers and the interpretation treatment was not significant, $F(1,15) = 2.28$, $p=.15$. Hypothesis 1 was not supported.

Patients' overall ratings for interpretation were significantly different by interpretation condition in that the Telephone condition yielded the highest satisfaction ratings, followed by No Interpretation, In Person, and Videoconference, $F(1, 15) = 8.49$, $p<.05$. Results provided support for Hypothesis 2.

Overall, patients' rating for providers and interpretation quality was relatively high across four interpretation conditions. The most satisfactory ratings were from the Telephone condition in both encounters although the difference was not statistically significant. Overall encounter ratings from patients were second highest in the In Person condition, followed by the No Interpreter and Videoconference conditions. A subsequent ANOVA test showed significant differences in patients' sense of privacy of the details discussed in encounters ($F=9.01$, $p<.01$). Patients' ratings for privacy

was also highest in the Telephone mode (M=4, SD=0, n=3) followed by the In Person (M=3.95, SD=.09, n=10) and the Video mode (M=3, SD=1, n=3).

With respect to Hypothesis 3, providers' overall assessment for interpretation was highest in the In Person treatment condition followed by the Telephone, and Videoconference conditions. However, the difference in ratings was not statistically significant, $F(1, 20) = .01$, $p=.93$. Hypothesis 3 was not supported.

3 Discussion

This study confirms earlier research indicating potentials for technology-based interpretation such as telephone interpretation as alternative to onsite human interpretation options (Ganey, Leng, et al, 2007; Ganey, Kapeluesznik, et al, 2007; Lee, Batal, Maselli, & Kutner, 2002). Results show a noticeable preference for mediated interpretation via telephone over the in-person or no interpretation conditions among patients. Remote interpretation encounters using telephone communication was time effective and produced less errors commonly found in customary interpretation modes such as ad hoc or chance interpreter services. Findings from this project also confirmed that patients felt as if their privacy was most carefully guarded in the Telephone communication. The finding adds an empirical evidence of the merits of technology-based interpretation services as new solutions to the problem of providing adequate interpretation services to LEP patients in medical settings.

One of the shortcomings of technology-based interpretation is negative response from medical staff and providers and their reluctance to integrate the new solution into existing administrative system (Wu, Ridgely, Escarce, & Morales, 2007). The two studies in this project demonstrated potentials of diverse interpretation services in the medical field and showed that the difference in ratings among providers was not significantly varied across four interpretation conditions. Different interpretation methods were all well accepted by providers and produced overall positive ratings. Physicians' evaluation was also independent of the presence of a human interpreter during interactions or technology used as communication method.

It is noteworthy that technology-based remote and near simultaneous interpretation was perceived by physicians as desirable in achieving positive encounter quality as other modes of interpretation. Although the differences obtained were not statistically significant and the effects were small, the level of satisfaction among doctors slightly fluctuated by the treatment conditions. When we compared the average ratings of providers for each interpretation quality, doctors viewed the traditional human method as slightly more satisfactory than remote methods of interpretation. In regard to their ratings of remote interpretation methods, the telephone treatment received slightly higher scores over the video mode in both patient and physician groups. Videoconference was the least satisfactory to both patient and provider groups.

Findings shed lights on limitations on the two studies. We found that patients were not sensitive to different interpretation methods when it comes to rating their physicians in both studies. It may be that provider participants had varying levels of medical Spanish skills. Earlier research indicated that a bilingual provider often results in

higher patient satisfaction and accurate understanding of medical details among LED participants (Tchen et al, 2003; Floors, 2005). Bilingual physician participants in the two studies may have affected patients' assessment.

Uniformly high and indiscernible ratings for physicians by patients may also be due to technical problems during the second experiment. During the focus group discussion with the standardized patients, there were complaints in remote interpretation communications including the discomfort of wearing a head-set device. There were also cases when video and audio quality was not optimal or the placement of a computer monitor made it difficult for participants to make eye contacts during encounters.

4 Conclusion

This study shows that comparative advantage of interpretation methods vary by medical context, participants' characteristics or technical settings. Rising cost of hiring onsite human interpreters, administrative burdens and lack of adequate resources to patients with language barriers can be effectively addressed by efforts to develop cost effective, easily scalable and widely deployable options. This project demonstrated that technology-based interpretation methods provide similar level of emotional satisfaction and sense of being respected compared to onsite human services. This reinforces the need for widely available technologies that address participants' sense of privacy and satisfaction in medical interpretation. A serious future research endeavor is required to understand the capacity of such technology-based interpretation in responding to rich contextual information, relational dynamics, and various demographic and socioeconomic backgrounds of participants in medical encounters.

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