

# AI Solutions for Lowering Language Barriers in Medical Settings

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## Abstract

Language barriers in healthcare pose significant challenges, hindering effective communication between providers and patients, leading to misunderstandings, misdiagnoses, and suboptimal treatment. Multilingual AI offers a transformative solution to bridge these gaps and enhance healthcare equity. This paper explores the potential of AI-driven language tools to improve healthcare access and quality in diverse populations. We discuss the challenges of healthcare communication due to language barriers, the advancements in translation accuracy, and the various applications of AI language tools such as remote interpretation, multilingual chatbots, and live meeting translations. The paper also presents examples of existing health AI language platforms and examines the efficiency and cost-effectiveness of these tools compared to traditional human interactions. Furthermore, we address the ethical considerations in implementing multilingual AI and provide a roadmap for healthcare organizations to successfully integrate these technologies. As multilingual AI continues to evolve, it holds immense potential to promote inclusivity, fairness, and improved patient outcomes, ultimately contributing to greater global health equity.

## Introduction

Language barriers significantly hinder effective healthcare delivery, presenting challenges in communication between healthcare providers and patients from diverse linguistic backgrounds. Multi-language AI offers a transformative solution to this issue, breaking down language barriers and enhancing healthcare equity. By providing accurate and timely translations, these advanced systems enable healthcare providers to understand and meet the needs of patients who speak different languages, ensuring that everyone receives the care they deserve regardless of their language.

## Challenges in Healthcare Communication Due to Language Barriers

Effective communication in healthcare is crucial for patient safety and quality care, and the shortage of healthcare interpreters exacerbates communication challenges. Although English is the dominant language in scientific and medical publications, it is not widely understood globally, creating barriers to healthcare access for many, particularly in underserved communities.

Language barriers can lead to misunderstandings, misdiagnoses, and inadequate treatment, exacerbating healthcare disparities among non-native speakers and immigrant communities. Healthcare communication hampered by language barriers is faced with several challenges:

- **Accurate Symptom Description:** Patients may struggle to describe their symptoms accurately, thereby making it a challenge for healthcare providers to reach a diagnosis.
- **Understanding Medical Jargon:** Non-native speakers might find it hard to understand medical terminology, resulting in poor adherence to treatment plans and worsened health outcomes.

- **Trust Issues:** Language barriers may contribute to a lack of trust between patients and healthcare providers, which can deter patients from seeking care.
- **Emergency Situations:** Delays in communication in emergency settings can be particularly dangerous, highlighting the critical need to overcome language obstacles.

### Advancements in Translation Accuracy

Recent advancements in Multi-language AI have significantly boosted translation accuracy in healthcare. The integration of neural networks and deep learning has revolutionized the field, allowing modern algorithms to grasp nuances and complex phrases with greater precision. Ongoing improvements in real-time processing enable instant translations without noticeable lag, ensuring that healthcare providers can rely on accurate multilingual support during critical interactions. Concurrently, the costs associated with these capabilities are being reduced through open-source models, and efficient optimization of AI platforms.

Open-source AI models "No Language Left Behind (NLLB)" were introduced by Meta, and they are capable of providing accurate translations between 200 languages—including low-resource languages like Asturian, Haitian Kreyol, Luganda, Urdu, and more

By Applying AI Techniques to Facebook and Instagram for translation of low-resource languages, Meta's platforms help people communicate with anyone regardless of their language preferences. So far, the technique is not reliable yet, but it is a beginning. One needs to be careful and revise the translated document prior to submitting it as the official one. Unfortunately, the translation is not always accurate, nor it represents always the ideas that you wanted to expose



Multilingual AI can improve healthcare access by providing translations in various languages.

To accurately translate medical content, AI translation tools must possess and master not just language proficiency and translation skills, but also a solid understanding of medicine in general and medical terminology.

Photo by Cedric Faunteroy: <https://www.pexels.com>

## Possible Applications of AI Language Tools

### Remote Video and Over-the-Phone Interpretation:

The adoption of remote interpretation services is growing, providing access to interpreters in situations where in-person interpreters are not available. Platforms like Stratus Video offer 24/7 remote interpreter access in hundreds of languages, facilitating visual connections between patients, doctors, and interpreters.

### Multilingual Chatbots:

Chatbots and virtual assistants in healthcare are incorporating support for multiple languages, enabling users to interact in their native language for guidance on symptoms, medications, and scheduling.

### Conduct Live Meetings In Multiple Languages:

Microsoft just introduced Livecaption by Copilot+, a software which allows real-time translation for any video or video conference call. Organizers can choose from over 50 languages for live captions.



Image Source: Microsoft

This feature allows meeting content to be instantly translated into the participants' preferred language. For instance, an organization having a multi-language constituency such as AMHE, can easily break the language barrier with these tools. Large meetings conducted in one language such as English, can be simultaneously translated in French and be captured by affiliates in Haiti, Canada and anywhere else in the world.

Another example is the possibility of improving what is being presently done at La Paix Hospital, Port au Prince by Dr Pierre-Marie Wooley MD, Assistant-Chief of Orthopedics there. For many years, he had organized weekly Orthopedics Grand Rounds, where Professors mainly from the US, but also from Haiti and European countries conduct learning sessions via Zoom, to discuss latest technologies in the Orthopedics field. In a recent conversation, Dr Wooley can foresee how his series of Grand Rounds, having reached its one hundredth session milestone, can be expanded thanks to Livecaption, to include not only the targeted audience of orthopedics trainees at area hospitals in Haiti, but also any interested orthopedic specialist, who

having subscribed to Livecaption translation module software, can participate in, while seating in the comfort of his/her home.

The software also supports multilingual responses during meetings, improving communication and understanding among team members who speak different languages.

## Examples of Health AI Language Platforms:

- Ada Health: An AI-driven platform that currently provides medical information and diagnostics in English, German, French, Spanish, Portuguese, Romanian, and Swahili. <sup>1</sup>
- Microsoft's Azure AI Health Bot Service is a cloud platform designed to help create AI-powered virtual health assistants that understand clinical terminology. These virtual assistants or AI bots can handle administrative workloads and engage with patients to determine the type of care needed. with an adaptive questionnaire and recommends the type of care needed.

## Efficiency and Cost-Effectiveness of AI Language Tools in Patient

AI language tools offer substantial benefits that cannot be overlooked. Their ability to provide consistent, efficient, and cost-effective communication makes them a valuable addition to healthcare systems. As technology continues to advance, the role of AI in patient communication is likely to expand, complementing human interactions and enhancing overall patient care.

The integration of AI language tools in healthcare communication presents a compelling case for enhanced efficiency and cost-effectiveness over traditional human interactions. While the human touch remains an essential component of healthcare, several factors illustrate why AI can be a superior option in certain contexts.

### Consistency and Calibrated Empathy

One of the primary advantages of AI language tools is their ability to provide consistent and measurable levels of empathy. Unlike humans, whose empathetic responses can fluctuate based on personal factors such as mood, stress, or fatigue, AI can be programmed to deliver a uniform level of empathy in every interaction. This consistency ensures that all patients receive the same quality of care and communication, which can be crucial in maintaining patient satisfaction and trust, plus the added advantage of having them less likely to switch providers because of dissatisfaction in the practice.

### Efficiency in Handling Repetitive Tasks

AI tools excel at handling repetitive tasks that do not necessarily require human intervention. Scheduling appointments, providing medication reminders, and offering initial consultations based on symptoms are areas where AI can operate more efficiently than humans. This efficiency not only saves time for healthcare providers but also reduces the workload on human staff, allowing them to focus on more complex and nuanced patient care.

### Cost-Effectiveness

The deployment of AI tools can lead to significant cost savings for healthcare institutions, and a substantial decrease in healthcare inflation . The initial investment in AI technology is offset by

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the reduction in labor costs over time. AI systems can operate 24/7 without the need for breaks, benefits, or overtime pay, leading to more economical operations. Additionally, the ability of AI to quickly process and analyze large volumes of data can enhance decision-making and improve outcomes, further contributing to cost savings.

### Reduction in Human Error

Human interactions are prone to errors, which can have serious implications in healthcare settings. AI language tools, when properly programmed and monitored, can reduce the likelihood of such errors. By ensuring that information is conveyed accurately and consistently, AI can help mitigate risks associated with miscommunication or oversight.

### Scalability and Accessibility

AI tools offer scalability that human resources cannot match. They can be deployed across multiple locations and can handle an increasing number of interactions without a proportional increase in costs. This scalability is particularly beneficial in underserved or remote areas where access to healthcare professionals may be limited. AI can bridge this gap by providing reliable and timely communication with patients, ensuring that they receive the necessary guidance and support.

### Empirical Support for AI Translation in Healthcare

Recent research has highlighted the potential of AI-driven machine translation in improving patient outcomes in multilingual healthcare settings in poor communities. Banik (2023) and Ji (2023) both emphasize the importance of accuracy and accessibility in medical translation, with Banik's regression-based approach and Ji's principles for designing assistive health communication tools. Khoong (2022) and Gangavarapu (2024) further underscore the need for research in this area, particularly in evaluating the use of machine translation in clinical care and in developing context-aware multilingual medical language models. These studies collectively point to the potential of AI-driven machine translation in addressing language barriers and improving healthcare access and quality in underserved communities.

For instance, AI-driven chatbots have been used successfully to manage patient inquiries and provide information, resulting in high levels of patient satisfaction (Bickmore et al., 2018). Moreover, AI applications in telemedicine have demonstrated their ability to maintain effective patient engagement and improve health outcomes (Wang et al., 2020).

### Ethical Considerations in Implementing multi-language AI

AI is not a solution without problems. We need to manage some of the ethical concerns when implementing multi-language AI in healthcare, such as:

- **Transparency:** Patients and providers need clear information about AI's role in medical decisions to foster trust and promote informed consent.
- **Algorithmic Biases:** Developers must ensure that AI systems do not perpetuate existing Health inequalities or exclude minority dialects through regular audits and diverse data inputs.
- **Patient Confidentiality:** AI systems must comply with strict data privacy regulations to protect sensitive health information, using secure encryption practices and robust cybersecurity measures.
- **Dependency on AI:** Healthcare professionals should view AI tools as supplements, not substitutes, for human judgment. Continuous training and oversight are vital for ethical and effective application.

# Implementing Multilingual AI: A Roadmap for Healthcare Organizations

Realizing the potential of multilingual AI in healthcare requires more than just acquiring the right technology. It demands a comprehensive strategy that addresses the technical, organizational, and human factors involved in deploying and managing AI systems (Gao et al., 2022; Mehandru et al., 2022). The following roadmap provides a step-by-step guide for healthcare organizations looking to implement multilingual AI solutions. By following this roadmap, organizations can ensure a smooth and successful transition to AI-enabled language access and equity (Ji et al., 2023; Khoong et al., 2022).

## Multilingual AI Roadmap

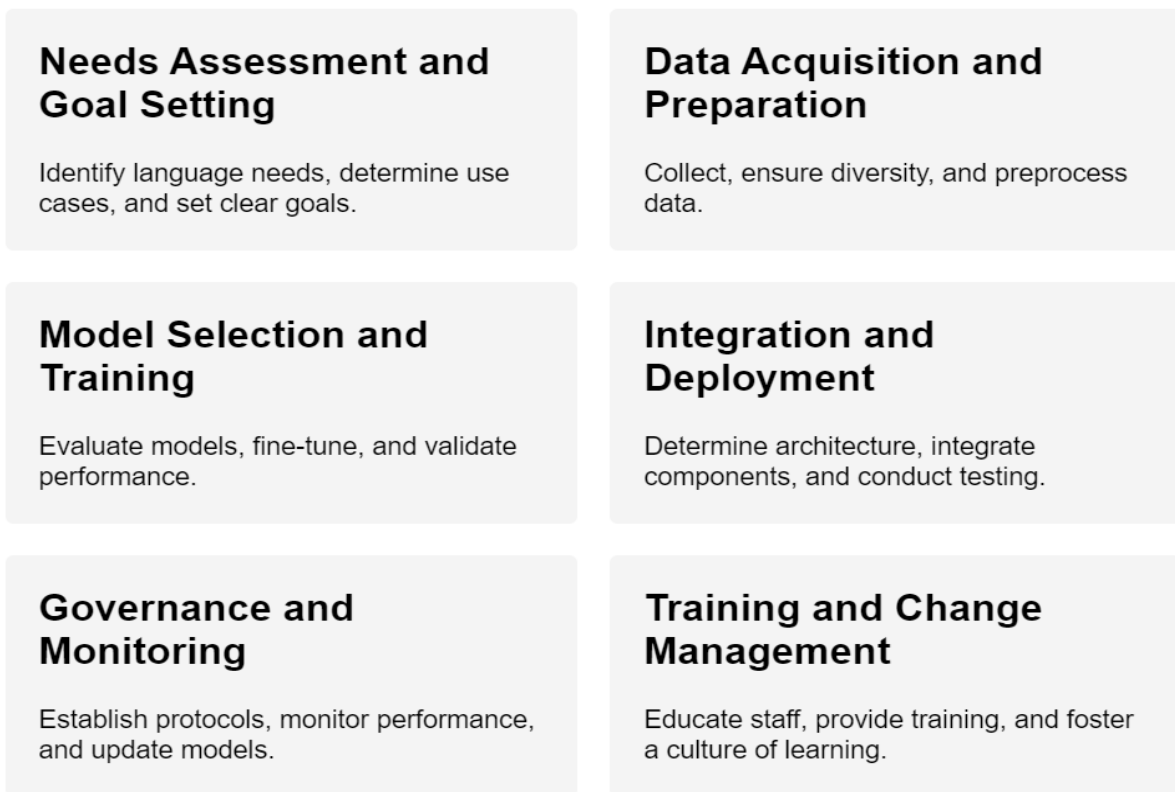


Figure 1 Multilingual AI Roadmap

### 1. Needs Assessment and Goal Setting

- Identify language needs of patient population
- Determine specific use cases for multilingual AI (e.g. telemedicine, patient intake, patient education) (Gangavarapu, 2024)
- Set clear goals and success metrics



## **2. Data Acquisition and Preparation**

- Collect high-quality texts in relevant languages and domains (Banik et al., 2023)
- Ensure data is diverse, representative, and ethically sourced (Xie et al., 2021)
- Preprocess and clean data, handling formatting, noise, and inconsistencies

## **3. Model Selection and Training**

- Evaluate state-of-the-art multilingual models (e.g., transformers, NLLB) (Meta, 2022)
- Fine-tune pretrained models on in-domain medical data (Han et al., 2023)
- Experiment with transfer learning, domain adaptation, and low-resource techniques
- Validate model performance, fairness, and robustness (Zeng-Treitler et al., 2010)

## **4. Integration and Deployment**

- Determine deployment architecture (cloud vs. on-prem, API vs. embedded)
- Integrate AI components with existing systems (EHR, telehealth platforms, etc.) (Microsoft, 2023)
- Implement user-friendly interfaces for providers and patients (Ada Health, 2022)
- Conduct thorough testing to ensure reliability and performance

## **5. Governance and Monitoring**

- Establish clear protocols for AI usage, oversight, and accountability
- Continuously monitor model performance and collect user feedback
- Implement strategies to detect and mitigate bias and fairness issues (Mehandru et al., 2022)
- Regularly update models with new data to maintain relevance

## **6. Training and Change Management**

- Educate staff on AI capabilities, limitations, and appropriate use cases (Bickmore et al., 2018)
- Provide hands-on training for interacting with AI interfaces
- Foster a culture of openness, collaboration, and continuous learning
- Monitor for unintended consequences and adjust processes as needed (Wang et al., 2020)

Implementing multilingual AI in healthcare requires a strategic and holistic approach (Gao et al., 2022). The roadmap presented above provides a general framework that organizations can follow, but it should be adapted to fit each organization's unique needs, resources, and contexts. Factors such as the size and diversity of the patient population, the complexity of the healthcare system, and the available budget and expertise will all shape how the roadmap is implemented in practice (Khoong et al., 2022).

Healthcare organizations should approach multilingual AI as an iterative process, starting with small pilot projects and gradually scaling up as they build confidence and capacity. Throughout the process, it is crucial to engage all relevant stakeholders - including providers, patients, administrators, and IT staff - to ensure buy-in, address concerns, and incorporate diverse perspectives (Ji et al., 2023). By following a structured approach and maintaining a commitment to continuous improvement, healthcare organizations can successfully harness the power of multilingual AI to enhance access, quality, and equity in care delivery (Gangavarapu, 2024; Xie et al., 2021).

# Future of Multi-language AI in Healthcare Equity

## Exploring Potential

Multi-language AI holds immense potential for making healthcare more accessible and equitable. By providing accurate translations, it ensures that patients can effectively communicate their symptoms and concerns, leading to more accurate diagnoses and effective treatments. As AI technology advances, real-time translation will become more precise and context-aware, likely being integrated into telemedicine platforms, hospitals, and clinics worldwide.

## Challenges and Opportunities

While integrating Multi-language AI into healthcare sectors presents challenges such as high initial costs and the need for ongoing tech support, the opportunities are immense. Multi-language AI can enhance patient satisfaction, bridge gaps in doctor-patient communication, and offer scalable solutions to language barriers. As technology evolves, these systems will become more cost-effective and widely available, making equitable healthcare more attainable.

## Conclusion

Multi-language AI is a transformative technology that addresses the critical issue of language barriers in healthcare, promoting inclusivity, fairness, and improved patient outcomes. The case studies highlighted demonstrate the significant benefits of recent AI advancements in improving healthcare delivery to underserved communities, showcasing the potential for AI to enhance accessibility, accuracy, and patient satisfaction. As advancements continue, the integration of Multi-language AI into healthcare systems worldwide will play a pivotal role in achieving global health equity.



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