



Development and usability testing of MediLanguage: A digital tool for use by Turkish-Dutch patients in language-discordant consultations

Brittany Ming Chu Chan, Julia C. M. van Weert, Hülya Ates, Inez Beukeleers, Geert Brône, Antoon Cox, Simone Goosen, Christopher Jenks, Peter Pype, Heidi Salaets, Jeanine Suurmond & Barbara C. Schouten

To cite this article: Brittany Ming Chu Chan, Julia C. M. van Weert, Hülya Ates, Inez Beukeleers, Geert Brône, Antoon Cox, Simone Goosen, Christopher Jenks, Peter Pype, Heidi Salaets, Jeanine Suurmond & Barbara C. Schouten (2026) Development and usability testing of MediLanguage: A digital tool for use by Turkish-Dutch patients in language-discordant consultations, *Health Literacy and Communication Open*, 4:1, 2694206, DOI: [10.1080/28355245.2026.2694206](https://doi.org/10.1080/28355245.2026.2694206)

To link to this article: <https://doi.org/10.1080/28355245.2026.2694206>



© 2026 The Author(s). Published with license by Taylor & Francis Group, LLC



[View supplementary material](#)



Published online: 07 Jul 2026.



[Submit your article to this journal](#)



[View related articles](#)



[View Crossmark data](#)

RESEARCH ARTICLE



OPEN ACCESS



Development and usability testing of MediLanguage: A digital tool for use by Turkish-Dutch patients in language-discordant consultations

Brittany Ming Chu Chan^a , Julia C. M. van Weert^a, Hülya Ates^a, Inez Beukeleers^b, Geert Brône^b, Antoon Cox^b, Simone Goosen^c, Christopher Jenks^d, Peter Pype^e, Heidi Salaets^b, Jeanine Suurmond^f and Barbara C. Schouten^a

^aDepartment of Communication Science, Amsterdam School of Communication Research (ASCoR), University of Amsterdam, Amsterdam, The Netherlands; ^bDepartment of Linguistics, Faculty of Arts, KU Leuven, Leuven, Belgium; ^cJohannes Wier Foundation, Amsterdam, The Netherlands; ^dDepartment of Languages, Literature and Communication, Faculty of Humanities, Utrecht University, Utrecht, The Netherlands; ^eDepartment of Public Health and Primary Care, Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium; ^fDepartment of Primary and Community Care, Radboud University Medical Centre, Nijmegen, The Netherlands

ABSTRACT

Background: Currently, no digital tools support migrant patients with limited language proficiency (LLP) in the host country's language(s) or healthcare providers (HCPs) in selecting effective communication strategies, such as professional interpreters or digital translation tools, for consultations. Such an aid is crucial for improving communication and health outcomes for LLP migrant patients.

Aims: Set in the Netherlands, this study aims to systematically develop and test the usability of MediLanguage, a digital tool with features including the Language Support Starter—a decision aid designed for LLP Turkish-Dutch patients and Dutch-speaking HCPs. It helps them choose appropriate communication strategies to overcome language barriers and make informed, collaborative decisions.

Methods: Guided by the *Spiral Technology Action Research Model*, the development began with a needs assessment through semi-structured interviews, based on the *Extended Technology Acceptance Model*. We conducted 78 interviews with ethnically diverse LLP migrant patients ($n=25$), informal caregivers ($n=26$), and HCPs ($n=27$) in languages including English, Dutch, Turkish, Syrian Arabic, Mandarin, Moroccan Arabic, and Tigrinya. Using these insights, we created a functional prototype of MediLanguage targeted at LLP Turkish-Dutch patients. The prototype was refined through three evaluation rounds, including expert reviews ($n=2$) and usability testing with HCPs, patients, and caregivers ($n=15$). HCP testing was conducted in Dutch, while patient and caregiver testing was conducted in Turkish.

Results: MediLanguage received positive feedback from users, especially valuing the information in the Language Support Starter about communication strategy pros and cons. Challenges included UI design issues like button sizes and excessive textual content. After three rounds, MediLanguage was refined into a user-friendly tool featuring enhancements such as a digital dictionary and embedded translation functions for use during consultations.

Discussion and Conclusion: The final MediLanguage version is patient-centred, accessible in real time, with an intuitive interface that prepares LLP Turkish-Dutch patients for shared decision-making about language barrier strategies. Although initially developed for Turkish-Dutch patients, it holds potential for adaptation to other migrant languages.

PLAIN LANGUAGE SUMMARY

MediLanguage is a digital tool developed in the Netherlands to help migrant patients with limited Dutch skills and healthcare providers talk about communication during consultations. Together with migrant patients, patients' family members, developers, and experts from academia and practice, we built a decision tool within MediLanguage called the Language Support Starter. The Language Support Starter helps patients learn about different ways to overcome language barriers. It is a digital decision aid that

ARTICLE HISTORY

Received 4 November 2025

Revised 8 June 2026

Accepted 17 June 2026

KEYWORDS

Usability testing; shared decision-making; decision aid; eHealth interventions; patient-provider interactions; intercultural communication; migrant patients; language barriers

CONTACT Brittany Ming Chu Chan  m.c.chan@uva.nl  Department of Communication Science, University of Amsterdam, Nieuwe Achtergracht 166, 1018 WV Amsterdam, The Netherlands.

 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/28355245.2026.2694206>.

© 2026 The Author(s). Published with license by Taylor & Francis Group, LLC

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

equips patients with information about different translation methods. Patients and providers can use it together during consultations to choose the best translation method to overcome language barriers.

In the Netherlands, approximately one-tenth of residents do not speak Dutch at home (Statistics Netherlands, 2022). Language differences – especially, migrant patients’ limited Dutch language proficiency (LLP) and healthcare providers’ limited proficiency in patients’ languages – are common in Dutch healthcare (Suurmond & Schouten, 2025). When language barriers are not properly addressed, LLP migrant patients experience unmet cognitive needs, including misunderstandings of diagnoses and treatment plans and difficulty navigating healthcare systems (Al Shamsi et al., 2020; Ali & Watson, 2018; Olsavszky et al., 2025). They also experience unmet affective needs, including distress stemming from communication difficulties and fear when seeking sensitive care (Barrio-Ruiz et al., 2024; Evenden et al., 2022; Pot et al., 2020). When both needs are unmet, medical communication becomes ineffective, negatively impacting health outcomes (De Haes & Bensing, 2009; Pandey et al., 2021). This can lead to greater health disparities such as misdiagnoses, poorer chronic condition management, higher mortality, and lower satisfaction among LLP migrants versus native speakers (Al Shamsi et al., 2020; Cano-Ibáñez et al., 2021; Chauhan et al., 2020; Czapka et al., 2019; Ekladius et al., 2023; Gil-Salmerón et al., 2021; Karliner et al., 2007; Zavala et al., 2021).

Despite evidence indicating that LLP migrant patients face greater healthcare disparities due to language barriers, HCPs underutilise professional interpreting services and digital translation tools (i.e., communication strategies) to improve communication. While both types of strategies have advantages, they also pose challenges. Working with interpreters, considered the gold standard for complex communication, is often limited by logistical and perceptual barriers, such as scheduling difficulties, time constraints and a lack of provider training (Brown et al., 2023; Claeys et al., 2023; Soh et al., 2022). In the Netherlands, financial barriers introduced from 2012 to 2020 also hinder interpreter use (Boe, 2015; Teunissen et al., 2017), though some budgets have eased in certain healthcare settings (e.g., mental healthcare) (Johannes Wier Stichting, 2025). Conversely, digital translation tools are accessible but face scepticism about accuracy for non-European languages and complex medical terminology and privacy concerns (Olsavszky et al., 2025; Van Lent et al., 2025). When a language barrier exists, HCPs often resort to using instrumental communication strategies, e.g., speaking slowly and gesturing; relying on patients’ families to act as informal interpreters (Zendedel et al., 2018); or engaging in ‘over-investigation’, requesting unnecessary medical tests (Chan et al., 2024; White et al., 2018). These strategies can further worsen communication, incur additional costs from unnecessary tests, or, in more severe cases, result in harm to the patient (i.e., iatrogenic illness) (Al Shamsi et al., 2020; Davidsen et al., 2022; Jacobs & Diamond, 2017). Therefore, minimising language barriers with effective communication strategies is essential.

Apart from previously noted barriers, two additional factors lead HCPs to rely on less appropriate strategies to mitigate language barriers. First, HCPs often decide unilaterally whether professional interpreters are needed (White et al., 2018). Second, LLP migrant patients are often unaware they have a legal right to information under Dutch law, which indirectly allows them to request professional interpreting services (Gedragscode Voor Artsen, 2022). This, along with patients’ unawareness, can lead them to feel a perceived obligation to overcome language barriers themselves (Peled, 2018; Würth, 2019), risking care disparities and undermining person-centred care for LLP migrant patients. To address these issues, a potential solution is to adopt the concept of decision aids from healthcare settings and develop one to assist LLP migrant patients and HCPs in choosing effective communication strategies to overcome language barriers.

Aims

Typically, decision aids support medical shared decision-making between patients and HCPs by presenting treatment options, benefits, and risks, and by helping clarify values (Stacey et al., 2017). To

date, no decision aid has been developed to assist HCPs and LLP migrant patients in identifying communication strategies to overcome language barriers—despite research showing that both groups often lack knowledge of such strategies, leading to their underuse (Chan et al., 2024; Paternotte et al., 2017). Although guidelines recommend professional interpreters during healthcare encounters given their positive impact on communication quality (Flores, 2005; Karliner et al., 2007; Kwan et al., 2023; Kwaliteitsnorm Tolkgebruik Bij Anderstaligen in de Zorg, n.d.), in practice they are frequently replaced by informal or ad-hoc interpreters (Chang et al., 2021; Hadziabdic et al., 2014; Zendedel et al., 2018). Patients should therefore have an active choice in this, be informed of risks such as child language brokering, and be advised about alternatives like digital translation tools (Al Shamsi et al., 2020).

To address this gap, we developed the Language Support Starter, a decision aid within MediLanguage—a digital tool that includes features such as a digital dictionary and translator. The Language Support Starter helps LLP migrant patients and HCPs collaboratively identify communication strategies before consultations, free of charge. Designed for accessible reading levels and developed with input from socially disadvantaged patients (Muscat et al., 2021), it also has the potential to reduce long-term healthcare costs associated with poor management of language barriers (Lindholm et al., 2012; World Health Organisation, 2025). In line with the WHO's (2019) call for eHealth interventions to secure migrants' healthcare rights, the current study aims to develop and test this tool to support HCPs in language-discordant consultations (Wammes et al., 2014) and empower LLP migrant patients to make informed choices about communication strategies, ultimately improving access to person-centred care (Ahmed et al., 2022; Ekman et al., 2021).

Methods

Study Context and Design

This study is part of a larger project, *Right2Health*¹, funded by the Dutch Research Council (NWO). The FMG Research Management Services, Amsterdam School of Communication Research (ASCoR) (FMG-7592) approved this study. All participants provided written informed consent before participating in our studies.

Using the *Spiral Technology Action Research Model* (STAR Model) (Skinner et al., 2006) as a guiding framework, we used qualitative and quantitative research designs to develop, test, and evaluate MediLanguage. The STAR Model emphasises involving targeted users (e.g., LLP migrant patients and HCPs) and other relevant stakeholders (e.g., caregivers, researchers) in five cycles: *Listen*, *Plan*, *Do*, *Study*, and *Act*, to ensure the intervention meets users' needs and incorporates their feedback to promote adoption (Brunner, 2018). The full *Listen* cycle results are published elsewhere and summarised below (Chan et al., 2025). This paper focuses on the *Plan* and *Do* cycles, where we develop and conduct usability testing for the digital decision aid. Steps taken in these phases are outlined in the following sections.

STAR Cycle Listen: Needs Assessment

To identify features that could ensure the perceived usefulness of MediLanguage content and the perceived ease of use of its format, we used the *Extended Technology Acceptance Model* (Chung et al., 2010) as a guiding framework to develop our interview topic guide. As we had decided before the interviews to develop a decision aid for use in LDCs, we ensured that all participants understood what decision aids were by providing examples for reference. Interviews were conducted by the first author (BC) and eight trained interviewers. Altogether, we conducted 78 interviews with a heterogeneous sample of HCPs, LLP migrant patients, and informal caregivers in English ($n=31$), Dutch ($n=16$), Turkish ($n=9$), Syrian Arabic ($n=7$), Mandarin ($n=6$), Moroccan Arabic ($n=5$), and Tigrinya ($n=4$). Among the three groups, there were no differences in their needs and preferences (Chan et al., 2025). Table 1 provides a brief summary of the needs assessment for MediLanguage. For more information about the needs assessment, please see Chan et al., 2025.

Table 1. Summary of results from needs assessment related to MediLanguage's development (N=78).

Category	Key need	Description
Perceived Usefulness of Content	Support Before Consultation	Helps patients prepare for visits by providing a communication strategy recommendation to use for overcoming language barriers.
	Assist During Consultation	Helps patients to show HCPs the recommended communication strategy.
Perceived Ease of Use of Format	Multilingual Options	Decision aid available in multiple languages to improve accessibility for migrant populations.
	Clear Multimedia Information	Uses visuals, audio, and videos to accommodate varying literacy levels.
	User-Friendly & Accessible Design	Uses simple wordings. Simple, intuitive digital design with clear navigation and readable text.

Table 2. Summary of features developed on MediLanguage.

Feature/module	Description	Purpose/use
Language Support Starter	A decision aid component that helps patients assess their language and communication needs in language-discordant healthcare settings.	Encourages users to evaluate communication challenges and determine language support needs before medical consultations.
Translator	A translation tool designed to support multilingual communication between patients and healthcare professionals.	Provides real-time, digital translations during medical consultations when language barriers are present.
Dictionary	A searchable glossary of medical terms and phrases in Turkish, Dutch, and English based on thuisarts.nl.	Helps users quickly search medical terminology commonly used during healthcare encounters.
Knowledge Hub	Informational resources explaining the structure of the Dutch healthcare system and patient rights.	Prepares patients for healthcare visits by increasing system literacy and expectations.
Personal Notes (formerly Digital Notebook)	A note-taking feature with an embedded translation function, i.e., translating between Turkish and Dutch, for recording symptoms, questions, and health concerns.	Enables users to organise relevant information before, during, and after consultations.

STAR Cycle Plan: Development of MediLanguage

Study Design

The results from the *Listen* phase laid the foundation for developing MediLanguage through two key stages: first, creating a prototype with Figma, and second, building a functional web-based digital tool accessible online in real-time (<https://medilanguage.com/en>). Although the initial plan was to develop a digital decision aid solely, the needs assessment revealed that HCPs, migrant patients, and informal caregivers required additional features, such as a digital translator, a dictionary, and a digital notebook. Consequently, MediLanguage offers more than its decision aid component (the Language Support Starter). Table 2 provides an overview of all developed features. The entire development process occurred from February to November 2024.

MediLanguage Development Process

Prototype Development. Using Figma, we designed all the features listed in Table 2. During this phase, MediLanguage was conceptualised to be accessible to both patients and HCPs (see Figure 1). It could receive input separately from patients and HCPs via a login feature. The decision aid component, the Language Support Starter, was called the 'Reflection Tree' and was designed as a short questionnaire based on findings from the Listen phase showing users preferred brief, multiple-question formats. It was designed for patients and HCPs to complete together before consultations to support shared decision-making about language barriers. The questionnaire explored patients' Dutch language proficiency, the complexity and sensitivity of their medical conditions, and encouraged reflection on previous consultations. After completing it, patients and HCPs could identify the best communication strategy to use for overcoming language barriers, e.g., a professional phone interpreter or on-site interpreter, for upcoming consultations.

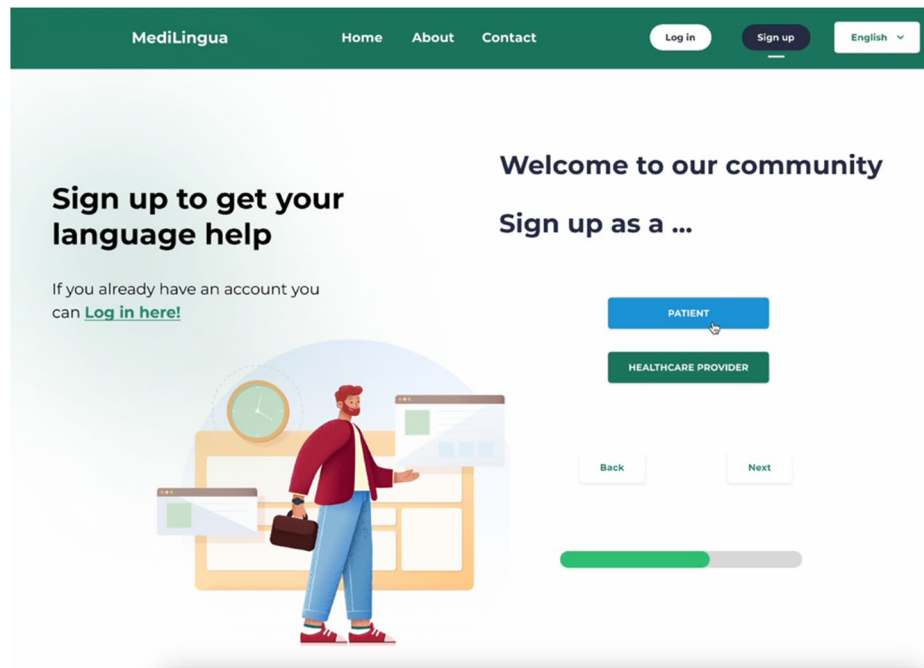


Figure 1. A screenshot of an early version of the MediLanguage prototype.

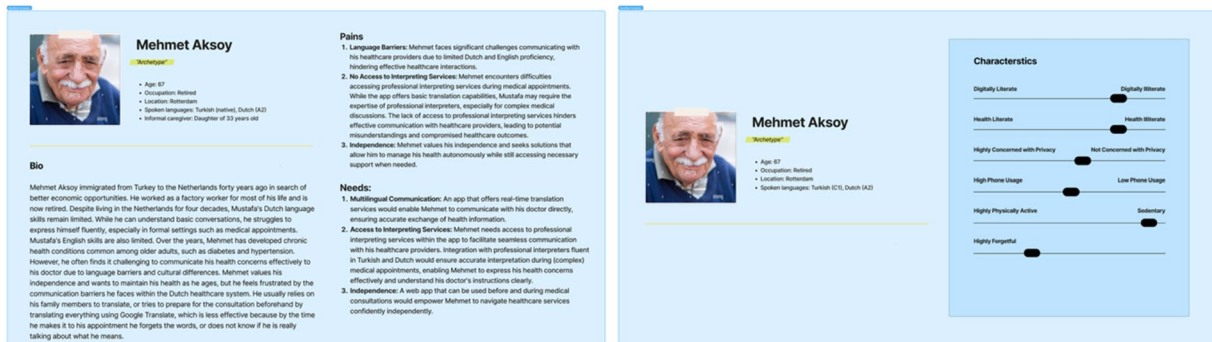


Figure 2. Persona of an LLP Turkish-Dutch patient.

Digital Development. After designing the MediLanguage prototype, the development team converted it into a web application on Vercel. While the Personal Notes, Digital Dictionary, Translator, and Knowledge Hub were deemed ready for use, the decision aid component sparked discussions due to its complexity within the core research team and the broader Right2Health consortium, which included experts in intercultural health communication, migrant health, linguistics, public health, and primary care. The Right2Health consortium comprised two countries that shared a language but had different cultures and included the University of Amsterdam, RadboudUMC, KU Leuven, Utrecht University, and the University of Ghent. To explore how the decision aid could be constructed and revised, two user personas were developed—archetypes representing different user needs—to inform revisions to the Language Support Starter (Groos et al., 2024). The first persona depicted an LLP Turkish-Dutch patient (see Figure 2), while the second represented an HCP in general practice (see Figure 3). These personas, developed from demographic data and insights from the *Listen* phase, clarified the challenges and informed the selection of target users for MediLanguage's decision aid. Additionally, a general practitioner (GP) from the Right2Health consortium noted GPs often work under strict time constraints, with consultations lasting about ten minutes, making the original design impractical. This led to redesigning the decision aid to be patient-led, enhancing its feasibility and effectiveness in clinical practice. Table 3 provides a side-by-side comparison of the MediLanguage's decision aid component developed for joint-completion versus patient-led.

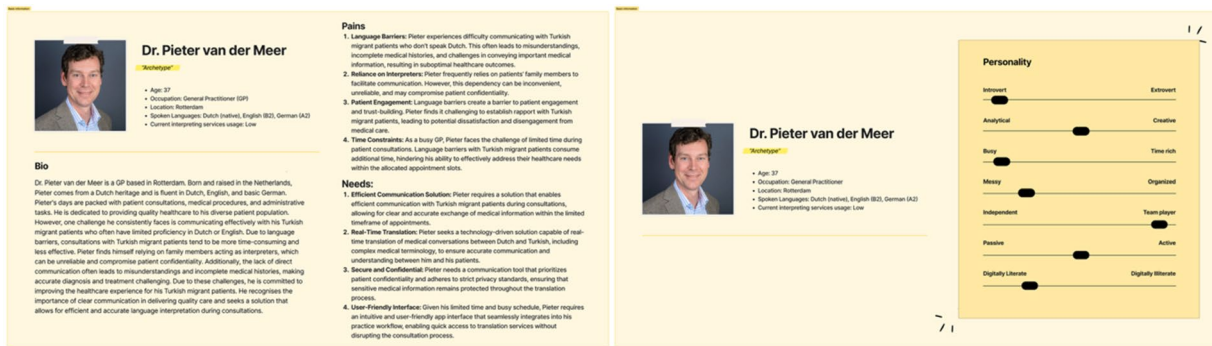


Figure 3. Persona of an HCP.

Table 3. A side-by-side comparison of an early version of MediLanguage's Language Support Starter vs. An adapted version of it.

Concept	Questions for patients and HCPs for MediLanguage's Language Support Starter	Questions for patients only for MediLanguage's Language Support Starter
Language proficiency	Do you feel confident that you can communicate effectively with your doctor in a shared language without assistance?! can talk easily and understand everything without help. - I can usually communicate well, but might occasionally miss some details. - I can get by, but it's sometimes hard. - I often struggle to communicate effectively without help. - I need help to communicate.	Have you been feeling confident in talking to your doctor without language help? We can talk easily and understand everything without help. - We can usually communicate well, but might occasionally miss some details. - We can get by, but it's sometimes hard. - We often struggle to communicate effectively without help. - We need help to communicate.
Complexity of medical condition	How complex do you think the medical condition being discussed is? Very simple: It's easy to understand and explain. - Somewhat simple: It's mostly easy, but has a few tricky parts. - Somewhat complex: It has several difficult aspects to grasp. - Very complex: It's challenging to understand and explain fully.	How hard will it be for you to describe your symptoms? They are easy to explain. - They are mostly easy but have a few tricky parts. - The symptoms have several difficult aspects to explain. - I cannot explain my symptoms at all in a different language.
Digital literacy	Are you comfortable with using digital tools (e.g., Google Translate; DeepL) for translation? Yes No	Would it be okay for you to use online translation tools, such as DeepL or Google Translate? Yes No
Sensitivity of medical condition	Do you feel embarrassed talking about your illness/symptoms with your family or friends? Yes - No - Note: Think about whether you're comfortable talking about sensitive health issues, like mental health or sexual health, with people you know.	Do you feel embarrassed to talk about your current symptoms with your family or friends? Yes No
Informal caregivers	Do you have any family members or friends who are over 18 years old, speaks Dutch fluently, and can join you on a call or in person during your consultation? Yes No	Do you have any trustworthy family members or friends who are over 18 years old, speak Dutch fluently, and can join you at the consultation? Yes No
Privacy concern	Are you comfortable sharing your medical condition with the following interpreter during your consultation? On-site professional interpreter - Phone professional interpreter - Video professional interpreter - None of the above	Do you prefer to talk to an interpreter anonymously? Yes - No - No preference
Time constraints	How long is the consultation you've booked with this patient? Less than 15 mins 15 ~ 20 mins 20 ~ 30 mins 30 mins or more	Did you ask or can you still ask to double-book your consultation? Yes No

STAR Cycle Do: Expert Review and Usability Testing of MediLanguage

Study Design

Expert reviews by usability specialists are common to evaluate digital tools' usability, usefulness, presentation, and information quality (Bolle et al., 2016; Sinabell & Ammenwerth, 2022). For MediLanguage, three evaluation rounds were conducted. First, the Dutch Centre of Expertise on Health Disparities (Pharos) conducted an independent walkthrough to identify design flaws, such as layout and navigation issues, before user interaction, and to ensure that the content suited different reading levels.

Following the expert review, we used a qualitative observational design, including think-aloud sessions and semi-structured interviews, for usability testing with HCPs, Turkish-Dutch patients, and caregivers. The benefits include requiring only 5-9 participants to identify most usability issues, systematic video observation, and the collection of participant feedback (Bolle et al., 2016). In the second round, HCPs assessed MediLanguage's usability and accessibility for Turkish-Dutch patients. The third round involved direct testing with patients and caregivers to identify usability issues from their perspectives.

Participants

All participants, except Pharos experts, were recruited via snowball or purposive sampling. The core team used contacts to email HCPs and invited them. A trained Turkish-Dutch interviewer called her contacts to recruit Turkish-Dutch patients and caregivers. All provided written consent before participating.

HCPs in General Practices. We focused on HCPs in general practices as they are the first point of contact for all patients in the Dutch healthcare system. The inclusion criteria for HCPs were as follows: 1) aged 18 and older, 2) working in general practice, and 3) having treated patients with limited Dutch language proficiency.

Turkish-Dutch Patients and Informal Caregivers. We focused on Turkish-Dutch participants as Dutch language proficiency is lowest among this group compared to other ethnic groups (Klokgieters et al., 2018; Statistics Netherlands, 2023). The inclusion criteria for patients were as follows: 1) aged 18 and older, 2) of Turkish-Dutch background, and 3) having limited Dutch language proficiency. For informal caregivers, we included those who were 1) aged 18 and older, 2) of Turkish-Dutch background, and 3) providing informal care to Turkish-Dutch patients with limited Dutch language proficiency. Patients and caregivers were given a €20 gift card each as compensation for their participation.

Data Collection and Procedure

The expert review, participant recruitment, and data collection for the usability testing sessions occurred from June to August 2024. While usability testing sessions with HCPs from general practices were outsourced to a usability specialist from Pharos and conducted in Dutch, sessions with Turkish-Dutch patients and informal caregivers were conducted by a Turkish interviewer with prior experience in qualitative research, using Turkish or Dutch, depending on the participants' preferences. The principal researcher (BC) trained both interviewers in the use of MediLanguage before data collection began.

Before each usability testing session, participants were briefly introduced to MediLanguage and informed that their audio and screen movements would be recorded using Camtasia, which captures the screen, mouse movements, and voices. Participants read the tasks aloud and shared their thoughts during interaction. They were told there were no right or wrong ways to complete the tasks, as the goal was to evaluate MediLanguage from their perspective (Russ & Saleem, 2018). In the first part, participants completed five main tasks, including sub-tasks such as locating the signup or homepage, changing language, finding information about interpreter types and digital translation tools, and navigating MediLanguage. Afterwards, questions concerning the usability, ease of use, comprehension, intention to use and barriers to using MediLanguage were assessed. On average, each usability testing session lasted about 45 minutes. The topic guides (in English) are available under [Appendix A](#).

Data Analysis

Expert Review. Two usability experts from Pharos conducted walkthroughs by independently navigating MediLanguage's interface and content while using the Patient Education Materials Assessment Tool. Using this framework, each expert systematically evaluated MediLanguage's screens and features, focusing on their ease of navigation, language of the information, and accessibility for users with low health literacy (Online Checklist Toegankelijke Informatie, [n.d](#)). When issues were identified, each expert documented them by describing the problem, assessing its severity, and suggesting possible changes. The two individual reviews were then merged into one consolidated report and shared with the Right2Health consortium.

Usability Testing. Participants' comments were coded according to the usability testing topic guide. Each task was analysed based on how participants completed it, specifically the time taken, whether it could be finished without guidance from the researchers, and whether difficulties in completing the task were verbalised. Usability problems identified during the fifteen testing sessions involving HCPs, patients, and informal caregivers were tabulated to monitor their occurrence. Based on the frequency of issues that arose per task, a list of features was compiled, organised by severity, along with recommended solutions for discussion with developers and the core research team.

Results

One round of expert review and fifteen usability testing sessions were conducted. Five sessions involved HCPs based in general practices ($M_{age} = 44.6$, $SD = 13.54$), five involved patients ($M_{age} = 53.4$, $SD = 8.38$), and five involved informal caregivers ($M_{age} = 41$, $SD = 5.70$). [Table 4](#) provides more details about all participants' background characteristics.

Table 4. Sample characteristics of participants ($N = 15$).

Characteristic	<i>n</i>	%
Healthcare providers ($n = 5$)		
Gender		
Male	2	25
Female	3	75
Age (years)	$M = 44.6$ ($SD = 13.54$)	Range = 34-67
Religious affiliation		
No	5	100
Country of birth		
Netherlands	4	80
Germany	1	20
Ethnic identification		
Dutch	4	80
German	1	20
Profession		
General practitioner	4	80
General practice-based nurse	1	20
Years in practice	$M = 11.20$ ($SD = 14.20$)	Range = 2-36
Migrants with low Dutch language proficiency per month	$M = 22.80$ ($SD = 27.23$)	Range = 4-70
Turkish-Dutch patients ($n = 5$)		
Gender		
Male	—	—
Female	5	100
Age (years)	$M = 53.4$ ($SD = 8.38$)	Range = 46-63
Spoken language		
Turkish	5	100
Dutch	0	0
Turkish-Dutch patients ($n = 5$)		
Gender		
Male	—	—
Female	5	100
Age (years)	$M = 41$ ($SD = 5.70$)	Range = 32-47
Spoken language at home		
Turkish	5	100
Dutch	0	0

Table 5. Expert review of MediLanguage's interfaces.

MediLanguage element	Problem	Solution
Opening page	App purpose unclear; Boxes are text-heavy and large; Imaging irrelevant; Sign in options not functioning well	Simplify layout; Move key message to top; Replace image; Ensure sign-in works promptly across methods
Landing page	Too many panels; Reused/confusing images; Navigation arrows malfunction	Reduce number of panels; Use unique images; Fix arrow navigation; Enlarge section headers
Top bar instructions Reflection Tree (Language Support Starter)	Important instructions hidden under "i" icon Button text hard to read; Multiple choice questions difficult for low literacy users	Make instructions directly visible on the bar Use black texts on buttons; Replace multiple choice questions with yes/no questions; Limit to two questions per section
Knowledge Hub: How to Talk to Your Doctor	Text too long; Image does not show doctor-patient context	Shorten text; Use image of doctor and patient in conversation
Knowledge Hub: Digital Translation Options	Assumes user knows what translation apps are; Image unclear; Spelling error	Explain where to download apps; Clarify visuals; Correct spelling; Emphasise confirming understanding
Knowledge Hub: Types of interpreters	Image unclear; Overly complex text	Use matching, relevant images; Simplify descriptions; Clearly distinguish interpreter types
Knowledge Hub: Introduction to Dutch Healthcare System	Too much information; Links are repetitive; Language too complex; Image unrelated	Consider removing this panel; If kept, streamline and tailor content; Replace image with healthcare related one
Knowledge Hub: Your Rights as a Patient	Long text; Image reused;	Simplify with bullet points; Update image;
Translator	Font too small and grey; Speech to text function missing; Unclear data security; Image not related	Improve readability; Add speech to text function; Clarify storage/security; Match image to translation context
Personal Notes	Font readability is poor; Note-taking is difficult for low-literacy users; QR code unclear; Data handling unknown	Improve readability; Explain QR code; Provide transparency on note storage and access

Note: These results are based on the opinions of two experts.

Expert Review

Usability specialists mainly pointed out that each panel on MediLanguage contained too much text, and the images used did not match the accompanying content. The main recommendation was to reduce the number of panels and the amount of text, and to select images relevant to the text's theme to enhance comprehensibility for patients with limited literacy. Table 5 provides more detailed results from Pharos' expert check.

Usability Testing with HCPs

HCPs expressed positive attitudes towards MediLanguage and the majority expressed intentions to use it in the future. From their perspectives, they believed LLP Turkish-Dutch patients would value the 'Reflection Tree' and MediLanguage's homepage information the most. However, HCPs voiced concerns about using the 'Reflection Tree' in practice, as they are often unable to provide professional interpreting services due to a lack of funding. Table 6 presents an overview of usability problems, their frequency, and the identified solutions from HCPs' perspectives.

Usability Testing with Turkish-Dutch Patients and Informal Caregivers

Patients and informal caregivers valued the development of MediLanguage and expressed satisfaction with it. There were no significant differences in the problems encountered by patients and caregivers,

Table 6. Overview of MediLanguage usability results from HCPs in general practices.

Feature	Feedback	Suggested solution	Frequency
Major problems			
Language Support Starter	The recommendation page has too much text; may overwhelm users	Shorten texts, use bullet points, and simplify language	5
Personal Notes	Unclear how notes are stored and retrieved	Clarify storage, retrieval process, and privacy measures	5
Changing the language	Found easily. Only English and Turkish available; HCPs questioned the lack of other language options	Add more languages (e.g., Arabic, Farsi); explain added value vs. Google Translate	4
Website tour	Ignored by users; HCPs skip straight to content panels	Remove or minimise tour; show panels immediately on login	4
Language Support Starter's previous name (Reflection Tree)	The term 'Reflection Tree' is too complex; not intuitive	Change name to something more self-explanatory	4
Signing in as doctor	Leading to the same page as patients	Fix doctor login functionality so it leads to a separate, functional doctor dashboard; Ensure this dashboard includes only doctor-relevant tools and content	4
Homepage	Images not seen as relevant or useful	Replace images with more context-relevant visuals or remove them	3
Introduction to the Dutch healthcare system	Content seems aimed at expats, not migrant patients	Tailor the content to reflect migrant patient needs	3
Personal Notes	QR-code to share note with HCPs will not be used	Provide email-based sharing or summary export instead	3
Minor problems			
Sign up/log in	Too complex; only works with Gmail	Remove or simplify login; allow login-free use or multiple login options	2
Information on translation options	No direct links to recommended tools	Add clickable links	2
Personal Notes	No speech-to-text	Add optional speech-to-text feature (if feasible)	2
Translator	Speech-to-text would be beneficial	Add speech-to-text option for translator	2
Dictionary	Helpful, but: broad scope, unclear source	Explain source and selection criteria in-app	2
Signing in as doctor	Font size too small	Increase font size	2
Dictionary	Only Dutch alphabetical order	Allow sorting in Turkish and English as well	1

and Table 7 provides an overview of usability problems, their frequency, and solutions identified from their perspectives.

Final Version of MediLanguage

The final version of MediLanguage is designed to be patient-focused and accessed in real-time², as depicted in Figure 4. The core research team used expert review and usability testing results, along with available financial resources, to determine which changes to implement in this final version. Removing the sign-up requirement enabled patients to immediately access the landing page, where a two-minute Turkish video with Dutch subtitles explaining the Language Support Starter was available (Figure 5). Users thus do not need to receive prior training to use MediLanguage. Following the video, users are introduced to the 'Language Support Starter' (the decision aid component formerly known as the 'Reflection Tree'), 'Knowledge Hub' (a page that consolidates all information needed before and during consultations, including types of interpreters, patients' rights to interpreting services, and an overview of digital translation tools), 'Translator' (the DeepL Translator embedded in MediLanguage), and 'Dictionary' (which contains medical terminologies in Dutch, Turkish, and English with a search function) as they scroll down. At the top of the landing page, all features are available as separate, clickable buttons with the same names for quick access. Under each feature, users receive not only the functional aspects but also brief explanations of each tool they can utilise, which are accompanied by an audio feature. Finally, we retained the digital notebook function, now named 'Personal Notes', in the final stage. Unlike the version developed during the *Plan* phase, this feature

Table 7. Overview of MediLanguage usability results from Turkish-Dutch patients and informal caregivers.

Task	Problem	Solution	Frequency
Major problems			
Log in/sign up	One-time-password is sent in English and not Turkish, takes a long time to arrive as a message or email, and often ends up in the spam folder	Either change the log in/sign up to a conventional method, i.e., ask users to create an account with a password, or remove the log in/sign up	10
Locating the Language Support Starter and understanding it	Locating the Language Support Starter was difficult because its original name, 'Reflection Tree' was mistranslated or improperly translated from English to Turkish; Participants suggested that the name of this should already signal what it is for	Renaming 'Reflection Tree' so it is self-explanatory and consider adding a video or audio explanation about 'Reflection Tree', as many participants understood it after the interviewer explained it verbally	10
Personal Notes: Favourite function	Participants had difficulties locating the 'favourite' function	Add 'favourite' function	10
Tour of MediLanguage	Participants were unaware that a 'tour' explaining MediLanguage's features was available, almost all skipped it	Add a pop-up window on homepage asking user if they would like to go through the tour	9
Retrieving previous recommendations after using Language Support Starter	Participants weren't entirely sure how to retrieve previous recommendation(s) received from the Language Support Starter	Add a 'history' page or on homepage a panel showing the last recommendation	6
Knowledge Hub: Information about translation options	Participants misunderstood that the box 'information about translation options' was for changing the page's language	Simplify Turkish texts and/or rewriting certain Turkish texts	5
Locating the Translator	Some participants had difficulties locating it, but namely because it is not named properly in Turkish	Renaming Translator to something else (e.g., <i>Help with Dutch</i>)	5
Minor problems			
Translator: Favourite function	Some found it hard to find	Make the button bigger	4
Knowledge Hub: Information about the Dutch healthcare system	External content was not available in Turkish immediately, therefore difficult to understand; The video icon was also sometimes difficult to locate	Replace content with Turkish content; Make icons bigger	4
Translator	Few experienced translation issues, i.e., minor mistakes	Make a bigger warning that users should only translate short sentences	3
Knowledge Hub: Information about talking to the doctor	Panel did not show entire sentence, so some participants found it difficult to locate this; Also not found to be as important	Ensure panel shows entire title; Move to bottom of homepage	3
Changing the language	Few participants had difficulties locating it	Instead of using an icon that represents 'translation', label the button as 'languages'	3
Locating Personal Notes	Easy, but more than half preferred this to show up first thing on homepage; Information on bottom instead	Show up as first panel on homepage	2
Personal Notes: Translation function	Typing can get tricky if not on PC	Remind users to use MediLanguage on bigger screens	2
Main recommendations from the Language Support Starter	Overall clear, but other texts below were too long	Simplify or rewrite Turkish text; Consider adding audio recordings of the texts	2

is now only accessible to patients, primarily serving as a note function with built-in language assistance to help patients prepare for their consultations. [Table 8](#) provides an overview of the final changes made.

Discussion

This paper discusses the development and usability testing of MediLanguage, a digital tool designed to help LLP migrant patients engage in shared decision-making with HCPs during consultations, especially regarding language barriers. Developed using the STAR Model (Skinner et al., 2006) with input from HCPs, software developers, researchers, Turkish-Dutch LLP patients, and caregivers, it is now a real-time, user-ready tool with various features: a decision aid, a digital dictionary, which received positive feedback from users.

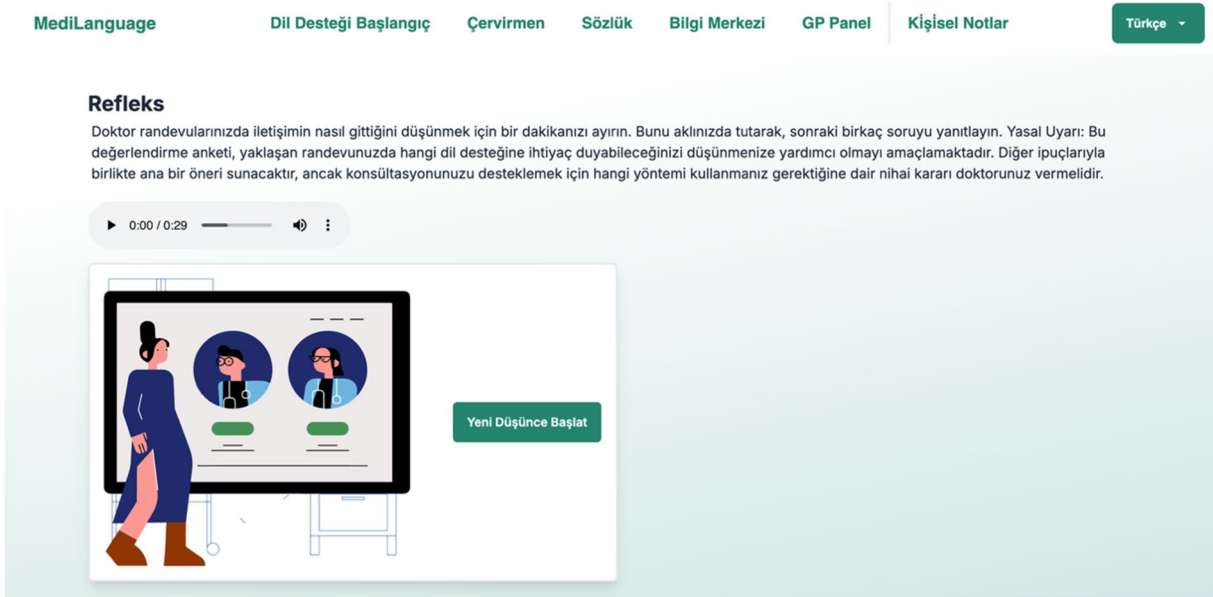


Figure 4. Finalised version of MediLanguage's Language Support Starter.

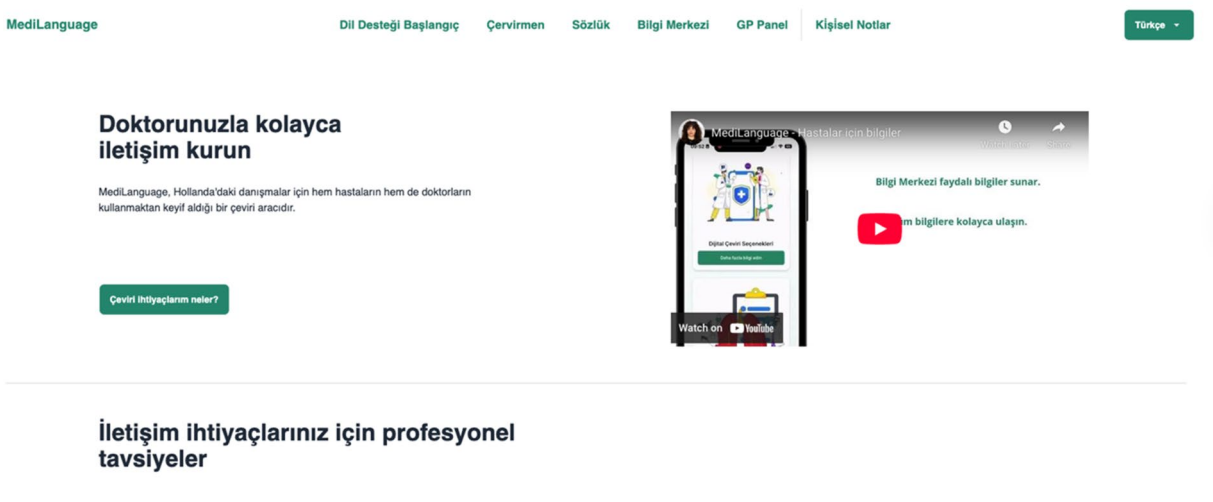


Figure 5. Finalised MediLanguage's landing page.

Overall, neither HCPs, patients, nor caregivers experienced major usability issues when using MediLanguage, and all evaluated it as intuitive and easy to use. The primary usability issues that emerged concerned the design elements of MediLanguage and the presentation of its information. First, participants had trouble with MediLanguage's user interface components, including locating the feature to change the web app's language from English to Turkish. As this may be due to age-related visual decline (Romano Bergstrom et al., 2013; Wildenbos et al., 2018), we enlarged all button sizes to address this. Second, some participants also encountered difficulties with the modality we used for information presentation, i.e., textual information, because of the length and clarity of the text. While we ensured that older patients would not be overloaded with too much information by including features allowing them to expand on the information themselves, e.g., using drop-down menus, some still found the information too lengthy to digest all at once (Nayak et al., 2006). Since research shows that older patients value mixed-modality information formats, such as text combined with audio recordings, the finalised MediLanguage features audio snippets for all functions. This allows users to listen and read simultaneously, reducing cognitive load (Lindberg & De Troyer, 2021; Mayer & Moreno, 2003).

Table 8. An overview of finalised changes for MediLanguage.

Issue	Suggestion	Implemented changes
Personal Notes		
Log-in for personal notes is too complex for patients	Remove log-in for personal notes to lower barriers for uptake	Log-in removed
Lack of speech to text for notes	No need to build function; instead, provide instructions for using built-in phone keyboard speech-to-text	Included screenshots of mic button (Android/iOS) and instructions to enable the speech-to-text function
Dictionary		
Dictionary not alphabetised in all languages	Ensure alphabetical order for all languages (depending on user)	Alphabetical order made possible for all languages
No source listed for dictionary entries	Provide source	Source is credited in dictionary (Thuisarts.nl)
Landing page		
Panel ordering not intuitive	Adjust to 3-3-1 visual layout with specified category order	Dashboard reordered accordingly
Language Support Starter		
Language Support Starter had too complex with many options	Simplify structure and reduce information per option	Structure simplified and texts adjusted
Term “Reflection Tree” too complex to understand	Use simpler, more intuitive terminology	‘Reflection Tree’ renamed to ‘Language Support Starter’
Audio	Record audio in Turkish for questions, answers and recommendations for Language Support Starter	Audio recorded and uploaded to web-app
General		
Use of QR-code not appealing	Offer alternative ways to share content with GP	QR code removed
Font size too small in some places	Increase font size	Font size increased
Turkish translations not always offered	Ensure Turkish translations for all features	Turkish translations applied
Images are not relevant for a medical environment	Replace with more medically relevant images	Images updated.
Phone compatibility could be improved	Ensure app functions perfectly on phone	Mobile testing and fixes applied
Explanatory video to explain the web-app could be beneficial	Create an explanatory video for patients to see on landing page	Video created and uploaded to the MediLanguage landing page

Although developing the design and layout of MediLanguage was relatively straightforward, creating the decision aid component, *Language Support Starter*, proved more complex. Initially, MediLanguage’s Language Support Starter was envisioned for joint use by HCPs and patients with LLP, based on two rationales. First, decision aids are traditionally designed for both parties to promote shared decision-making (Muscat et al., 2021; Stacey et al., 2024). Second, research (Jones et al., 2009) suggests that greater effectiveness is achieved when decision aids are delivered by HCPs rather than external individuals (e.g., researchers) prior to consultations. However, discussions with a GP from the Right2Health consortium indicated that this approach was impractical in clinics due to the typical ten-minute GP consultation (Deveugele et al., 2002). In other words, while the Language Support Starter comprises only seven brief, multiple-choice questions, the added complexity of communicating across a language barrier was found to lengthen the interaction, potentially reducing consultation time. Given that the Dutch healthcare system has undergone significant changes (e.g., care work traditionally delivered by outpatient clinics has been transferred to general practices), this has led to a growing demand for GPs’ services. GPs in the Netherlands thus face increased workload and pressure, with their workload and diversity of duties being among the highest in Europe (Schäfer et al., 2011; Van der Horst & De Wit, 2020). Taking this into consideration, this resulted in a fundamental redesign of MediLanguage’s Language Support Starter to be patient-focused, ensuring its practical applicability and potential future adoption. The final ready-to-use Language Support Starter thus did not require input from HCPs.

Although the Language Support Starter is now patient-led, we believe it remains an innovative eHealth intervention that will empower and prepare LLP migrant patients to participate in SDM, addressing language barriers. We ensured the targeted end users, LLP patients, were actively involved in developing our decision aid so it is tailored to their needs and preferences (Van Weert et al., 2016). It increases patients’ understanding of the risks and benefits of communication strategies and enables them to save recommended strategies to communicate with HCPs about language barriers. This preserves the decision aid’s purpose: supporting structured discussions on managing language barriers. While it cannot guarantee HCPs will adopt the strategies, it may influence their perceptions

of the time needed to involve interpreters when resources are available. It could encourage involving professional interpreters instead of informal ones (Chan et al., 2024; Diamond et al., 2009). This shift may reduce costs and burdens of poor language barrier management, improving communication, increasing efficiency, and enhancing healthcare quality for LLP migrant patients.

Strengths, Limitations, and Future Research

A major strength of this study was the high level of migrant involvement in its design. A migrant researcher was involved in conceptualising the study, arranging data collection, and analysing the data. Additionally, migrant patient representatives assisted in revising and piloting the usability testing guides developed for this study. However, this study also has its limitations.

First, to ensure MediLanguage's Language Support Starter can be effectively tested by patients facing language barriers in the Netherlands, we chose to develop it specifically for Turkish-Dutch patients, who represent the largest group experiencing such barriers (Klokgieters et al., 2018; Statistics Netherlands, 2023). Although MediLanguage's Language Support Starter helps Turkish-Dutch patients reflect on their language needs based on previous consultations, it does not support newly registered patients from other migrant groups (e.g., migrants from Eastern Europe) (Suurmond & Schouten, 2025). As the flow of migrants continues, translating the tool into languages used by newly immigrated patients and in a culturally sensitive manner would be beneficial, especially since it requires minimal effort. This expansion would better address the language needs of new migrant patients and enable use in other healthcare settings, such as emergency care. In addition, since we developed as a standalone tool, its compatibility with other healthcare technologies is unknown. Further research should explore how it can be integrated into assistive technologies during expansion.

Second, whether MediLanguage will work well in underserved health systems in low or middle-income countries depends less on income level and more on digital readiness (infrastructure, connectivity, and user familiarity). For example, highly tech-enabled settings like Kenya could adopt it successfully, whereas lower digital readiness contexts (e.g., parts of Indonesia) may require more intensive adaptation and support (Malhotra, 2025; Rohmah et al., 2023). Future research should empirically test MediLanguage across low- and middle-income settings with varying levels of digital readiness, focusing on how infrastructure, connectivity, and user digital literacy mediate adoption and effectiveness.

Finally, although MediLanguage enables LLP migrant patients to engage in SDM with HCPs about using professional interpreting services when needed, it does not address the limited availability of such services for emerging languages, a challenge reported in some high-income countries (Arya et al., 2024; Mavreles Ogrodnick et al., 2024). Consequently, the tool cannot assist patients in accessing necessary professional interpreting services. While digital translation may offer limited support in specific situations, it cannot replace professional interpreters, and enabling this was beyond the scope of the tool. We therefore acknowledge MediLanguage does not resolve systemic interpreter shortages. Future research should explore initiatives to bridge these gaps and investigate how digital tools can ethically support communication without replacing professional interpreters. Such efforts will increase the likelihood of effective medical communication across low-, middle-, and high-income settings.

Conclusion

This study used the STAR Model to develop and test MediLanguage, a digital tool. MediLanguage's decision aid component, the Language Support Starter was developed to promote shared decision-making between LLP migrant patients and HCPs about language barriers during consultations. Involving all end users, namely HCPs and Turkish-Dutch patients, during development ensured MediLanguage aligns with their needs. Although initially designed for joint use by HCPs and patients, the final version is patient-led. While not intended for direct use by HCPs, it may help start standardised conversations about overcoming language barriers. Ultimately, MediLanguage could improve medical communication for LLP migrant patients, promoting health equity.

Notes

1. The Right2Health consortium comprises of the University of Amsterdam, RadboudUMC, Catholic University of Leuven, Utrecht University, and the University of Ghent. More information is available on <https://www.right2health.eu/>.
2. <https://medilanguage.com/tu/language-support>

Acknowledgements

This study is funded by the Dutch Research Council (NWO), grant number 406.20.SW.024. The authors thank Yating Fang, Jiyuan Song, Bas Ekkelenkamp, Naud Roos, and Csenge Ambrus for designing and developing MediLanguage. The authors thank Anke van Dam and Eline Heemskerk from Pharos for conducting the expert review and usability testing with health-care providers, and Nazli Lale-Kahraman for recruiting and conducting the usability test with Turkish participants.

Author contributions

CRediT: **Brittany Ming Chu Chan**: Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing; **Julia C. M. van Weert**: Conceptualization, Funding acquisition, Supervision, Writing – review & editing; **Hülya Ates**: Formal analysis, Visualization; **Inez Beukeleers**: Writing – review & editing; **Geert Brône**: Writing – review & editing; **Antoon Cox**: Writing – review & editing; **Simone Goosen**: Writing – review & editing; **Christopher Jenks**: Writing – review & editing; **Peter Pype**: Methodology; **Heidi Salaets**: Methodology; **Jeanine Suurmond**: Conceptualization, Funding acquisition, Supervision, Writing – review & editing; **Barbara C. Schouten**: Conceptualization, Funding acquisition, Supervision, Writing – review & editing.

Declaration of generative AI and AI-Assisted technologies in the writing process

During the preparation of this work, the first author utilised Grammarly Version 1.139.6 to improve sentence structures, enhance readability, and correct language errors. After using this tool, all authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by Nederlandse Organisatie voor Wetenschappelijk Onderzoek, 406.20.SW.024.

ORCID

Brittany Ming Chu Chan  <http://orcid.org/0000-0001-6827-5332>

Data availability statement

Due to the nature of the research and ethical restrictions, supporting data is not available.

References

- Ahmed, A., van den Muijsenbergh, M. E. T. C., & Vrijhoef, H. J. M. (2022). Person-centred care in primary care: What works for whom, how and in what circumstances? *Health & Social Care in the Community*, 30(6), e3328–e3341. <https://doi.org/10.1111/hsc.13913>
- Al Shamsi, H., Almutairi, A. G., Al Mashrafi, S., & Al Kalbani, T. (2020). Implications of language barriers for healthcare: A systematic review. *Oman Medical Journal*, 35(2), e122–e122. <https://doi.org/10.5001/omj.2020.40>

- Ali, P. A., & Watson, R. (2018). Language barriers and their impact on provision of care to patients with limited English proficiency: Nurses' perspectives. *Journal of Clinical Nursing*, 27(5-6), e1152–e1160. <https://doi.org/10.1111/jocn.14204>
- Arya, A. N., Hyman, I., Holland, T., Beukeboom, C., Tong, C. E., Talavlikar, R., & Eagan, G. (2024). Medical interpreting services for refugees in Canada: Current state of practice and considerations in promoting this essential human right for all. *International Journal of Environmental Research and Public Health*, 21(5), 588. <https://doi.org/10.3390/ijerph21050588>
- Barrio-Ruiz, C., Ruiz de Viñaspre-Hernandez, R., Colaceci, S., Juarez-Vela, R., Santolalla-Arnedo, I., Durante, A., & Di Nitto, M. (2024). Language and cultural barriers and facilitators of sexual and reproductive health care for migrant women in high-income European Countries: An integrative review. *Journal of Midwifery & Women's Health*, 69(1), 71–90. <https://doi.org/10.1111/jmwh.13545>
- Boe, E. d. (2015). The influence of governmental policy on public service interpreting in the Netherlands. *Translation & Interpreting*, 7(3), 3.
- Bolle, S., Romijn, G., Smets, E. M. A., Loos, E. F., Kunneman, M., & J. C. M., van Weert. (2016). Older cancer patients' user experiences with web-based health information tools: A think-aloud study. *Journal of Medical Internet Research*, 18(7), e5618. <https://doi.org/10.2196/jmir.5618>
- Brown, C., Roucoux, G., Dimi, S., Fahmi, S., Jeevan, R. B., Chassany, O., Chaplin, J. E., & Duracinsky, M. (2023). Exploring the limitations of language interpretation: A qualitative study on clinicians' experiences at French Office of Immigration and Integration. *PLOS Global Public Health*, 3(12), e0002436. <https://doi.org/10.1371/journal.pgph.0002436>
- Brunner, J. W. M. (2018). *Clinical decision support: design strategies and quality outcomes in primary care*.
- Cano-Ibáñez, N., Zolfaghari, Y., Amezcua-Prieto, C., & Khan, K. S. (2021). Physician–patient language discordance and poor health outcomes: A systematic scoping review. *Frontiers in Public Health*, 9, 629041. <https://www.frontiersin.org/article/10.3389/fpubh.2021.629041> <https://doi.org/10.3389/fpubh.2021.629041>
- Chan, B. M. C., Suurmond, J., van Weert, J. C. M., & Schouten, B. C. (2024). Uncovering communication strategies used in language-discordant consultations with people who are migrants: Qualitative interviews with healthcare providers. *Health Expectations: An International Journal of Public Participation in Health Care and Health Policy*, 27(1), e13949. <https://doi.org/10.1111/hex.13949>
- Chan, B. M. C., van Weert, J. C. M., Fang, Y., Song, J., Suurmond, J., & Schouten, B. C. (2025). Identifying needs for a decision aid to support communication with low-language-proficient migrant patients. *Patient Education and Counseling*, 141, 109307. <https://doi.org/10.1016/j.pec.2025.109307>
- Chang, H., Hutchinson, C., & Gullick, J. (2021). Pulled away: The experience of bilingual nurses as ad hoc interpreters in the emergency department. *Ethnicity & Health*, 26(7), 1045–1064. <https://doi.org/10.1080/13557858.2019.1613518>
- Chauhan, A., Walton, M., Manias, E., Walpole, R. L., Seale, H., Latanik, M., Leone, D., Mears, S., & Harrison, R. (2020). The safety of health care for ethnic minority patients: A systematic review. *International Journal for Equity in Health*, 19(1), 118. <https://doi.org/10.1186/s12939-020-01223-2>
- Chung, J. E., Park, N., Wang, H., Fulk, J., & McLaughlin, M. (2010). Age differences in perceptions of online community participation among non-users: An extension of the Technology Acceptance Model. *Computers in Human Behavior*, 26(6), 1674–1684. <https://doi.org/10.1016/j.chb.2010.06.016>
- Claeys, A., Berdai-Chaoui, S., Tricas-Sauras, S., & De Donder, L. (2023). Barriers and facilitators in providing care for patients with a migration background. *Journal of Clinical Nursing*, 32(5-6), 912–925. <https://doi.org/10.1111/jocn.16491>
- Czapka, E. A., Gerwing, J., & Sagbakken, M. (2019). Invisible rights: Barriers and facilitators to access and use of interpreter services in health care settings by Polish migrants in Norway. *Scandinavian Journal of Public Health*, 47(7), 755–764. <https://doi.org/10.1177/1403494818807551>
- Davidson, A. S., Lindell, J. F., Hansen, C., Michaëlis, C., Lutterodt, M. C., Krasnik, A., Norredam, M. L., & Reventlow, S. (2022). General practitioners' experiences in consultations with foreign language patients after the introduction of a user's fee for professional interpretation: A qualitative interview study. *BMC Primary Care*, 23(1), 103. <https://doi.org/10.1186/s12875-022-01718-7>
- De Haes, H., & Bensing, J. (2009). Endpoints in medical communication research, proposing a framework of functions and outcomes. *Patient Education and Counseling*, 74(3), 287–294. <https://doi.org/10.1016/j.pec.2008.12.006>
- Deveugele, M., Derese, A., Brink-Muinen, A., van den, Bensing, J., & Maeseneer, J. D. (2002). Consultation length in general practice: Cross sectional study in six European countries. *BMJ (Clinical Research ed.)*, 325(7362), 472. <https://doi.org/10.1136/bmj.325.7362.472>
- Diamond, L. C., Schenker, Y., Curry, L., Bradley, E. H., & Fernandez, A. (2009). Getting by: Underuse of interpreters by resident physicians. *Journal of General Internal Medicine*, 24(2), 256–262. <https://doi.org/10.1007/s11606-008-0875-7>
- Ekladios, A., Bhandari, R., Sudusinghe, T. N., Jiang, B., & Jahan, F. (2023). Consultation with patients for whom English is not their native language. *Internal Medicine Journal*, 53(5), 866–870. <https://doi.org/10.1111/imj.16087>

- Ekman, I., Ebrahimi, Z., & Olaya Contreras, P. (2021). Person-centred care: Looking back, looking forward. *European Journal of Cardiovascular Nursing*, 20(2), 93–95. <https://doi.org/10.1093/eurjcn/zvaa025>
- Evenden, R., Singh, N., Sornalingam, S., Harrington, S., & Paudyal, P. (2022). Language barriers for primary care access in Europe: A systematic review. *European Journal of Public Health*, 32(Supplement_3), 724. ckac129 <https://doi.org/10.1093/eurpub/ckac129.724>
- Flores, G. (2005). The impact of medical interpreter services on the quality of health care: A systematic review. *Medical Care Research and Review: MCRR*, 62(3), 255–299. <https://doi.org/10.1177/1077558705275416>
- Gedragcode voor artsen. (2022). <https://www.knmg.nl/actueel/publicaties/publicaties-per-onderwerp/gedragcode-voor-artsen>
- Gil-Salmerón, A., Katsas, K., Riza, E., Karnaki, P., & Linos, A. (2021). Access to healthcare for migrant patients in europe: Healthcare discrimination and translation services. *International Journal of Environmental Research and Public Health*, 18(15), 7901. <https://doi.org/10.3390/ijerph18157901>
- Groos, S. S., Linn, A. J., Kuiper, J. I., van Schoor, N. M., van der Velde, N., & van Weert, J. C. M. (2024). Combining user-centered design and behavioral theory to enhance health technologies: A personas-based approach for a primary-care based multifactorial falls risk assessment tool. *International Journal of Medical Informatics*, 186, 105420. <https://doi.org/10.1016/j.ijmedinf.2024.105420>
- Hadziabdic, E., Albin, B., Heikkilä, K., & Hjelm, K. (2014). Family members' experiences of the use of interpreters in healthcare. *Primary Health Care Research & Development*, 15(2), 156–169. <https://doi.org/10.1017/S1463423612000680>
- Jacobs, E. A., & Diamond, L. C. (2017). *Providing Health Care in the Context of Language Barriers: International Perspectives*. Multilingual Matters.
- Johannes Wier Stichting. (2025). *Zo schakelt u een tolk in*. Zo Schakelt u Een To. <https://www.zoschakeltueentolkin.nl>
- Jones, L. A., Weymiller, A. J., Shah, N., Bryant, S. C., Christianson, T. J. H., Guyatt, G. H., Gafni, A., Smith, S. A., & Montori, V. M. (2009). Should clinicians deliver decision aids? Further exploration of the statin choice randomised trial results. *Medical Decision Making: An International Journal of the Society for Medical Decision Making*, 29(4), 468–474. <https://doi.org/10.1177/0272989X09333120>
- Karliner, L. S., Jacobs, E. A., Chen, A. H., & Mutha, S. (2007). Do professional interpreters improve clinical care for patients with limited english proficiency? A systematic review of the literature. *Health Services Research*, 42(2), 727–754. <https://doi.org/10.1111/j.1475-6773.2006.00629.x>
- Klokgieters, S., Vantilburg, T., Deeg, D., & Huisman, M. (2018). Gezondheidsverschillen onder oudere migranten in Nederland. *Demos*, 34(9), 4–7.
- Kwaliteitsnorm tolkgebruik bij anderstaligen in de zorg. (n.d). Retrieved 1 December 2022, from <https://www.pharos.nl/kennisbank/kwaliteitsnorm-tolkgebruik-bij-anderstaligen/>
- Kwan, M., Jeemi, Z., Norman, R., & Dantas, J. A. R. (2023). Professional interpreter services and the impact on hospital care outcomes: An integrative review of literature. *International Journal of Environmental Research and Public Health*, 20(6), 5165. <https://doi.org/10.3390/ijerph20065165>
- Lindberg, R. S. N., & De Troyer, O. (2021). *Towards an up to date list of design guidelines for elderly users* [Paper presentation]. CHI Greece 2021: 1st International Conference of the ACM Greek SIGCHI Chapter, CHI Greece 2021. <https://doi.org/10.1145/3489410.3489418>
- Lindholm, M., Hargraves, J. L., Ferguson, W. J., & Reed, G. (2012). Professional Language Interpretation and Inpatient Length of Stay and Readmission Rates. *Journal of General Internal Medicine*, 27(10), 1294–1299. <https://doi.org/10.1007/s11606-012-2041-5>
- Malhotra, K. (2025). *Digital health readiness in Africa: Trends, challenges, and opportunities (Digital Health Readiness in Africa Countries Study-03)*. ACCESS Health International. <https://accessh.org/wp-content/uploads/2025/06/DH-Readiness-in-Africa-Countries-Study-03.pdf>
- Mavreles Ogrodnick, M., O'Connor, M. H., Lukas, C., & Feinberg, I. (2024). Bridging the language gap in healthcare: Implementing a qualified medical interpreter program for lesser-spoken languages. *International Journal of Environmental Research and Public Health*, 21(10), 1377. <https://doi.org/10.3390/ijerph21101377>
- Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist*, 38(1), 43–52. https://doi.org/10.1207/S15326985EP3801_6
- Muscat, D. M., Smith, J., Mac, O., Cadet, T., Giguere, A., Houston, A. J., Langford, A. T., Smith, S. K., Durand, M.-A., & McCaffery, K. (2021). Addressing health literacy in patient decision aids: An update from the international patient decision aid standards. *Medical Decision Making: An International Journal of the Society for Medical Decision Making*, 41(7), 848–869. <https://doi.org/10.1177/0272989X211011101>
- Nayak, L., Priest, L., Stuart-Hamilton, I., & White, A. (2006). Website design attributes for retrieving health information by older adults: An application of architectural criteria. *Universal Access in the Information Society*, 5(2), 170–179. <https://doi.org/10.1007/s10209-006-0029-9>
- Olsavszky, V., Bazari, M., Dai, T. B., Olsavszky, A., Finkelmeier, F., Friedrich-Rust, M., Zeuzem, S., Herrmann, E., Leipe, J., Michael, F. A., Westernhagen, H. v., & Ballo, O. (2025). Digital translation platform (translatly) to overcome communication barriers in clinical care: Pilot study. *JMIR Formative Research*, 9(1), e63095. <https://doi.org/10.2196/63095>

- Online checklist Toegankelijke informatie. (n.d). *Pharos*. Retrieved 13 August 2025, from <https://www.pharos.nl/kennisbank/checklist-toegankelijke-informatie/>
- Pandey, M., Maina, R. G., Amoyaw, J., Li, Y., Kamrul, R., Michaels, C. R., & Maroof, R. (2021). Impacts of English language proficiency on healthcare access, use, and outcomes among immigrants: A qualitative study. *BMC Health Services Research*, 21(1), 741. <https://doi.org/10.1186/s12913-021-06750-4>
- Paternotte, E., Dulmen, S., van, Bank, L., Seeleman, C., Scherpbier, A., & Scheele, F. (2017). Intercultural communication through the eyes of patients: Experiences and preferences. *International Journal of Medical Education*, 8, 170–175. <https://doi.org/10.5116/ijme.591b.19f9>
- Peled, Y. (2018). Language barriers and epistemic injustice in healthcare settings. *Bioethics*, 32(6), 360–367. <https://doi.org/10.1111/bioe.12435>
- Pot, A., Keijzer, M., & De Bot, K. (2020). The language barrier in migrant aging. *International Journal of Bilingual Education and Bilingualism*, 23(9), 1139–1157. <https://doi.org/10.1080/13670050.2018.1435627>
- Rohmah, A. ‘, Rachmawati, R., & Mei, E. T. W. (2023). Smart city achievement through implementation of digital health services in handling COVID-19 Indonesia. *Smart Cities*, 6(1), 639–651. <https://doi.org/10.3390/smartcities6010030>
- Romano Bergstrom, J. C., Olmsted-Hawala, E. L., & Jans, M. E. (2013). Age-related differences in eye tracking and usability performance: Website usability for older adults. *International Journal of Human-Computer Interaction*, 29(8), 541–548. <https://doi.org/10.1080/10447318.2012.728493>
- Russ, A. L., & Saleem, J. J. (2018). Ten factors to consider when developing usability scenarios and tasks for health information technology. *Journal of Biomedical Informatics*, 78, 123–133. <https://doi.org/10.1016/j.jbi.2018.01.001>
- Schäfer, W. L. A., Boerma, W. G. W., Kringos, D. S., De Maeseneer, J., Gress, S., Heinemann, S., Rotar-Pavlic, D., Seghieri, C., Svab, I., Van den Berg, M. J., Vainieri, M., Westert, G. P., Willems, S., & Groenewegen, P. P. (2011). QUALICOPC, a multi-country study evaluating quality, costs and equity in primary care. *BMC Family Practice*, 12(1), 115. <https://doi.org/10.1186/1471-2296-12-115>
- Sinabell, I., & Ammenwerth, E. (2022). Agile, easily applicable, and useful eHealth usability evaluations: Systematic review and expert-validation. *Applied Clinical Informatics*, 13(1), 67–79. <https://doi.org/10.1055/s-0041-1740919>
- Skinner, H. A., Maley, O., & Norman, C. D. (2006). Developing internet-based eHealth promotion programs: The Spiral Technology Action Research (STAR) model. *Health Promotion Practice*, 7(4), 406–417. <https://doi.org/10.1177/1524839905278889>
- Soh, H., Rohlfing, M. L., Keefe, K. R., Valentine, A. D., Noordzij, P. J., Brook, C. D., Levi, J., Soh, H., Rohlfing, M. L., Keefe, K. R., Valentine, A. D., Noordzij, P. J., Brook, C. D., & Levi, J. (2022). Interpreter use and patient satisfaction in the otolaryngology outpatient clinic. *Cureus*, 14(5), e24839. <https://doi.org/10.7759/cureus.24839>
- Stacey, D., Lewis, KB, Smith, M., Carley, M., Volk, R., Douglas, EE, Pacheco-Brousseau, L., Funderup, J, Gunderson, J, Barry, MJ, Bennett, CL, Bravo, P, Steffensen, K, Gogovor, A, Graham, ID, Kelly, SE, Légaré, F, Sondergaard, H, Thomson, R, Trenaman, L., & Trevena, L. (2024). Decision aids for people facing health treatment or screening decisions. *Cochrane Database of Systematic Reviews*, (1). <https://doi.org/10.1002/14651858.CD001431.pub6>
- Stacey, D., Légaré, F., Lewis, K., Barry, M. J., Bennett, C. L., Eden, K. B., Holmes-Rovner, M., Llewellyn-Thomas, H., Lyddiatt, A., Thomson, R., & Trevena, L. Cochrane Consumers and Communication Group. (2017). Decision aids for people facing health treatment or screening decisions. *Cochrane Database of Systematic Reviews*, 2017(4). <https://doi.org/10.1002/14651858.CD001431.pub5>
- Statistics Netherlands. (2023). 3. *Migratie en Nederlandse taalvaardigheid* [Webpagina]. Centraal Bureau voor de Statistiek. <https://www.cbs.nl/nl-nl/longread/statistische-trends/2023/nederlandse-taalvaardigheid-van-migranten-en-hun-positie-op-de-arbeidsmarkt/3-migratie-en-nederlandse-taalvaardigheid>
- Suurmond, J., & Schouten, B. (2025). Chapter 19 Language difficulties: Healthcare provider-migrant patient communication. In G.-J. de Bruijn & H. Vande Bosch (Eds), *Health, media, and communication* (pp. 375–390). De Gruyter Mouton. <https://doi.org/10.1515/9783110775426-020>
- Teunissen, E., Gravenhorst, K., Dowrick, C., Van Weel-Baumgarten, E., Van den Driessen Mareeuw, F., de Brún, T., Burns, N., Lionis, C., Mair, F. S., O'Donnell, C., O'Reilly-de Brún, M., Papadakaki, M., Saridaki, A., Spiegel, W., Van Weel, C., Van den Muijsenbergh, M., & MacFarlane, A. (2017). Implementing guidelines and training initiatives to improve cross-cultural communication in primary care consultations: A qualitative participatory European study. *International Journal for Equity in Health*, 16(1), 32. <https://doi.org/10.1186/s12939-017-0525-y>
- Van der Horst, H. E., & de Wit, N. (2020). Redefining the core values and tasks of GPs in the Netherlands. *The British Journal of General Practice: The Journal of the Royal College of General Practitioners*, 70(690), 38–39. <https://doi.org/10.3399/bjgp20X707681>
- Van Lent, L. G. G., Yilmaz, N. G., Goosen, S., Burgers, J., Giani, S., Schouten, B. C., & Langendam, M. W. (2025). Effectiveness of interpreters and other strategies for mitigating language barriers: A systematic review. *Patient Education and Counseling*, 136, 108767. <https://doi.org/10.1016/j.pec.2025.108767>
- Van Weert, J. C. M., van Munster, B. C., Sanders, R., Spijker, R., Hooft, L., & Jansen, J. (2016). Decision aids to help older people make health decisions: A systematic review and meta-analysis. *BMC Medical Informatics and Decision Making*, 16(1), 45. <https://doi.org/10.1186/s12911-016-0281-8>

- Wammes, J. J. G., Jeurissen, P. P. T., Verhoef, L. M., Assendelft, W. J. J., Westert, G. P., & Faber, M. J. (2014). Is the role as gatekeeper still feasible? A survey among Dutch general practitioners. *Family Practice*, 31(5), 538–544. <https://doi.org/10.1093/fampra/cmu046>
- White, J., Plompen, T., Osadnik, C., Tao, L., Micallef, E., & Haines, T. (2018). The experience of interpreter access and language discordant clinical encounters in Australian health care: A mixed methods exploration. *International Journal for Equity in Health*, 17(1), 151. <https://doi.org/10.1186/s12939-018-0865-2>
- Wildenbos, G. A., Peute, L., & Jaspers, M. (2018). Aging barriers influencing mobile health usability for older adults: A literature based framework (MOLD-US). *International Journal of Medical Informatics*, 114, 66–75. <https://doi.org/10.1016/j.ijmedinf.2018.03.012>
- World Health Organisation. (2025). *Low health literacy is costing health*. <https://iris.who.int/items/6eb6f303-6389-4dba-ad36-6764e7fedc60>
- WHO. (2019). *WHO guideline: Recommendations on digital interventions for health system strengthening*. WHO.
- Würth, K. M. (2019). *What matters to patients and physicians in their cross-cultural clinical encounters: An ethnographic study and a medical ethics perspective* [Thesis]. University_of_Basel.]. <https://doi.org/10.5451/unibas-007123603>
- Zavala, V. A., Bracci, P. M., Carethers, J. M., Carvajal-Carmona, L., Coggins, N. B., Cruz-Correa, M. R., Davis, M., de Smith, A. J., Dutil, J., Figueiredo, J. C., Fox, R., Graves, K. D., Gomez, S. L., Llera, A., Neuhausen, S. L., Newman, L., Nguyen, T., Palmer, J. R., Palmer, N. R., ... Fejerman, L. (2021). Cancer health disparities in racial/ethnic minorities in the United States. *British Journal of Cancer*, 124(2), 315–332. <https://doi.org/10.1038/s41416-020-01038-6>
- Zendedel, R., Schouten, B. C., van Weert, J. C. M., & van den Putte, B. (2018). Informal interpreting in general practice: The migrant patient's voice. *Ethnicity & Health*, 23(2), 158–173. <https://doi.org/10.1080/13557858.2016.1246939>