Study Protocol

Protocol ID Number and Title: #14647: Impact of Remote Interpreter Modality on Comprehension, Communication Quality and Length of Stay in the Pediatric ED

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Intervention: Telephone versus Video Interpretation

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A Introduction

A1 Study Abstract

Professional interpretation improves quality of care for patients with limited English proficiency (LEP),\textsuperscript{1,2} yet it remains underutilized.\textsuperscript{3-8} Most providers prefer in-person interpreters over other methods (e.g. telephone),\textsuperscript{9} but costs are prohibitive. Telephone interpretation is inexpensive, easy to use, and available on demand, but many providers dislike it and so choose to "get by" without professional interpretation rather than use it.\textsuperscript{10-13} Forgoing professional interpretation, even for part of a medical encounter, increases the risk of a serious miscommunication and patient harm.\textsuperscript{14-16} Video interpretation is a newer technology that is also easy to use and available on demand; it is more expensive than telephone but substantially less expensive than in-person interpretation.\textsuperscript{9} It is currently unknown how video and telephone interpretation compare with regard to quality of communication and interpretation, parent comprehension, length of stay and provider consistency of professional interpreter use. This randomized trial will compare the impact of telephone versus video interpretation on multiple aspects of health care quality, including family comprehension, provider communication, length of stay, and provider consistency of interpreter use for LEP families in the pediatric emergency department (ED) at Seattle Children’s Hospital (SCH). This study will provide information critical to hospitals looking to improve the quality and safety of care delivered to LEP patients, by informing which type of remote interpretation they should invest in.

The study proposes to enroll 208 LEP families presenting to the SCH ED. Participating families will be randomized to receive either telephone or video interpretation for the duration of their ED visit. Both services are currently available in the ED and are provided by companies with large, national networks of professional interpreters. Between 1 and 7 days after the visit, parents will be asked to complete a short telephone survey, gathering information about themselves and the child, along with outcome measures.

We will collect baseline data and potential covariates or effect modifiers related to the child (e.g. medical complexity), the parent (e.g. education), the ED (e.g. census), and the provider (e.g. bilingual certification). We will evaluate communication quality using the Consumer Assessment of Healthcare Providers and Systems (CAHPS) Child Visit Survey 2.0 communication composite (5 items).\textsuperscript{17-19} Interpretation quality will be measured with the Interpreter Satisfaction Survey (7 items).\textsuperscript{20} Parent comprehension will be assessed by comparing parent-reported diagnosis to the diagnosis recorded in the child’s ED note.\textsuperscript{21} Provider consistency of interpreter use will be determined by asking the parent and provider to report on provider communication about medical care without professional interpretation.

Analyses will be conducted in an intention-to-treat fashion, using unadjusted chi-squared and t-tests to evaluate the relationships between assigned interpreter modality and outcomes. If potential confounders or effect modifiers are unbalanced between groups, they will be adjusted for in a sensitivity analysis using multivariate linear or
logistic regression. A sample size of 104 families per group will be adequate to detect small to medium effects in communication and interpretation quality, and medium to large effects in diagnosis comprehension, communication without professional interpretation, length of stay, and charges.

We will also video-record a subset of encounters for families that consent to be recorded. Analysis of the video-recorded encounters will provide additional, granular information regarding the use of various methods to communicate with LEP families in over the course of multiple communication episodes during an ED visit.

A2 Primary Hypothesis

Hypothesis 1: Parent-reported quality of communication and interpretation and parent diagnosis comprehension will be higher among families assigned to video interpretation compared to telephone interpretation.

Hypothesis 2: Parent-reported provider lapses in professional interpreter use (e.g. using the patient or a family member to interpret for some part of the visit) will be lower for families assigned to video interpretation compared to telephone interpretation.

Hypothesis 3: LOS and charges will not differ between families assigned to video and telephone interpretation.

Hypothesis 4 (video-recording sub-study): Providers will be most likely to use professional interpretation for the initial history and for discharge instructions. They will be less likely to use professional interpretation for family updates, follow-up questions and medication administration.

Hypothesis 5 (video-recording sub-study): Video interpretation will be associated with a shorter start-up time delay compared to telephone interpretation.

A3 Purpose of the Study Protocol

The protocol is intended to be used by all study staff as the approved procedures for conduct of the study.

B Background

Provide background material which supports the purpose of the research, and which is detailed enough to allow someone who is not an expert in the field to understand the context of the question and the study design.

References may be cited in the Background section.
B1 Prior Literature and Previous Studies

In 2007, over 24 million individuals in the United States reported speaking English less than “very well,” representing 8.6% of the population. In the absence of professional interpretation, language barriers in the medical setting are associated with increased costs of care, decreased patient satisfaction and adherence, and increased risk of serious adverse events. Unfortunately, underuse of professional interpretation remains widespread, in spite of federal laws requiring provision of professional language services. As a result, LEP patients and families continue to receive medical care that is less efficient, safe and equitable than the rest of the US population.

Technological advances have resulted in increasing availability of telephone and video-based interpreters, but use remains low: only 15-32% of LEP patient encounters receive any kind of professional interpretation. The reasons for underuse of these services are multi-factorial, but cost, technical requirements, concerns about delayed care, time constraints and providers opting to “get by” with non-proficient language skills all contribute. The methods available in a given setting, and the perceived barriers to accessing those methods, likely influence provider behaviors regarding whether they use a professional interpreter for all communications with LEP families, or whether they instead use an ad hoc interpreter or rely on non-proficient language skills at times. These are examples of communication without professional interpretation, which increases the risk of serious miscommunication and potential patient harm. Understanding the relationship between interpreter modality and patterns of use is essential for identifying strategies to improve communication and decrease the patient safety risks associated with failure to use professional interpreters.

Previous studies have sought to compare various aspects of different interpreter modalities, mostly focusing on patient satisfaction, with mixed results. One study also measured parental ability to name the child’s discharge diagnosis, but universally high rates of correctly naming the diagnosis (>95%) limited the authors’ ability to detect a difference between groups. However, a study in our institution’s inpatient setting found much lower rates of correctly naming the child’s diagnosis (70% for LEP parents, 83% for English proficient parents). Providers report that they prefer in-person interpretation over other methods, but in many practice settings and for most languages, in-person interpretation is not feasible due to high costs and concern for delayed care. It is therefore important to understand the relative impacts of the remote modalities that have the potential for widespread use. At present, very little is known about how remote interpreter modalities (telephone versus video) impact family comprehension, quality and patterns of provider communication, and ED LOS. These data will help providers and hospitals assess the expected benefits associated with each interpretation approach and to make informed decisions regarding implementation. LOS is an important metric to consider, as it has implications for an ED’s patient flow and capacity to deliver care, and it may be impacted by changes in provider communication patterns or delays associated with technology use.
**B2 Rationale for this Study**

Video interpretation more closely approximates the experience of in-person interpretation, as it allows the interpreter to see the patient room and all of the speakers, while still providing the convenience and efficiency of a remote modality. Providers have been found to prefer video over telephone interpretation; if they like using a particular modality more, they may be more likely to use it consistently, leading to better communication and parent comprehension and fewer opportunities for serious miscommunication.

**B3 Alternative Treatments**

In-person interpretation remains the modality preferred by most providers, although patients and families do not consistently rate it more highly compared to remote modalities. However, in-person interpretation requires an interpreter of the right language to be present and available, or it introduces wait times into the patient experience. Because the cost, availability, and staffing models used for in-person interpretation are so different than those for telephone and video interpretation, we chose not to include it in the present study.

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**C Study Objectives**

The overall objective of this study is to compare the impact of telephone versus video interpretation on parent-provider communication, consistency of professional interpreter use, and ED utilization for Spanish-speaking LEP families of children being treated in a pediatric ED.

**C1 Primary Aim**

Aim 1: To determine whether randomly assigned remote interpreter modality (telephone versus video) impacts parent-reported quality of communication and interpretation, diagnosis comprehension, and consistency of provider interpreter use among LEP Spanish-speaking families seen in a pediatric Emergency Department (ED).

**C2 Secondary Aim**

Aim 2: To determine whether assigned interpreter modality is associated with ED length of stay and charges for children from LEP Spanish-speaking families seen in the pediatric ED.

Aim 3 (video-recording sub-study): To understand patterns of interpreted communication use and interpreter modality start-up delays during encounters in the pediatric ED.
D Intervention

D1 Intervention Description

The study intervention will be randomly-assigned remote professional interpreter modality (telephone or video). The ED will be randomized by day by sealed envelope, and providers will be asked to use the assigned modality of the day with all Spanish-speaking LEP families, unless there is a medical indication to use in-person interpretation or the family declines. Telephone interpretation services will be provided by SCH’s standard vendor, Pacific Interpreters, via dual-handset telephones with 1-touch dialing in every ED room. Video interpretation will be accessed through Systematec/In Demand, using one of four portable video monitors that can be wheeled into exam rooms as needed. The assigned interpreter modality will be indicated on the exam room door to ensure consistent use.

E Study Design

E1 Overview or Design Summary

Potential participants are identified as preferring Spanish for medical care during triage in the ED, using standard ED procedures. These children are indicated requiring interpretation using an icon on the ED tracking board.

Potentially eligible families are approached as early in the ED visits as possible, after obtaining permission from a treating doctor or nurse. The consent and assent conferences then take place for potentially interested families. For families that are ineligible or decline to participate, the door sign indicating the assigned interpreter modality of the day is covered with another sign indicating that the family is not participating, so providers can use any interpreter modality they prefer.

Clinical research assistants (CRAs) collect contact information, preferred contact times, and ED visit data (e.g. triage acuity) from families that consent to participate. Families who consent to the main study will also be asked for permission to video record the ED encounter. For families that consent, a video camera will be set up in the room, and additional signs and information sheets will be hung on the door to the ED room alerting providers to the recording that is occurring.

A bilingual CRA calls enrolled families to administer the survey, between 1 and 7 days after the ED visit. After 7 days or 10 unanswered phone calls, a family is declared lost to follow-up.
Subject Selection and Withdrawal

2. Subject Population

- Number of subjects: Approximately 350 families will be screened, to enroll 260 families, to achieve a final sample of 208 completed surveys, assuming 20% attrition.

2. Eligibility Criteria

We will recruit parents of children presenting to the SCH ED for care. Spanish-speaking parents who prefer to receive medical care in Spanish will be eligible to participate. Only Spanish-speaking LEP parents will be enrolled, as over two-thirds of LEP patients seen at SCH speak Spanish, and validated study instruments are available only in English and Spanish. Parents will not be eligible if the child has a life-threatening emergency (triage level 1) or is being evaluated for a primary psychiatric disorder or suspected child abuse. Further screening will not occur prior to participation, given the need for prompt enrollment and randomization, and the poor correspondence between chief complaint and eventual diagnosis.

2. Inclusion Criteria

1. Parents request Spanish interpreter during ED visit
2. Child age 0-17 years

2. Exclusion Criteria

1. Child is a ward of the state.
2. Child has a triage acuity level 1, indicating a life-threatening emergency
3. Child’s chief complaint is a primary behavioral or psychiatric disorder, or is evaluation for child abuse
4. Provider(s) indicate that failure to use in-person interpretation for an individual patient/family would compromise the quality of medical care the child receives
5. The family declines to participate

2. Randomization Method and Blinding

Randomization will occur via opening of a sealed envelope at the beginning of recruitment each day. Envelopes will be opaque and blocked in groups of 6, as
recruitment will generally occur 6 days per week. Once the envelope has been
opened, signs will be hung on the door to each room in the ED, announcing the
assigned interpreter modality for the day (telephone or video).

2.f Ethical Considerations

Families will be randomized to receive 1 of 2 methods of professional
interpretation, which is the standard of care and required by law. While we will be
requesting that providers not default to using their generally preferred
interpretation method, in person interpretation, we are emphasizing that if a
provider believes that failure to use in-person interpretation would compromise
care, they should use in-person interpretation, regardless of study group
assignment. Our exclusion criteria aim to avoid enrolling families where an in-
person interpreter would likely be of great benefit, such as when psychiatric or
behavioral concerns have prompted the visit. While providers prefer in-person
over remote methods of interpretation, families have not been found to do so
consistently, and no difference in interpretation effectiveness has been
documented between in-person and remote interpretation modalities.

We expect that professional interpreter use will ultimately be higher in the context
of the study due to the Hawthorne effect, in spite of the fact that we are asking
providers to use modalities that they do not prefer.

No sensitive information will be collected from families. No information will be
added to participant medical records. All video recordings will be destroyed within 1
year of their creation.

2.g Early Withdrawal of Subjects

If families wish to withdraw from the study during the ED visit, the sign on the ED
room door will be changed to reflect that providers can resume using whatever
type of interpretation they prefer, and the family will not be contacted to complete
the survey. If they withdraw after the ED visit, their personal information will be
deleted, including any video recordings that were made.

2.h When and How to Withdraw Subjects

Subject withdraw will occur at family request, at the moment the family requests it.

2.i Data Collection and Follow-up for Withdrawn Subjects

Additional data will not be collected from withdrawn subjects.

E3 Risks and Benefits

Completely describe the risks and benefits of the research itself, the procedures,
and the intervention or investigational agent.
Potential Risk. This study is low risk, and the risks that do exist primarily relate to loss of confidentiality for parents or patients. We do not anticipate that assignment to either video or telephone interpretation would constitute a risk for families, compared to the current practice of using a combination of in-person, telephone and video interpretation (based on availability at the moment), given that the limited data that exist suggest equivalence between methods. All three methods are nationally accepted as constituting standard of care. We will be gathering data from families regarding the child’s illness and conducting a brief review of the child’s medical record, which could lead to loss of confidentiality. The risk of this is low, and the information collected would not be likely to cause long-term or permanent harm should it be inadvertently disclosed. We will also be asking parents about their experience around provider communication and quality of interpretation, which could be distressing for parents to reflect upon in the case of a negative experience. We believe the risk of such an occurrence to be very low as well.

Potential Benefits to the Subjects. There are no direct expected benefits for research participants in either the telephone or video interpretation arm, as all LEP families should be receiving consistent use of professional interpretation for every medical communication while in the ED. However, given that providers sometimes choose to use non-professional interpretation (eg, a sibling) or opt to “get by” without an interpreter, enrollment in the study may provide a higher standard of care, by encouraging providers to use a professional interpreter more frequently.

3.a Methods of Reducing Risks to Subjects and Others
There are no physical risks associated with participation in our study. The survey questions asking parents about the quality of interpretation and communication have been used in other studies without incident. Research assistants will be trained to identify signs of distress in parents and to provide referral to follow-up services as appropriate.

3.b Methods of Protecting Subject Privacy, Data and Rights.
All study information will be collected via a secure, password-protected data entry system to minimize the risks of inadvertent disclosure. In the study database, patient and parent names will be replaced by ID numbers and the key linking the two will be stored separately from the data. All video recordings will be deleted within 1 year of their creation.

E4 Intervention
4.a Description
The study intervention will be to randomly assign LEP Spanish-speaking families to receive either telephone or video professional interpretation throughout the duration of their ED visit. Both modalities are currently in use in the ED and are readily available. Both are considered consistent with standard of care. Both modalities of remote interpretation will be provided through the normal SCH vendors: Pacific Interpreters for telephone interpretation and Symantec/In Demand for video interpretation. Both are readily available in all ED rooms.

4.b Method for Assigning Subjects to Treatment Groups
Randomization will occur at the level of the day of presentation, in order to maximize the number of families we are able to recruit, while minimizing contamination with other interpreter modalities prior to enrollment. Randomization will occur via sealed, opaque envelopes, grouped in blocks of 6 to ensure an even distribution of each modality over different days of the week.

4.c Subject Compliance Monitoring
We will ask parents to report on the frequency with which providers used a variety of methods of communication with them, including each assigned modality. We will also obtain invoices from the remote interpretation vendors to look at numbers of minutes of each modality billed for study patients.

4.d Prior and Concomitant Therapy
This is a pragmatic trial, so some contamination between groups and non-adherence is expected. We will attempt to capture the degree to which non-adherence occurs, but it will not impact patient retention in the study.

4.e Blinding of Intervention
Neither families nor clinicians will be blinded to study group. Investigators will be blinded to assigned modality during outcome ascertainment.

F Study Procedures

F1 Study Procedures
1. On recruitment days, the CRA will draw a sealed envelope to determine the assigned interpretation modality for the day. She will inform the registration/triage RN, the charge RN and the medication intake coordinator of the assigned modality. CRA will also join huddles to inform providers of default modality.
2. The CRA will attach signs to the door of every patient room informing people of the default method of the day for Spanish interpretation.

3. The CRA will watch the ED tracking board to identify LEP families by the interpreter icon. For LEP families, she will check the chart for Preferred Language for care.

**Inclusion criteria:** Families are eligible if the preferred language for care is Spanish and at least one primary caregiver requires interpretation. **Exclusion criteria:** Triage level 1, legal guardian not present, or presenting complaint is concern for abuse (examples are ill defined complaint (IDC) or non-accidental trauma (NAT)) or a behavioral or psychiatric concern. The CRA will check with the RN or MD if there is a Casper Alert on FirstNet to determine eligibility.

4. After obtaining permission from patient’s RN or MD, CRA will then approach potentially eligible families, explain the study, and obtain consent from interested families for either survey-only or survey and video portions of the study. Approach should happen as early as possible in the visit. Contact information (all telephone numbers) will be collected, and optimal times for a follow-up phone call the next day will be elicited. The family will also be asked for permission to contact them in the hospital if the child gets admitted. If the CRA is not certified bilingual in Spanish, the default method of interpretation for the day should be used for consent. The CRA will record each instance of a screened patient who was ineligible. CRA will also record each instance of a family who was approached but who declined to participate.

5. For families who consent to video recording, the CRA will set up the video camera and start recording. She will announce that recording is occurring, after recording has begun. She will hang an additional sign on the door informing providers that recording is occurring, and that the CRA should be contacted with questions or concerns. A folder with leaflets will be next to it. All providers and staff exiting the room will be encouraged to take one. Family members who did not sign a consent will be given a leaflet in Spanish.

6. At the time of enrollment, the CRA will fill out the beginning of the electronic data collection tool, which includes family contact info, triage level, and NEDOCS score. Initial providers will also be recorded.

7. At the end of the visit, the rest of the data collection tool will be filled out, which includes patient disposition and the names of all doctors or ARNPs involved in child’s care (so she can send them a survey after the visit).

8. For video recorded families, at the end of the visit, the CRA will stop the recorder and the camera will be removed from the room. The memory card/recorder will be removed,
placed into a Ziploc bag with the patient’s study ID affixed and study phone number, and stored in a lock box in a secure room in the ED.

9. The following day (or next business day, for families enrolled on Fridays and Saturdays), the bilingual CRA based at the research institute will call the family at the appointment time to complete the study survey in Spanish over the phone. Answers will be entered into DatStat electronically. Up to 10 call attempts without contact, or 3 attempts with contact, will be made. For families whose child gets admitted, if there is no answer on the family-provided telephone number and they consented to be contacted in the child’s hospital room, the CRA will call into the patient room. If there is still no answer, the hospital-based CRAs from the Outcomes Assessment Program will be asked to stop by the room and facilitate telephone survey completion (helping the family with the phone, for instance), if the family is interested. Follow up surveys must be completed within 7 days of the ED visit to be included.

F2 Study Outcome Measurements and Ascertainment

1. Quality of communication: This parent-reported outcome is an important aspect of overall quality of care, and is likely affected by interpreter modality. To measure communication quality, we will use the Consumer Assessment of Healthcare Providers and Systems (CAHPS) Child Visit Survey 2.0 communication composite (5 items). CAHPS Survey items were rigorously developed in English and Spanish, have good validity across diverse populations and settings, and are widely used.17-19,38-44

2. Quality of interpretation: This parent-reported outcome is an essential component to achieving high quality communication for LEP families. It will likely vary by interpreter modality. Interpretation quality will be measured with the Interpreter Satisfaction Survey, which was developed and validated in Spanish (7 items).20

3. Diagnosis comprehension: This outcome, determined by comparing the parent-reported diagnosis to the one recorded by the provider in the encounter note, assesses the effectiveness of the communication occurring in the ED, which may also vary based on interpreter modality.

4. ED length of stay and ED charges: These metrics are important to consider, as changes in communication practices can impact length of stay, amount of treatment provided, and patient flow through the ED.

5. Provider communication without professional interpretation: Determined in 2 ways, by parent report and recorded and coded observation. Parents will be asked to report on the frequency with which providers used a list of communication methods with them (eg, telephone interpreter, family member or friend). For the objective measure (video-recorded sub-study), all recorded communications will be classified by duration, general content (eg, initial history), and interpretation type,
and percent of time using each will be calculated. This measure assesses how consistently providers use professional interpretation during the visit. If providers like a particular modality more, they may be more likely to use it consistently, rather than attempting to use ad hoc interpreters (family member or friends) or "get by" in either English or with non-proficient Spanish.

F3 Safety and Adverse Events

3.a Safety and Compliance Monitoring

No adverse events are anticipated; if any occur, the PI or Physician of Record will report them to the SCH IRB according to SCH IRB guidelines.

The PI or designated study personnel will review all data, including completeness of study data, enrollment, protocol deviations, drop-outs, adverse events on a regular basis and an annual report of all adverse events and a summary of the investigation will be submitted to the Seattle Children's IRB.

3.b Medical Monitoring

i Data and Safety Monitoring Plan

This study will not have an independent safety monitor, given its low risk to participants.

3.c Classification of Events

Adverse events are not expected. Any that do occur will be assessed by the PI and reported to the IRB. Adverse events will be graded as Mild, Moderate or Severe, and as Related / Possibly Related / Not Related to study procedures.

G Statistical Plan

In this section you will describe the data collection protocol for a typical subject. Describe the data sources and key information/variables obtained from each source.

G1 Sample Size Determination and Power

Based on the budget available, we will be able to recruit 208 families total over the course of 13 weeks, assuming the RA approaches 4 families per day, 5 days per week, with 80% participation (13 wk x 5d/wk x 4 families/day x .8 = 208). Currently, approximately 8 LEP Spanish-speaking patients are seen in the SCH ED per day, mostly during peak hours. A sample of 104 families per group will be adequate to detect small
to medium effects in communication and interpretation quality, and medium to large
effects in diagnosis comprehension, communication without professional interpretation,
and LOS (Table 1).

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Reference mean (SD) or proportion</th>
<th>Minimum detectable Δ</th>
<th>Power</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAHPS Communication</td>
<td>83.8 (21)</td>
<td>9</td>
<td>87%</td>
<td>Weech-Maldonado18</td>
</tr>
<tr>
<td>Interpreter Satisfaction Survey</td>
<td>69 (15)</td>
<td>6</td>
<td>82%</td>
<td>Gany20</td>
</tr>
<tr>
<td>Correct diagnosis</td>
<td>70%</td>
<td>17%</td>
<td>81%</td>
<td>Lion41</td>
</tr>
<tr>
<td>Length of stay (min)</td>
<td>186.7 (107.6)</td>
<td>42 min</td>
<td>80%</td>
<td>Hospital data</td>
</tr>
<tr>
<td>Communication without professional interpretation</td>
<td>45%</td>
<td>20%</td>
<td>80%</td>
<td>Bachi45, Arthur46</td>
</tr>
</tbody>
</table>

**G2 Analysis Plan and Statistical Methods**

CAHPS composite scores will be calculated, using top-box scoring to avoid ceiling
effects.47 Interpreter Satisfaction Index scores will be calculated and transformed into a
composite using top-box scoring. Diagnosis concordance will be determined using a
method we have used previously.48 Briefly, parent-reported diagnosis will be compared
to the clinician-recorded diagnosis and rated as correct, incomplete/vague, or incorrect
by 2 independent clinicians blinded to study group. Disagreements will be resolved by
discussion.

We will test for bivariate associations between study group (interpreter modality)
and the patient, parent, ED and provider attributes described above. While these
attributes should be evenly distributed among the experimentally-assigned interpreter
groups, they may need to be adjusted for if that is not the case. Attributes associated
with study group at p <.1 will be included in multivariate regression models as a
sensitivity analysis.

Primary analyses will be conducted without adjustment, using t-tests for
continuous outcomes and chi-squared for categorical outcomes. For the adjusted
sensitivity analyses, separate regression models will be constructed for each outcome.
Linear regression will be used to evaluate the impact of study group on parent-reported
communication and interpretation quality. Logistic regression will be used to test the
impact of interpreter modality on frequency of communication without professional
interpretation during the visit and correctly naming the child’s diagnosis. Length of stay
will be evaluated using a generalized linear model. We will also consider conducting
analyses stratified by medical complexity and common diagnoses (e.g. asthma) to
assess for effects within more medically homogeneous groups.
For the video-recording sub-study, coding and analysis of the taped interactions will be performed by the PI, Dr. Lion, and a trained research assistant. The coding scheme will be developed using the first 5 recordings, then validated by independent coding by both coders of the next 10 encounters. Differences will be identified and resolved, and the coding scheme will be revised as needed. A randomly selected 10% sample will be coded by both coders to ensure consistency and reliability over time.

Through coding, each discrete communication event between the family and provider(s) will be identified (e.g. initial history, attending exam, update on results, etc). These will then be classified according to communication content, duration, and how providers communicated with the family (e.g. video interpreter, provider's non-proficient Spanish). Duration of delays in interpretation start-up will also be noted.

Consistency of interpreter use will be determined at the visit level in 2 ways. Percent of interpreted communications will be calculated by dividing the number of professionally interpreted communications by the overall number of communications, excluding those conducted by a certified bilingual provider. Percent of interpreted time will be calculated by dividing the duration of all professionally interpreted communications by the total duration of all family-provider communications, again excluding time with a bilingual provider. The association of each of these outcomes with assigned interpreter modality (telephone vs video) will be assessed with a generalized linear model using a logit link function and binomial family, controlling for potential confounders.

Factors associated with professional interpreter use or non-use for each communication throughout an encounter will be assessed with multivariate hierarchical logistic regression. The outcome will be use of a professional interpreter, and the unit of analysis will be the discrete communication event, clustered by patient. Predictors will include assigned interpreter modality, type of communication (eg, initial history, update), and duration of communication. Additional potential covariates will include the child, family, and ED factors mentioned above.

Interpretation start-up delay time will be defined as time between the provider entering the room and beginning a conversation with the family through a professional interpreter. Delay time will be determined for every conversation using a professional interpreter. Association between delay time and interpreter modality will be evaluated using multivariate linear regression, controlling for time of day and ED census.

**G3 Confounding Factors**

We will collect information about the child, parent, ED conditions, and treating providers that might influence or moderate parent reports of communication quality, comprehension of the diagnosis, LOS, or provider interpreter use. The child attributes collected will be sex, age, insurance type, diagnosis as recorded in the provider note, disposition (admit or discharge), acuity level at triage, and illness complexity, calculated using the Pediatric Medical Complexity Algorithm. Parent attributes will be collected by self-report and will include educational attainment, household income level, ability to speak English using the US Census categories (not at all, not well, well, or very well), and previous experience with the child’s current condition or presenting complaint. ED attributes, such as time of day of presentation, day of the week, length of stay, and
crowding using the National Emergency Department Overcrowding Score (NEDOCS), may influence family satisfaction or provider behavior and will also be recorded. Provider attributes collected will include number and duration of interpreted communications and bilingual status, as determined from the hospital bilingual certification database. Given that there are relatively few certified bilingual providers, and that most ED patients receive care from multiple providers, families receiving some care from a bilingual provider will not be excluded from the study. These factors will all be measured and compared between groups. Adjustment for them will be conducted if they are unbalanced between groups.

G4 Missing Outcome Data
Surveys with >70% completed questions will be retained in the analysis. Composites will be calculated using the available responses so long as no more than 2 constituent questions are missing answers; otherwise, the composite will be scored as missing.

H Data Handling and Record Keeping

H1 Confidentiality and Security
Data Storage and Confidentiality. Data will be collected and stored within a secure computer system and accessed through password-protected computers. Once data linkage is complete, individuals will be identified by a code, and the key to the code will be stored separate from the data. Once analysis is complete, the data will be de-identified. Videos will be deleted within 1 year of their creation.

H2 Data and/or Sample Sharing
We do not anticipate sharing any data outside of the research team, and if any data were to be shared, it would be done only after fully de-identifying the data. Only research team members will have access to the data, and access will be controlled by the PI. Data will initially be coded, and then will be de-identified after primary analysis is complete.
References


