A REVIEW OF INTERVENTIONS TO ADDRESS LANGUAGE BARRIERS IN THE EMERGENCY DEPARTMENT

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INTRODUCTION

The current health system provides care to an increasingly diverse society, which is why it is continuously reviewed and improved to serve all kinds of patients. Title VI of the 1964 U.S. Civil Rights Act ensures that federal money does not support providers who discriminate based on race, color, or national origin, which includes those with Limited English Proficiency (LEP). Furthermore, under section 1557 of the Affordable Care Act, LEP patients are entitled to a qualified interpreter, defined as someone who has proven abilities in English and the target language in addition to training in the ethics of interpretation. Beyond this, there is a legal precedent that requires that language assistance be offered to LEP patients (Chen et al., 2007). Even though these laws are in place, many LEP patients are still not given any interpreter services when they visit the Emergency Department (ED), resulting in negative outcomes (Flores et al., 2012). Some of these outcomes are prolonged length of stay (LOS), higher rates of 72-hour return to the ED, poor comprehension of prescription directions, discharge education, and procedure risk and benefits (Abbato et al., 2019; Abdulla et al., 2020; Chartier et al., 2021; Dahl et al., 2015; Gallagher et al., 2013; Lindholmet al., 2012; Lopez et al., 2015; Mahmoud et al., 2013; Ngai et al., 2016; Samuels-Kalow et al., 2013, 2017; Saunders et al., 2016; Taira et al., 2019; Wallbrecht et al., 2014)

In order to combat these outcomes, healthcare institutions have been providing more language interpreter services. Research indicates that the cost of providing language services may be recouped since interpreted LEP patients compared to English-speaking and non-interpreted LEP patients had the shortest emergency department (ED) stays; had the fewest tests, intravenous catheters, and medications; were more likely to follow-up in a clinic and less likely to return to the emergency department; and had the lowest overall charges (Masland et al., 2010). Despite the promise of qualified interpreters to resolve disparities for LEP patients, implementation barriers specific to the ED may exist, requiring different and innovative interventions. This review will provide effective solutions to language barriers as seen through the literature that are applicable to the Emergency Department, as well as a wider range of healthcare facilities. The literature used in this review is mainly focused on projects based in EDs from the United States, but studies from other countries were also included since they show similar problems related to linguistic barriers and have implemented innovative solutions that could be applied to the United States as well.

For the purposes of this review, proficiency was categorized as Language Proficient (LP) and Limited Language Proficient (LLP). Most studies defined patients as LP if they answered the question "How well do you speak [official language of the country]?" with "very well". LLP patients were defined when the patients answered the question with less than "very well" (i.e. well, not well, not at all) (Diamond et al., 2010; Grover et al., 2012; Hartford et al., 2019; Lion et al., 2015; Nguyen

et al., 2020). This categorization varied regarding the context the patient referred to when asked about preferred language. Some studies asked about language spoken at home while others asked to select the language of their choice while in the ED or when completing a questionnaire. LLP patients were defined as those who picked a language other than that of the country.

METHODS

Since we are only including the results of the review regarding intervention studies, the methods will reflect the search strategy for these studies only, with the exception of Figure 1, which reflects the search outcomes for the general review.

A literature review was conducted on the current research regarding the topic of Interventions to address Language Barriers in the Emergency Department (ED). Recommendations from the Cochrane Collaboration (Higgins et al., 2022) regarding guidance on the organization of reviews were followed.

Intervention studies were only included if they:

1. Were published between the years 2010 and 2021.
2. Were written in English and peer-reviewed.
3. Focused on the Emergency Department or included a section dedicated to it.
4. Evaluated interpreter modalities, technological advances, policies, and curriculum modifications based on cost and effectiveness.
5. Had a population of interest, or part of it, which included patients with language barriers who visited the Emergency Department.
6. Quantified the effectiveness of the interventions by comparing the outcomes of LP and LLP patients' care in the Emergency Department (i.e. Length of Stay (LOS), satisfaction levels, trust in provider).

Search Strategy and Screening:

Searches were undertaken on PubMed and Google Scholar from October 2020 to January 2021. The search terms for the databases included: "solutions to 'language barriers' in the emergency department", "language barriers and solutions in healthcare". Truncation was used while searching through PubMed by adding "*" to the end of all Medical Subheadings terms in order to broaden the articles found. The study design of the intervention did not impact screening outcomes.

Two authors (JH, MM) independently screened articles using their abstracts and titles to classify them as included, unclear, or excluded. Then, from the selected studies, a full-text review was conducted. Disagreements were discussed between the two authors (JH, MM) and a final decision was made. Lastly, the final list of included studies was reviewed by three authors (KZ, AM, DF) who ensured agreement of the studies with the inclusion and exclusion criteria.
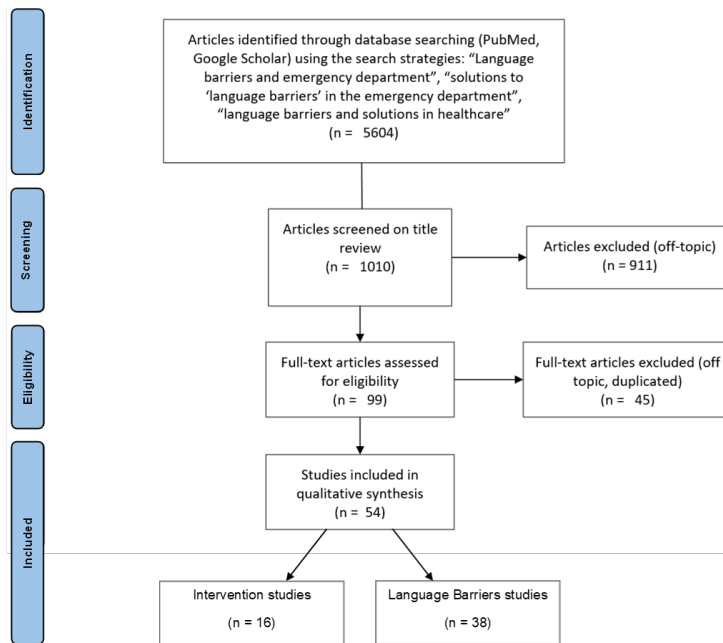
Figure #1 This figure visually describes the process mentioned above. Template obtained from The PRISMA Group (Moher et al., 2009).

Data Extraction

      All of the studies included were reviewed and data was obtained from them by two authors (JH, MM) and checked by two authors (AM, KZ). Data from each study included: study objectives, eligibility criteria (population, intervention, comparators, outcomes, and study designs), any reported protocol, and methods used for search, screening, data extraction, and synthesis. Using this data, each study was evaluated using the eligibility criteria for this literature review. Afterwards, the following information was extracted from the eligible group of studies: study design, countries involved, characteristics of included participants (demographics, language proficiency, healthcare outcomes), description of interventions and any co-interventions, categorization of types of interpreters (if any), technological advances, policies and curriculum modifications, and duration of intervention and follow-up.

Data Synthesis

      The studies were separated based on the type of intervention (curriculum modifications, policy changes, technological advances, comparison of interpreter modalities) and presented as a narrative synthesis in the discussion.

RESULTS

      The literature search yielded 5604 articles, out of which we screened 1010 based on title and abstract review. After excluding 911 articles, a full-text review of 99 studies was conducted using the eligibility criteria. After excluding 45 articles from this stage, the remaining 54 studies were classified as an intervention study or as a study focused on the effect of language barriers in the Emergency Department. This review showcases the results from the 16 interventions studies analyzed.

Study Design	Number of Studies
Randomized Controlled Trial	1
Prospective Cohort Studies	2
Retrospective Cohort studies	1
Cross-Sectional study	2
Qualitative studies	1
Surveys	3
Literature Review	6

Figure #2: 16 articles reported data on interventions to language barriers in the Emergency Department.

Author, year	Intervention	Study design, sample type, and size	Summary of Outcomes
Lundin et al., 2018	In-person professional interpreters, bilingual healthcare staff and family members	**Study Design:** Qualitative **Sample:** 14 males, 32 females, ages 21 to 65 (median 37), all 46 are healthcare workers	Laws requiring use of interpreter were not followed. Clinicians look for trust, confidence, empathy, and competency regarding the specific context of the ED in interpreters.
Jaeger et al., 2019	Healthcare policy	**Study Design:** Cross-Sectional **Sample:** 599 primary care physicians, 5 regional interpreter agencies, and 20 regional administrations	Higher rates of interpreter use in regions with universal coverage than with partial or no coverage.
Mazori et al., 2019	Training for MS3 on how to work effectively with interpreters	**Study Design:** Prospective Cohort Study **Sample:** 76 3rd-year medical students	The intervention yielded better skills regarding the turn-taking process, interruptions, language complexity, and pacing.

Green et al., 2018	Assessment of a tool to evaluate medical students' perceptions of the hidden curriculum regarding the care of LEP patients (LEP-HC).	**Study Design:** Survey **Sample:** 111 3rd and 4th-year medical students from Harvard Medical School and Case Western Reserve University	Three components accounted for >50% of the variance in the scores for the LEP-HC tool: Role Modeling, Demonstration of effective systems for interpreter services, and Consequences of structural barriers to care for LEP patients. This significantly increased the construct validity of the tool, which can be now used to effectively measure the LEP-HC of medical schools.
Janakiram et al., 2020	BabelDr, a phrase speech-enabled translator specialized for medical language	**Study Design:** Survey **Sample:** 22 patients who speak a language available on BabelDr and LLP. Median age is 41. Native language: Spanish (9), Arabic (4), Farsi (6), Tigrinya (2) and Albanian (1).	The majority of participants (>85%) showed a positive satisfaction level using BabelDr
Grover et al., 2012	Comparison between interpreter modalities: in-person translator, telephone translator, and bilingual provider	**Study Design:** Secondary Analysis Sample: 1,201 LEP patient encounters	Shorter throughput time for patients provided with in-person interpretation as opposed to the telephonic interpretation and bilingual provider modalities
Lion et al., 2015	Comparison of interpreter modality (telephone v. video)	**Study Design:** Randomized Control Trial **Sample:** 208 surveys to Spanish-speaking parents: telephone arm (91), video arm (117)	Video interpretation led to significantly higher rates of parents naming their child's diagnosis correctly, lower rates of reporting frequent lapses in professional interpretation, and twice the cost of telephone interpretation. No significant

			differences regarding the reported quality of interpretation
Flores et al., 2012	Comparison of interpreter modality (ad hoc v. professional v. no interpreter)	**Study Design:** Cross-Sectional **Sample:** 57 encounters: professional interpreters (20), ad hoc interpreters (20), no interpreters (10)	Use of ad hoc or no interpreters results in false-fluency and omission errors while professional interpreters' errors were additions, substitutions, and editorializations. Differences between amount, type, and outcome of errors were associated with hours of training for professional interpreters; no association between years of experience and number of errors.
Ginde et al., 2010	Policy change	**Study Design:** Survey **Sample:** 498 patients, 53% female; 65% non-Hispanic white, 20% Hispanic, 13% non-Hispanic black, and 2% other race/ethnicity. The primary language was English for 84%, Spanish 7%, and another language 9%.	No significant change in the use of professional interpreters was found immediately after the passage of the law. After 6 years, there was a 78% decrease in the use of hospital staff as interpreters and a 2.5-fold increase in the use of ad hoc interpreters such as family members.
Hartford et al., 2019	Effect of interpreter use	**Study Design:** Retrospective Cohort Study **Sample:** 51,826 patient encounters	EP patients had higher admission rates than LEP patients with no professional interpretation. All LEP patients were transferred to the ICU within 24 hours of admission to an inpatient unit more often than EP patients. No differences between rates of return to the ED for all groups.

Nguyen et al., 2019	Policy change	**Study design:** Policy Proposal **Studies included:** not reported	Two possible policies proposed: Develop and mandate statewide certification for medical interpreters or Increase reimbursement rates of community health workers (CHWs) from Medical Assistance (MA) /MinnesotaCare as an incentive to work with local LEP communities
Brandl et al., 2020	Professional interpreters	**Study design:** Literature Review **Studies included:** 11	Mixed results were found regarding costs and rates of readmission and visits to the ED when comparing LEP patients with and without interpretation services to LP patients.
Schouten et al., 2020	Comparison of interpreter modality (no interpreter v. ad hoc v. professional interpreters v. bedside technology)	**Study design:** Literature Review **Studies included:** not reported	Digital translation tools and multilingual eHealth applications have the advantage of being able to educate patients about their treatment through the use of pictograms. Interpreters have the advantage of addressing cultural barriers in the patient room when complemented with family interpreters.
Diamond et al., 2010	Curriculum changes	**Study design:** Literature Review **Studies included:** not reported	Spanish speaking students who completed the training showed lower rates of interpreter use than those without training. Five topics identified for inclusion in education regarding care for LEP patients.
Masland et al., 2010	Comparison of interpreter modality (telephonic v. video)	**Study design:** Literature Review **Studies included:** not reported	Telephonic interpretation showed shorter wait times; videoconferencing better simulates face-to-face interpretation, can provide more specific interpretation skills like

			American sign language, and is preferred by patients and clinicians. Both modalities led to lowered costs.
Chan et al., 2010	Comparison of interpreter modality (no interpreter v. ad hoc v. professional interpreters v. bedside technology)	**Study design:** Literature Review **Studies included:** not reported	Use of professional medical interpreters results in heightened communication, patient satisfaction, and lowered costs.

Figure #3: Characteristics of included studies

DISCUSSION

Different healthcare settings count with different resources and are therefore limited to selected solutions when addressing the presence of language barriers. This section of the review will present several studies that have created, implemented, or assessed different types of solutions to language barriers. Two common solutions, technology and interpreters, offer more than simply serving as a medium of communication between patient and provider. Technology such as digital translation tools and multilingual eHealth applications offer the advantage that they can also be used outside the consultation room. For instance, they are useful when educating patients about their treatment after the consultation. Additionally, for those patients that are illiterate in their native language, videos and images explaining the medical topic at hand can help them better understand their situation and allow them to participate more in the consultation. Similarly, interpreters help address cultural barriers in the patient room when complemented with family interpreters. In cases when the patient-clinician interaction is communicative and emotionally complex, the combination of these interpreter modalities has the potential to provide the patient with relational autonomy resulting in effective decision-making (Schouten et al., 2020).

Curriculum Modifications

Three articles addressed solutions related to how the formation of healthcare professionals can be improved by including preparation for working with LEP patients and using interpreters. Because these are changes to medical school curriculums, the studies are not focused on the ED specifically but can be easily translated to be useful in that scenario. One study analyzed the effectiveness of a short and low-cost training program on how to collaborate with in-person interpreters (Mazori et al., 2019). It found that third-year medical students exposed to the training better implemented the skills of waiting for the interpreter and patient to speak after asking one

question and then prompting the next one, avoiding unnecessary interruptions of the interpreter, adapting their language to be mostly non-complex, brief sentences, and pausing for interpretation; these proved to heighten the quality of care and communication (Mazori et al., 2019).

Another study dealt with the Hidden Curriculum (HC), which is defined as "the set of influences that function at the level of organizational structure and culture including, for example, implicit rules to survive the institution such as customs, rituals, and taken-for-granted aspects" (Green et al., 2018, p. 21). The HC regarding patient-focused care has been measured previously thanks to a validated instrument by another study (Haidet et al., 2005). With that study as the baseline, a new instrument was created to specifically assess the HC in medical schools regarding care for LEP patients. This tool is called the LEP-Hidden Curriculum (LEP-HC). The researchers found that three domains were most linked to the variance in the survey scores. This led them to adjust the domain structure to better reflect the perceptions and context of the students. As a result, the tool gained high construct validity. Thus, in the future, it can be used by administrators of medical schools to evaluate the education and delivery of care for LEP patients during clerkship rotations, implicit biases against this patient population, and interventions targeted to improve the delivery of care for them (Green et al., 2018). Future research is needed to test the tool in other educational institutions and to decide how the LEP-HC can be turned into a scale with only one composite value. However, it would be interesting to see how educational institutions use this tool to form more culturally competent healthcare professionals in the future. Lastly, a literature review investigated different methods of teaching about language barriers in healthcare. The researchers discussed that classes regarding language barriers in the healthcare field and the correct utilization of interpreters have been useful to the students since they have improved attitudes and are more knowledgeable and skilled (Diamond et al., 2010). This in turn improves the care for their LLP patients. However, it is important to note that after highly condensed, rapid language training of medium-level Spanish speaking students, these participants had lowered rates of interpreter services utilization than if they had not done the training even though their Spanish skills were limited. Therefore, medical Spanish courses should highlight the limitations that the medical students will still have after the course to avoid underutilization of interpreters when they are in fact needed. Lastly, the investigators emphasized five topics that should be taught when aiming to provide better care for LEP patients: (1) how health disparities can be worsened by language barriers, (2) best available solutions to language barriers, (3) being assisted by an interpreter, (4) how to notice the signs of a bad interpretation experience and how to fix it, and (5) understanding the extent to which the students can safely and appropriately use their Spanish skills. Some of the disparities that LLP patients face are the result of clinicians' own insufficient knowledge of their import, actions, and attitudes towards them (Diamond et al., 2010). Thus, training and education in the topic can therefore be one of the solutions to reducing the disparities that arise from language barriers in the healthcare setting.

Policy changes

Two of the studies dove into laws that have been created to minimize the effect of language barriers in their respective regions. In 2001, the state of Massachusetts passed a law mandating

access to and use of professional medical interpreters for patients with limited-English proficiency in all healthcare settings, including the ED. A survey was conducted in 2002 and 2008 with very similar methods to assess the effect of this policy. No significant change in the use of professional interpreters was found immediately after the passage of the law. In 2008, there was a 78% decrease in the use of hospital staff as interpreters and a 2.5-fold increase in the use of ad hoc interpreters such as family members (Ginde et al., 2010). A possible reason for these unexpected outcomes is that the state law had strict guidelines for not using hospital staff as interpreters. Since the legislation did not achieve its goals, further research needs to be done to assess why patients are receiving these types of interpreters instead of what is mandated by the law and how to ensure that clinicians follow the guidelines.

An interesting study analyzed different policies used in Switzerland to address insufficient professional interpreter use. They found higher rates of interpreters usage by physicians in regions with enacted universal coverage than in regions with partial or no coverage. Other regions focused on asylum-seeking refugees (who usually present language barriers) by pairing them with providers who spoke the same language as them. There was no data presented regarding the effectiveness of this policy but it was remarked that there is a significant economic barrier to the use of interpreters in some regions (Jaeger en et al., 2019). Further research should focus on assessing the effectiveness of all the attempted policies and other factors affecting physicians' use of interpreters.

Technological advances

The following studies created or tested technological devices that have the potential to aid or in some instances replace interpreters. A recent French study about user satisfaction with a speech-enabled translator specialized for medical language in emergency settings was conducted to rate the effectiveness of a new technology called BabelDr (Janakiram et al., 2020). The researchers recruited patients who speak a language available on BabelDr and that were not proficient in French. While using BabelDr, the tool could be used by both the doctor and the patient. They had the choice to select from sentences provided by the translator or use the translating software when they spoke their own phrases. Results from the survey indicate positive feedback by both parties. More specifically, two-thirds of patients expressed that BabelDr allowed them to fully provide their chief concern and most doctors (90%) mentioned that the system was effective at helping them understand the patients' concerns. The tool is currently being improved by expanding coverage and the languages supported as well as adding features such as pictograms to overcome patients' literacy barriers. There are some weaknesses relating to the study. The sample size was small (n=22) and there was not enough information regarding the mechanism and details of how BabelDr works. However, given the positive satisfaction levels using BabelDr, other researchers could work on similar technologies in order to create initiatives that can help improve the healthcare quality of LLP patients.

Another study conducted in the Seattle Children's Hospital (SCH) emergency department compared telephone vs video interpretation on parent communication in the hospital. They found that video interpretation was more effective than telephone interpretation, resulting in significantly higher rates of parents naming their child's diagnosis correctly and lower rates of reporting frequent

lapses in professional interpretation. Video interpretation cost was twice that of telephone interpretation. There were no differences between the groups regarding the reported quality of interpretation (Lion et al., 2015). Future research should focus on improving communications to achieve an optimal understanding of the diagnosis by the patients using either or both modalities and then assess respective cost-effectiveness.

Finally, a systematic review assessing the effect of technology on the availability of interpreter services found that telephonic interpretation is user-friendly and can be easily converted to other languages, indicating that wait times are much smaller than those for in-person interpretation. Videoconferencing is also accessible with telephonic interpretation, which better simulates face-to-face interpretation and can provide more specific interpretation skills like American sign language. Both modalities of interpretation can make the current system more efficient, leading to lowered costs. Videoconferencing is preferred by patients and physicians over telephonic interpretation. Effectiveness is ensured by training staff in using interpreters. In order to maintain confidentiality, recording is not allowed and high-quality encryption is necessary (Masland et al., 2010). A limitation of this article is that its publication lies on the earlier spectrum of the studies analyzed in this review (closer to 2010) and thus it does not contain information about the most recent technologies. Fortunately, more recent studies such as the previous ones also talk about the use of these technologies.

Comparison of Interpreter Modalities

Lastly, five studies compared no interpreter use, professional interpreters, and other interpreter services. One of them, a literature review of 11 articles published in 2020, discovered that some studies indicated that when professional interpreters were used, the patients experienced a decreased rate of visits to the ED and to general doctors, decreased test balances, and a decreased likelihood for readmission than when there were no interpreters. Nonetheless, the review also found other studies with the opposite conclusions, these mentioned that patients with interpreters faced heightened charges for treatment and had visited the doctor more often when compared to patients with language barriers without an interpreter (Brandl et al., 2020). Another study found shorter throughput time for patients provided with in-person interpretation as opposed to the telephonic interpretation and bilingual provider modalities. Aspects of the in-person modality that could result in higher efficiency are the interpreter's role in managing the turn-taking process between patient and clinician and in achieving aspects of care such as empathy and visual cues better than the telephonic counterpart. Providers might have spent more time with the patient if they were bilingual because the lack of language barrier could lead to more engagement with the patient resulting in more detailed interviewing and assessment (Grover et al., 2012).

A different team of researchers who were comparing ad hoc interpreters to no interpreters and professional interpreters found that ad hoc interpreters and no interpreters led to many more errors that can have clinical significance. Most of these were false-fluency and omission errors. In contrast, professional interpreter's errors often were additions, substitutions, and editorializations. Interestingly enough, for professional interpreters the years of experience were not associated with more or less errors, but the hours of training did correlate with amount, type, and consequence of

the mistakes. Thus, making a minimum of 100 hours of training a requisite for professional interpreters has the potential to dramatically decrease interpretation errors and their effects in quality of care and safety (Flores et al., 2012). Another study done at a pediatric emergency department discovered that EP patients were more likely to be admitted than LEP patients who had not been provided with professional interpretation; though when these patients did receive interpreter services, they were slightly more likely to be admitted than EP patients. Also, regardless of usage of interpreters, LEP patients were transferred to the ICU within 24 hours of admission to an inpatient unit more often than EP patients. Furthermore, EP and LEP patients with and without interpretation all had equal return rates to the ED (Hartford et al., 2019). The fact that LEP patients are more likely to be transferred to the ICU, but in the end have the same rate of return visits than EP patients, suggests that future research needs to be done on the impact of being transferred to the ICU on return visits and the underlying causes of this difference between LEP and EP patients.

A literature review about interpreter services in emergency medicine explained some of the advantages and disadvantages of possible interventions. Some of these are improved staffing, technological advances, and reinforcement of connections to the community. The study concludes that heightened communication, patient satisfaction, and lowered costs can be achieved with the use of professional medical interpreters. It also emphasizes that this mode of interpretation has demonstrated to be more successful than ad hoc interpretation and all other modes of intervention tested (Chan et al., 2010). Most of the studies mentioned above were done at one or two locations, thus their individual results are not generalizable to other settings. However, they all agree on professional interpretation as the most effective way of diminishing language barriers in the emergency department.

Lastly, a study from 2018 performed in Switzerland described how different healthcare staff from an ED used interpreters and their recommendations to improve the use of interpreters in healthcare. Despite the presence of laws requiring the use of interpreters, many health professionals failed to provide this service to migrant patients. Relevant testimonies from the staff remarked that interpreters should show trust, confidence, empathy, and competency regarding the specific context of the Emergency Department in order to have the most effective interactions with patients (Lundin et al., 2018). Thus, clear formal guidelines for clinical settings regarding how and when to use interpreters must be developed. They should focus on the extent of including the patient in the decision-making process considering their health status and the type of emergency presented. Similarly, the concerns of professionals—need for easy access to interpreters and education on how to effectively incorporate them into the workplace—should be addressed. This indicates that future improvements need to be performed on the interpreter's professional attitudes and/or organizational routines. Overall, these studies demonstrated that professional interpreters yield the best outcomes for LLP patients in terms of emergency room and doctor visits, test costs, and readmission.

Future steps

In order to improve the quality of care in LLP populations, healthcare providers or administrators can focus on taking advantage of the literature. More specifically, they can analyze

systematic reviews and articles that provide guidelines and/or best practices such as instructions for using interpreter services, preparation of medical students and residents for using interpreters, and information on what makes an interpreter qualified and certified to perform well (Clarke et al., 2019). The development of policies can also improve the quality of care of LEP patients. A proposal published in the University of Minnesota School of Public Health provides insight into how to make impactful changes in the quality of care for LEP patients in the ED through the creation of statewide standards for language interpreters. Two possible options were proposed. First, through the establishment of an obligatory statewide certification for interpreters, the state of Minnesota could standardize the minimum mastery of the interpreters regarding subjects such as language proficiency (including medical terminology), ethics, and standards of practice. The second option could be making financial incentives where community health workers are rewarded for working with LEP populations since they serve as a bridge to healthcare for these communities which can prevent several negative outcomes that present in the ED. The preferred policy is to set statewide standards as there are already bills in the Minnesota Senate and House in place. The policy can be modeled after court interpreters, and there are self-sufficient funds from the annual roster fee for healthcare interpreters (Nguyen et al., 2019). These policies can also be implemented in other states and countries in hopes of bridging the gap between LEP and EP patients.

CONCLUSIONS

The literature from the last 10 years regarding interventions to address language barriers in the Emergency Department mostly portrays creative solutions as well as an evaluation of the effectiveness of traditional methods. Some studies developed interventions with less significant results but provided valuable insight regarding the direction to be taken in this field. It is clear that in-person interpretation is the most effective method of addressing language barriers, but it comes with its own set of drawbacks such as higher costs. Policies and the use of technology can be effective initiatives to address the same problem, but they must be developed with more detail to ensure that proper guidelines and the intended effects are achieved. Future research should focus on the mechanisms of making these interventions as effective as possible and on evaluating proposals for policy changes.

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Keer Zhang is expected to graduate with a BS in biomedical engineering and a minor in health disparities in society from the University of Florida in fall 2022. As the Research Director at the Equal Access Clinic Network Research program, she hopes to dedicate research studies for the underserved and improve healthcare delivery for all. She aspires to be a physician who integrates medicine and engineering to address health disparities.

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