Automated Machine Translation - A Means to Circumvent Challenges Associated with Interpreters

Hailee Tougas and Peter Yellowlees, MD, MBBS

UC Davis School of Medicine; UC Davis Department of Psychiatry & Behavioral Science

Background

- In the United States, over 25 million individuals over the age of 5 speak English less than 'very well' with limited English proficiency (LEP). Of this group, more than 16 million individuals identify their preferred language as Spanish or Spanish Creole.
- Among Latino immigrants, those with LEP are less likely to receive mental healthcare services as compared to those with English proficiency (EP).
- A variety of Federal and state policies, including the Civil Rights Act of 1964, require that interpreter services be available to all LEP individuals.
- Professional interpreters are widely considered the best means of providing linguistically and culturally competent healthcare to patients with LEP. Use of interpretation services is proven more accurate, however, when providers are made to simplify their speech.
- This simplification includes shortening of phrases and avoidance of complex language, including idioms, jargon, humor and acronyms.
- Bilingual providers offer an alternative option to professional interpreters and recent research has found that language concordance between provider and patient can lead to improved healthcare outcomes.
- Until now, automated machine translation (AMT) has not been explored as an alternative option to professional interpreting services.

Objectives

- To compare the transcripts of initial psychiatric intake interviews for LEP, Spanish-speaking patients, conducted in both language discordant and language concordant formats.
- Specific points for analysis include patient word-count per minute, and instances of use of complex, figurative language expressions per patient word count.
- Types of figurative language includes, but is not limited to, similes, metaphors, euphemisms, idioms, and hyperboles.

Methods

Interview transcripts are generated for 6 patients as a subset of patient interviews performed by Dr Yellowlees' research team for a clinical trial to investigate the validity of their previously developed, online language interpreting tool.

Each LEP patient is interviewed in the following two formats:

- Format A - A language-concordant interview between a Spanish-speaking trained mental healthcare worker, and the patient; video and audio recording of this interview is then transcribed and translated via the online automated machine translation tool and then forwarded to a psychiatrist for later review.
- Format B - A language-discordant interview between an English-speaking psychiatrist and the patient, mediated by a Spanish-English interpreter.

Patients 1 through 3 completed interviews in person, and patients 4 through 6 completed interviews over Zoom, after the start of the COVID-19 pandemic.

Transcripts for patient interviews are reviewed and edited by two separate bilingual team members for transcriptional accuracy.

Instances of use of complex, figurative language, spoken by the patient, are marked and then identified as being either correctly translated to match the original meaning in Spanish or incorrectly translated.

Patient word counts are recorded and divided by the minutes of each interview to control for interview length.

Data analysis was performed with paired t-tests using Excel.

Results

Frequency of Figurative Language Expressions

P-value < 0.05

Patient Word Count per Minute

P-value < 0.05

Percentage Correct Translation

P-value > 0.05; * percentage correct translation = 0% for patient 6, format B
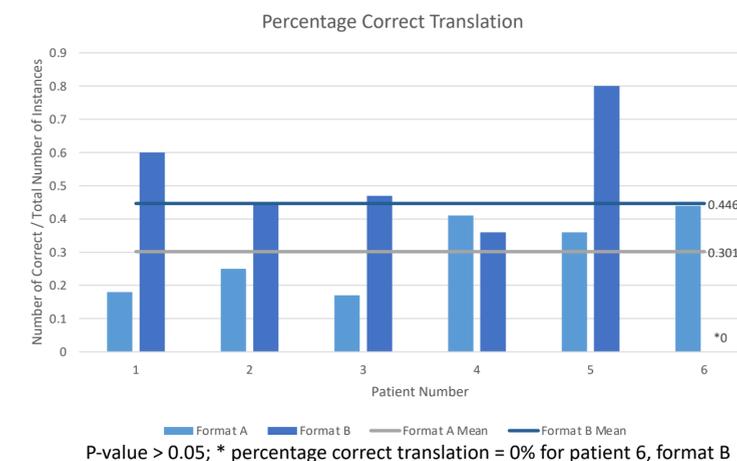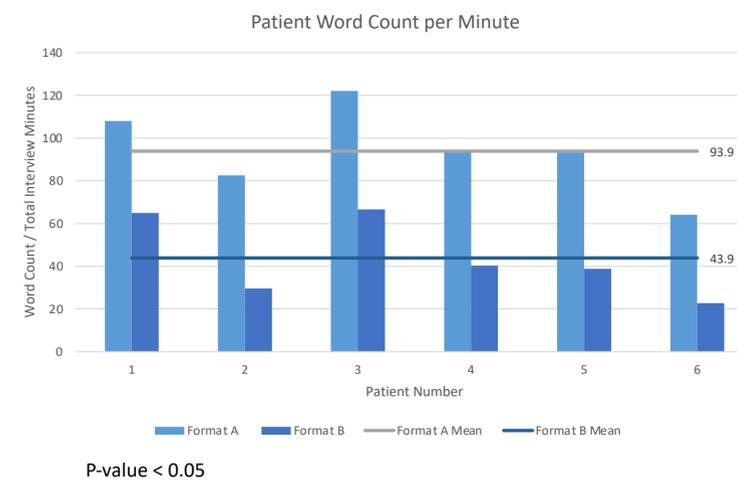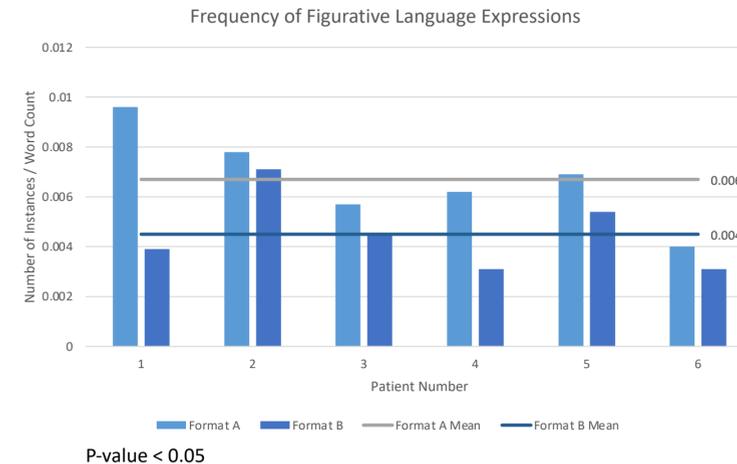
Conclusions and Discussion

Language concordant psychiatric intake interviews demonstrate a statistically significant higher frequency of use of complex, figurative language expressions by the patient than when using an interpreter. Language concordant interviews also demonstrate a statistically significant higher patient word count per minute. Human interpreters provide a higher percentage of translational accuracy when translating instances of figurative language, with a mean of 45% accuracy as compared to AMT with a mean of 30%; p-value > 0.05.

These findings suggest that the use of human interpreters pose a significant time barrier to interviewing patients, whereby the patient's speech is reduced by more than 50% per minute. These findings also suggest that patients are making either conscious or sub-conscious decisions to simplify their speech and use more literal language when using an interpreter. This may suggest that patients are limited in their ability to convey the same detail and subtlety to their interviewer when using an interpreter. Although it was found that AMT is currently less accurate than professional interpreters, the field of AMT has been in a state of rapid advancement within the last decade with a major shift in the way that language is processed; further advancements will continue to improve the technology behind AMT and will be conducive to improved accuracy of translation.

References

Bauer AM, Chen CN, Alegría M. English language proficiency and mental health service use among Latino and Asian Americans with mental disorders. Med Care. 2010 Dec;48(12):1097-104. doi: 10.1097/MLR.0b013e3181f80749. PMID: 21063226; PMCID: PMC3135417.

Diamond, L., Izquierdo, K., Canfield, D. et al. A Systematic Review of the Impact of Patient–Physician Non-English Language Concordance on Quality of Care and Outcomes. J GEN INTERN MED 34, 1591–1606 (2019). https://doi.org/10.1007/s11606-019-04847-5

Fathi, Ehsan, and Babak Malesi Shoja. "Deep Neural Networks for Natural Language Processing." Handbook of Statistics, vol. 38, Elsevier, 2018, pp. 229–316.

Juckett G, Unger K. Appropriate use of medical interpreters. Am Fam Physician. 2014 Oct 1;90(7):476-80. PMID: 25369625.

US Census Bureau. "Detailed Languages Spoken at Home and Ability to Speak English." The United States Census Bureau, U.S. Department of Commerce, 6 Oct. 2020, www.census.gov/data/tables/2013/demo/2009-2013-lang-tables.html.

Acknowledgments