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Telephone interpreter discrepancies: videotapes of Hmong medication consultations

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Abstract

Background—Over 25 million people in the USA have limited English proficiency (LEP). Interpreters are often used to facilitate communication with health care providers. Little is currently known about interpreter quality.

Objective—To explore the quality of telephone interpretation during medication consultations between Hmong clients and their pharmacists.

Methods—This descriptive study analyzed transcripts from videos of consultations between six triads of Hmong patients, pharmacy students and interpreters. Analysis was divided into two segments: (1) *pharmacy*: communication from student pharmacist the interpreter to patient and (2) *patient*: communication from patient to interpreter to student pharmacist. Researchers coded transcripts separately then compared codes.

Key findings—The six encounters yielded 496 communications with 275 discrepancies including omissions, additions, and word substitutions. Pharmacy to patient communications included, 45% (118/262) of omissions, 27.5% (72/262) of substitutions, and 15.6% (41/262) of additions. The patient to provider communications included, 8.1% (19/234) of omissions, 6.0% (14/234) of substitutions, and 4.2% (10/234) of word additions. Some omissions, additions, and substitutions in the pharmacy to patient communications were classified as potentially clinically relevant. Significantly, substantial discrepancies between the student pharmacists' comments and the interpretation to patients had potential for hindering relationship building between patients and their providers.

Conclusions—Pharmacists may assume that the presence of an interpreter ensures accurate communication from pharmacist to patient and from patient to pharmacist. This study confirms that those assumptions may not be valid. These findings highlight the need to improve pharmacy education and interventions to improve pharmacist communication with LEP patients.

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Declarations

Conflict of interest

The authors declare that they have no conflicts of interest to disclose.

Authors' contributions

All of the authors have worked collaboratively on this research including data collection, analysis, and writing of this manuscript.

Keywords

Hmong; medication encounters; patient-provider communication; telephone interpreters

Introduction

Twenty-five million (9%) of the US population have limited English proficiency (LEP),^[1] which serves as a barrier to quality healthcare. Over the last 20 years, the number of LEP individuals in the USA has grown by 81%.^[1] Given that the number of LEP individuals has increased significantly, health care providers must be competent and efficient in cross-cultural communication. This is particularly true for health care providers interacting with the Hmong population, 90% of whom have LEP.^[2]

LEP creates challenges to effective communication between patients and providers. Effective patient provider communication is critical to the delivery of safe and high-quality care.^[3] A study of adverse events in six US hospitals found that LEP patients compared with English-speaking patients experienced a disproportionate percent of adverse events.^[4] It was also noted that the adverse events experienced by LEP patients resulted from communication discrepancies over half (52.4%) of the time compared with a little over a third (35.9%) of the time for English-speaking patients.^[4] Further, patients whose families have language barriers were found to have a twofold increased risk for serious medical events, including medication discrepancies, compared with patients whose families had no such barriers.^[5]

Pharmacists are in a unique position to help LEP individuals take their medications safely.^[6] However, in order for pharmacists to carry out their role effectively, they must be able to communicate effectively with their patients. It has been reported that many pharmacists lack the skills needed to counsel LEP patients.^[7,8] In a study that evaluated pharmacists' abilities to provide communication to LEP patients, only 55% of the pharmacists reported being satisfied with their communication.^[9] Given this situation, medical interpreters offer an important option to assist effective communication between LEP patients and health care professionals.

The role of an interpreter 'is to interpret, that is, to convert a message uttered in a source language into an equivalent message in the target language so that the intended recipient of the message responds to it as if he or she had heard it in the original'^[10] (p. 13). Most medical interpreters are employed by organisations that serve large hospitals and clinics. They are required to have certification in medical interpreting. According to the National Board of Certification for Medical Interpreters, interpreters must (1) be a minimum of 18 years of age; (2) have at least a high school diploma or general education development diploma; (3) have completed the medical interpreter educational programme; (4) demonstrate oral proficiency in English; and (5) demonstrate oral proficiency in the target language.^[11] However, only six languages are available for formal testing and certification by the National Board of Certification for Medical Interpreters – Spanish, Russian, Mandarin, Cantonese, Korean and Vietnamese.^[11] It is unclear how oral proficiency with other targeted languages including Hmong is tested.

Interpreters are considered the gold standard for assisting communication with LEP patients, and research has shown that professional interpreters can improve health outcomes.^[12,13] However, only a few studies have examined interpretation discrepancies by medical interpreters,^[14–17] leaving a significant gap in research on the quality of interpretation in medical settings. Existing studies done on medical interpreters have been focused on patient satisfaction,^[6–9] health care delivery,^[10,11] current interpreter utilisation practices^[6,12,13] and clinical outcomes.^[12,14] Researchers have studied interpreter services in settings including pediatric care,^[15] psychiatric care,^[16] primary care,^[17–19] emergency room^[6,10,14,20,21] and community health centers.^[11] From a systematic review reported by Jacobs and colleagues, the majority of studies on interpreter services focus on Spanish-speaking patients.^[22] Currently, only two studies that examined interpreter quality, specifically examined interpreting errors.^[23,24] However, these two studies have only been conducted with Spanish-speaking interpreters. They found that errors in medication interpretation are common and most have potential clinical consequences. For example, Flores and colleagues reported 63% of all errors had potential clinical consequences.^[23] Clinical consequences included ‘being told to use the wrong dose, frequency, duration or mode of administration of drugs and other therapeutic interventions, and omitting relevant clinical information on drug allergies and the past medical history’^[23] (p. 12). There has been no reported research on the quality of interpretation of medication consultations specifically during pharmacist consultations, telephone interpretations, or with Hmong patients.

The purpose of this study was to explore the quality of telephone interpretation during medication consultations in the Hmong language. More specifically, our aims were to assess (1) the patterns of interpreters’ omissions, substitutions, and additions; and (2) communication discrepancies that could affect relationship building and patient-centred care.

Method

This descriptive study retrospectively examined transcripts from videos of six triads of standardised Hmong patients (2), pharmacy students (6) and interpreters (6) from a pharmacy communication course in 2013. Video-recordings inclusion criteria included: (1) standardised patients must identify as Hmong patients and must speak Hmong; (2) interpreters must interpret in Hmong and English; and (3) students must identify as pharmacy students. Video-recordings were made of medication consultations done face to face between third-year pharmacy students and trained ‘standardised’ Hmong patients (2) who did not speak English. The consultations were supported by medical interpreters from a national company providing this service commercially via telephone. The interpreters were randomly selected, as were the pharmacy students. More specifically, there were six students in a course lab of 18 students who by chance did the Hmong encounters. Across a 12-week period, students systematically rotated each week across booths 1–6. The standardised patients stayed stable in the same booth each week. In week 9, when Hmong standardised patients were used, the same student rotation process was in place so the students who came to booths 2 and 5 for three waves of student consultation by chance received the Hmong consultation experience. No selection was imposed from the outside. The standardised

Hmong patients were selected specifically for their LEP and availability. Initially, a bilingual Hmong doctoral student recruited standardised Hmong patients from a large Hmong community. As a retrospective study with de-identified transcriptions of the encounter data to analyse, our Institutional Review Board did not require consent. This study was approved by the University of Wisconsin Education and Social/Behavioral Science Institutional Review Board.

In the scenario, the patient had just been discharged from a hospital and was having his/her medications explained for the first time. Three of the five medications were new. Patients were coached to play a confused patient. To address the patient's specific health needs the interpreter had to be precise about the timing of each medication. This study took place at a Midwestern US School of Pharmacy. The conversation from the videos of six triads of Hmong patients, pharmacy students, and interpreters were transcribed verbatim by a bilingual Hmong PhD student, who is fluent in both oral and written Hmong and English. The transcripts were analysed in English. Two coders independently coded each transcript following a communication coding protocol.

Students practiced a Transaction Model of Communication, which conceptualises communication as a two-way process where shared meaning is negotiated between the two participants.^[18,19] Inserting an interpreter into this process could aid or complicate achieving 'shared meaning' depending on the interpreter's ability to interpret each participant's meaning and words accurately. Students had been prepared to use state of the art patient-centred communication skills to elicit patient concerns; respond empathically; ask openended questions; give precise information about the drug (name, function, when and how it should be taken); assess patient agreement that the medication regimen plan was feasible and comfortable to the patient; and evaluate patient understanding.

Because Hmong patients have no English proficiency, pharmacy students were directed to use visuals to increase Hmong patients' comprehension of medications using a telephone interpreter. Through a telephone interpreter, the pharmacy student had to explain a weekly visual medication calendar with pictures to indicate the times of the day the patient could take the medications. Colour-coded stickers were put on the medication vials and the same coloured stickers were put on the appropriate time of day in the weekly calendar to show Hmong patients when to take each medication. The telephone interpreter was online during the entire medication encounter from the initial greeting to its conclusion.

Communication coding methodology

A coding protocol from the literature^[20,21] was used to identify frequencies of three categories of interpreter communication: (1) omissions – defined as any word or phrase that is missing or not interpreted by the speaker (patient or pharmacist); (2) additions – defined as any word or phrase that was added in the translation by the speaker; and (3) substitution – defined as any word or phrase that was substituted from the original word said by the speaker. While coding the transcripts, authors did not focus on literal translation of a phrase word-by-word. Instead they focused on whether or not the main idea was expressed. For example, if the general sense of the passage is the same then they did not code it as a substitution. Examples of coding are discussed in later section.

Two coders analysed and coded the transcripts separately and then compared and verified codes for each of the transcripts. When there were discrepancies in coding, they worked through multiple iterations to achieve consensus of coding. We divided each encounter into a series of cycles composed of two segments: (1) *pharmacy segment*, which refers to when the student pharmacist speaks to the patient through the interpreter; and (2) the *patient segment*, which refers to when the patient responds back to the pharmacy student through the interpreter. For each segment in the encounter, we counted whether there was an event of omission, addition and substitution of words. Further, some events were flagged because they were considered relevant to patient safety. For example, omission, addition or substitution of medication names, when to take medications and dosage were flagged if they were inaccurate. Each event identified in each of the segments (e.g. pharmacy and patient segment) was counted for each patient. For example, if something was omitted in the pharmacist segment (pharmacy student speaking to the patient through the interpreter) then that was counted as one discrepancy. Likewise, if something was substituted in the patient segment (patients speaking to the pharmacists through the interpreter) then that too was counted as one discrepancy.

Some omissions in the pharmacist segment were classified as having potential for clinical consequences. We used Flores and colleagues' classification list of potential clinical consequences to identify clinical errors in this study.^[23] These included: (1) omitting medication names; (2) omitting medication dosage; (3) omitting function of the medications; and (4) omitting when patients are supposed to take their medication. In addition, substituting the wrong sticker colour to distinguish which medications to take at a particular time was identified as having potential clinical consequences.

Lastly, to promote relationship-building and patient centred care student pharmacists had been taught to acknowledge their patients' experience empathically, ask patients to participate in the decision-making process of when to take the medications, assess patients' agreement on care plans and to use open-ended questions to better understand the patient's perspective and encourage their active participation. All of these contribute to rapport-building and elicitation of key information from the patient needed to tailor regimens. Coders analysed the extent to which these events were omitted by interpreters in the pharmacist segments.

Results

There were a total of 496 segments of both the pharmacy and patient for all six encounters, yielding 12–15 min per each of the six encounters. The standardised patients were two women ages 63 and 65, while four of the six students were women and all were white. All of the telephone interpreters were women and proficient in the English and Hmong languages.

Number of interpretation discrepancies

There were 262 (52.8%) pharmacist segments, and 234 (47.2%) patient segments. More than one omission, substitution or addition could occur in the same segment. A total of 62.9% (312/496) of both the pharmacy and patient segments did not have any discrepancies.

Discrepancy-free segments tended to be shorter sentences and were largely confirmatory passages from the patient to the provider. See Table 1 for more details.

Many more events occurred during the interpretation of the pharmacy segments compared with the patient segments. Of the total 262 pharmacy segments, 232 segments (88.6%) had discrepancies interpreted from the pharmacy student to the patient. Of the 234 patient segments, a total of 43 segments (18.4%) had discrepancies interpreted from the patient to the pharmacy. Some interpreters showed far more discrepancies than others.

Of the total 496 segments, 54 segments had more than one interpreter discrepancy in the segments. In the 54 segments that had more than one type of interpreter discrepancy, the most common type of discrepancy combination was substitution and omission. See Table 1 for more details.

Patterns of interpreters' omissions, substitutions and additions

Omissions occurred in 45% (118/262) of the pharmacist segments and in only 8.1% (19/234) of patient segments. The most common pattern of omission during the pharmacist segment was leaving out medication information including medication name, amount, and time to take it. For example, in 29.8% (17/47) of the times, the medication name was mentioned by the pharmacy student; this detail was omitted by the interpreter (see Table 2). The following is an example of an interpreter omitting a medication name and dosage (*italicised words indicate what was omitted*):

Pharmacy student: “*And then the next medication that we’re going to go through is her Digoxin, and this one is the 0.125 mg,* and this one is also taken for her heart.”

Interpreter to patient: “Hmmm ... what is the ... ok ... She says that’s one that you take to help your heart too. And do you know what time to take it?”

Additions occurred in 15.6% (41/262) of pharmacist segments and 4.2% (10/234) of patient segments (see Table 1). The most common pattern of additions made by the interpreter was adding an *elaboration* to the passage interpreted (*italicised words indicate substitution*).

Pharmacy student: “Ok, we can have you try it first about a half an hour before breakfast.”

Interpreter to patient: “Ok, then you should try to take it 30 min before you eat breakfast *and see if your stomach will hurt. If it does, then you can take it with food.*”

Lastly, substitutions occurred in 27.5% (72/262) of pharmacy segments and 6.0% (14/234) of patient segments. The most common pattern for substitution was *rephrasing* of the passage spoken by the pharmacist student. More specifically, when the pharmacy students discussed the time to take the medications, 63% (26/41) of the times, the interpreter substituted the information (see Table 2). For example, the interpreter would rephrase or change the original passage from the main speaker (e.g. the pharmacist student) thereby changing the meaning. In this example, there is also a substitution of the time:

Pharmacy student: “Ok, take it after eating dinner then.”

Interpreter to patient: “Ok, so take it in the evening then.”

Interpreter discrepancies of potential clinical consequences

A substantial percent of pharmacist segments were classified as having an omission with the potential for clinical consequences. While the student pharmacists said the names of medications 47 times, the interpreters omitted the medication names 17 times (36%; 17/47). While the student pharmacists said the medication dosage eight times, the interpreter omitted the medication dosages three times (37.5%; 3/8). While the student pharmacists explained the time to take the medications 29 times, the interpreter omitted the information 11 times (37.9%; 11/29). Lastly, the interpreter omitted to explain the medication’s function only once (5.3%; 1/19) out of the 19 times it was explained by the pharmacist.

Furthermore, of the 19 times the student pharmacists spoke about the colours of stickers to demarcate medications to be taken by the patient at particular times, 10 times (52%; 10/19) these were not interpreted by the interpreter.

Interpreter omissions related to patient–provider relationship building

Interpreters showed substantial omissions of pharmacist techniques to develop rapport, evaluate patient understanding and identify regimen agreement on schedules to take medications. The most striking example was the omission of pharmacists’ empathic responses to patient comments. The interpreter interpreted none of the student pharmacists’ 15 empathic responses to the patient’s concern. See Table 3. For example, the passage below displays the interpreter omitting the pharmacy student’s expression of understanding that it is hard for the patient to keep the medications straight (*italicised words indicate they were omitted*):

Pharmacy student: “Okay I can under ... I can see that it can be a lot to have this many medications and to try to keep it straight.”

Interpreter to patient: “Yes, that’s right. There are a lot of medications so you have to remember how to take it like this and like that so ... there are problems.”

Interpreters only interpreted 10 of the 30 times the student pharmacist attempted to assess patient preferences for or agreement with the regimen plan (*italicised words indicate omitted*):

Pharmacy student: “Okay. With these medications there are several that can be taken together. Perhaps taking them at breakfast and at dinner would be the easiest time. What do you think about that?”

Interpreter to patient: “She said that these medications, you take it in the morning ok. Take it in the morning when you eat breakfast, then you take the medication ok and then in a bit when you go sleep then can you take it?”

It is worth pointing out a frequent substitution occurred in the above example, where the interpreter substituted taking medication ‘when you go to sleep’ for the pharmacist phrase ‘at dinner’. This substitution could have serious implications for medication efficacy or adverse effects.

An additional overlooked process element by interpreters was that student pharmacists had been encouraged to use open-ended questions in the encounter to encourage patient participation and to assess patient understanding. Of the seven times, the student pharmacists asked an open-ended question, these were interpreted as open-ended questions only four times (57%; 4/7).

Lastly, interpreters missed interpreting 10 of the 30 times that student pharmacists sought to assess the patient's agreement with some portion of the medication plan. This meant that pharmacists were unable to assess the patient's comfort with the plan and its feasibility.

Discussion

This is the first study to explore interpreters' omissions, substitutions, and additions during medication consultations with standardised Hmong patients. Interpreters had more problems interpreting what student pharmacists said than they did with interpreting what patients said. This is logical since the student pharmacist passages tended to be longer and contain more medical terms. Consistent with earlier work,^[14] omission was the most common discrepancy by interpreters. Some of the omitted information had safety implications including medication names, dosages, medication function, and time to take the medication.

There are several limitations in this study that should be noted. The small sample size of Hmong interpreters limits generalisability to other languages and groups. Further, the patients were standardised patients just as the pharmacists were third-year pharmacy students. It would be useful to replicate this study with patients and pharmacists in practice. The focus of this study however, is the interpreters' patterns. Given that the interpreters were from a respected national company providing interpreter services, the findings about discrepancies are expected to be representative of interpreter patterns of discrepancies across different regions.

It may well be that having the interpreter present for face to face nonverbal cues could ameliorate some of these problems noted with telephone interpreter services. However, given that community and clinic pharmacies are unlikely to have the luxury of in-person interpreters, the telephone interpreter service remains an important option to evaluate. It would be useful to replicate this study with face to face interpreters to see if fewer discrepancies occur. Future research could also examine the direct effect of medical interpretation errors on clinical outcomes.

This paper adds new information about the effect of interpreter discrepancies on patient-centred communication. While the student pharmacists were trying to use a transaction model of communication that accords with patient centred communication, the interpreters used a transmission model of communication. In other words, instead of a two way process where shared meaning was negotiated between the patient and student pharmacist through the assistance of the interpreter, the interpreter largely omitted the negotiation process. For example, when student pharmacists utilised rapport-building techniques such as asking open-ended questions, interpreters often changed the open-ended question to a closed-ended question. When the pharmacy students attempted to assess patients' agreement about the

feasibility of the medication schedule, the interpreter often omitted the passage, thereby, diminishing the patient-centred participation.

Perhaps most revealing, none of the student pharmacists' empathic responses were interpreted by the interpreters. It may well be that interpreting the medication-related information is so challenging that interpreters under attend to information they considered less critical. Acknowledging empathic responses and assessing the patient's comfort or ability to follow a medication plan may have been beyond what interpreters could handle. Further, they may have thought these elements were superfluous to the encounter. These omissions may be particularly important for LEP patients if they are embarrassed or uncomfortable asking key questions or seeking clarification of points not well understood. Hence, this represents a significant issue. Studies have suggested that patient perceptions of patient centredness or provider congruence of interviewing styles are better predictors of trust,^[22,29] visit satisfaction,^[23] and medical outcomes^[24,25] than a provider's actual patient centredness. If this is equally true in medication-related encounters, these omissions are all the more important to address through improved training and orientation to the role responsibilities of interpreters.

Implications for providers

This study suggests the importance of training student pharmacists to work carefully with an interpreter as well as their LEP patient in order to avoid serious interpretation gaps. Although all providers are told to provide short and explicit instructions to the patients, this research suggests several other points should be considered as well.

At the beginning of the encounter, the provider may wish to orient the interpreter by stating the primary goals of the medication consultation and number of medications that would be covered. Interpreters should be encouraged to say when they wish the pharmacist to repeat or explain something more clearly or more slowly. Similarly, the pharmacist should encourage the interpreter to indicate if they are using too many medication/medical terms before allowing the interpreter to interpret for the patient. In essence, there needs to be a sense of a team, facilitated by negotiation at the outset with continuing feedback as needed.

Second, judging from the omission of medication names in this study it may be helpful for pharmacists to ask the interpreter if they would like the names of the medications to be repeated or spelled when they are covered. Health care providers need to use explicit language about when to take medications in order to enhance patient understanding and clear interpreter communication. This may be particularly true when telling someone to take a medication at dinner (emphasising not at bedtime if this is important). This can be briefly reinforced.^[26] It was striking how the interpreters did not communicate pharmacists' empathic or reflective listening statements and rarely included their questions about whether the regimen was feasible and comfortable for the patient. This would suggest the usefulness of a few comments to interpreters at the beginning of the session to indicate that the pharmacist is going to look for opportunities to build rapport and make sure that the patient agrees that the regimen is feasible and comfortable. Therefore, the pharmacist would like the interpreter's help with interpreting this portion of the communication specifically. When

giving empathic and rapport-building statements, the pharmacist may want to stop and wait for the interpreter to interpret before moving onto giving information.

Providers also need to evaluate whether a patient understands key information after a 'chunk' of information is given. 'Talk Back' techniques could be used throughout the encounter. It may also help to check in with the interpreter to make sure the interpreter understood the key information being delivered. Again, providing information in short chunks will be important to facilitate the interpreter's completeness and accuracy.

Training and certification implications

This study suggests that interpreter training and certification is crucial to promote high-quality interpretation. Interpreters in this study sometimes omitted medication name, dose, time to take, etc. As part of their training and certification process, interpreters should be encouraged to ask a provider to repeat and/or slowdown their information delivery as needed by the interpreter. Recognising that social desirability might work against interpreters' asking for clarification, interpreter training should reinforce professional ethics to indicate when an interpreter is confused. For example, interpreters could not interpret words such as rows and columns in the Hmong language in a weekly visual medication calendar. Some also misinterpreted the colours of stickers although such terms exist in the language. In an actual medication consultation the interpreter's confusion would likely have hindered a Hmong participant's comprehension and impede utilising visuals for a low literate population. In terms of certification it is critical that languages like Hmong are included with the other six testing languages for certification soon.

This study suggests there is a need for more discussion of what the role of the interpreter is. We observed a few interpreters directly answering patient's questions without interpreting it back to the provider as well as taking the information spoken by the provider and adding their understanding of the information to their interpretation.

The importance of training and certifying strong interpreters has never been more important, particularly considering health disparities. Patients with LEP have poorer health outcomes, access to care and health status.^[27,28] To the extent that clear communication with providers can lessen these disparities, the qualified, trained medical interpreters' roles are all the more important and deserve the support needed to play their roles successfully.

Conclusion

Limited research focuses on the quality of medical interpreting and how health care providers can optimise its quality. This is the first to focus on medication consultations with patients specifically using telephone interpreters. Health care providers including pharmacists are challenged to work with interpreters as well as with LEP patients, and may not realise that omissions, additions and substitutions by medical interpreters are occurring. This study suggests that omissions, additions and substitutions in medical interpretation may be common.

Descriptive studies are needed to examine the generalisability of findings from this study to other languages and settings. Also, intervention studies with both pharmacists and interpreters are needed to evaluate strategies to reduce the observed problems. Both interpreters and health care providers need systematic training to be able to interact effectively on behalf of the patient. This study has important implications for providers to be more sensitive to the challenging process of interpretation and likely discrepancies between intended and actual communication with a patient who has LEP.

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Table 1

Percentage of pharmacist (Phr) and patient segments with interpreter discrepancies[†]

	Total number of pharmacy segments	Total number of patient segments	Percentage of omission (number of segments with omitted/total pharmacy segments) (Phr, Patient)	Percentage of addition (number of segments with additions/total pharmacy segments) (Phr, Patient)	Percentage of substitution (number of segments with substitutions/total pharmacy segments) (Phr, Patient)	Percentage of no discrepancy (number of segments with no discrepancies) (Phr, Patient)
Interpreter 1	59	52	37.2, 7.9 (22/59), (4/52)	13.6, 3.85 (8/59), (2/52)	23.7, 3.85 (2/52), (14/59)	52.54, 90.4 (31/59), (47/52)
Interpreter 2	53	47	26.4, 10.6 (14/53), (5/47)	13.2, 1.1 (7/53), (1/47)	26.4, 4.3 (14/53), (2/47)	47.2, 83 (25/53), (39/47)
Interpreter 3	13	12	76.9, 0 (10/13), (0/12)	38.4, 0 (5/13), (0/12)	38.4, 0 (5/13), (0/12)	23.8, 100 (3/13), (12/12)
Interpreter 4	49	46	30.6, 2.2 (15/49), (1/46)	22.45, 0 (11/49), (0/46)	22.45, 4.35 (12/49), (2/46)	42.9, 91.3 (21/49), (42/46)
Interpreter 5	41	34	36.6, 8.8 (15/41), (3/34)	14.6, 5.9 (6/41), (2/34)	34.15, 14.7 (14/41), (5/34)	46.3, 76.5 (19/41), (26/34)
Interpreter 6	47	43	89.4, 13.95 (42/47), (6/43)	8.5, 11.6 (4/47), (5/43)	27.7, 7 (13/47), (3/43)	25.5, 81.4 (12/47), (35/43)
TOTAL	262	234	45, 8.1 (118/262), (19/234)	15.65, 4.3 (41/262), (10/234)	27.5, 6 (72/262), (14/234)	42.4, 85.9 (111/262), (201/234)

[†] A segment can have multiple discrepancies in it (e.g. a combination of omission, addition and/or substitution).

Table 2

Types of omission, additions and substitution

	Medication names				Medication dosage				Function of medication		Time to take medications (e.g. words such as breakfast, dinner, evening)	
	Omission (number times interpreter omitted medication name/total # pharmacist said)	Addition (number times interpreter added medication name/total # pharmacist said)	Substitution (number times interpreter substituted medication name/total # pharmacist said)	Omission (number times interpreter omitted medication dosage/total # pharmacist said)	Addition (number times interpreter added medication dosage/total number pharmacist said)	Substitution (number of times interpreter substituted medication dosage/total number pharmacist said)	Omission (number of times interpreter omitted function of medication/total number pharmacist said)	Omission (number of times interpreter omitted word/total number pharmacist said)	Addition (number of times interpreter added word/total number pharmacist said)	Substitution (number of times interpreter substituted word/total number pharmacist said)		
Interpreter 1	1/5	1/5	1/5	1/4	1/4	1/4	1/5	4/7	5/7	6/7		
Interpreter 2	0/9	0/9	0/9	0/0	0/0	0/0	0/5	4/9	2/9	5/9		
Interpreter 3	4/6	0/6	0/6	2/3	0/3	0/3	0/4	1/3	1/3	1/3		
Interpreter 4	5/8	0/8	0/8	0/0	0/0	0/0	1/4	1/8	1/8	8/8		
Interpreter 5	0/8	0/8	0/8	0/0	0/0	0/0	0/1	2/7	0/7	4/7		
Interpreter 6	7/7	0/7	0/7	0/0	1/0	0/0	0/0	7/7	2/7	2/7		
Total	17/47 (29.8%)	1/43 (2.3%)	1/43 (2.3%)	3/8 (37.5%)	3/7 (42.9%)	1/7 (42.9%)	1/19 (5.3%)	19/41 (46.3%)	11/41 (26.8%)	26/41 (63.4%)		

Table 3

Number of times interpreter omitted relationship-building category spoken by the pharmacist student

	Empathetic response (number of times interpreter omitted acknowledgement response/total number pharmacist said)	Open-ended questions (number of times interpreter omitted open-ended question/total number pharmacist said)	Assess patient agreement (number of times interpreter omitted agreement/total number pharmacist said)
Interpreter 1	3/3	0/0	6/13
Interpreter 2	4/4	2/6	0/0
Interpreter 3	1/1	0/0	1/1
Interpreter 4	1/1	1/1	0/7
Interpreter 5	2/2	0/0	1/5
Interpreter 6	4/4	0/0	2/4
Total	15/15 omitted	3/7 omitted	10/30 omitted

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