

Image-e-cation: An Image-Centric Solution to Cross-Cultural Healthcare Communication

Veerraj Satish Chitragar¹, Shailesh Pawale¹, Nidhi S Chickerur¹, Radhika Amashi², Vijayalaxmi M¹

¹School of Computer Science and Engineering, KLE Technological University, Hubli

²Center for Engineering and Education and Research, KLE Technological University, Hubli

¹01fe22bcs164@kletech.ac.in

¹01fe22bcs174@kletech.ac.in

¹01fe22bcs114@kletech.ac.in

²radhika.amashi@kletech.ac.in

¹viju11@kletech.ac.in

Abstract—Effective communication plays a vital role in healthcare especially between the nurses and patients who are the primary stakeholders in the healthcare sector. However, language barriers can create communication difficulties leading to miscommunication and misunderstandings. To address this issue, we have developed a mobile application to facilitate communication through images as a part of a first-year course named “Design thinking for Social Innovation”. It features a wide range of images and diagrams that can be used to illustrate various medical conditions. The app heavily relies on visual diagrams like body diagrams (to identify the area of discomfort), when (referring to the number of days the patient is suffering from the particular medical condition or disease), problem duration (selecting a period in a day when the patient feels the pain is more), pain scaling illustrations (depicting the level of pain on a scale of 1 to 10) and to choose if they have any allergies. The app has a simple User Interface for patients to use. The Design Thinking Methodology was used to build the project starting from gathering requirements to developing a solution. The results of the study highlight that the solution can become a product to help nurses or any healthcare professionals diagnose and treat their patients more accurately, resulting in better patient outcomes.

Keywords—Enter Cross-cultural communication, Language Barrier, Design Thinking, Application, Awareness.

I. INTRODUCTION

Approximately 7,000 languages are spoken worldwide and in India alone other than the 22 official languages is a home to more than 1652 languages, each representing a unique cultural perspective (Leben, W. R. (2018)., n.d.). In a world that thrives on diversity, mastering the art of cross-cultural communication has become an indispensable skill for fostering understanding, building connections, and unlocking a world of opportunities. Cross-cultural communication basically refers to the exchange of information and ideas between people from different cultural backgrounds (G, 2021). In an increasingly interconnected world, effective cross-cultural communication skills are crucial for individuals and organizations to navigate diverse environments, foster understanding, and build successful relationships. The problems faced by cross-cultural communication are between

two individuals of different backgrounds. There are several problems encountered, such as Language Barriers (H Al Shamsi et al., 2020), Nonverbal Communication (P Ravi & HS Vethabothagam, 2021), Cultural Norms and Values (JK Fady, 2021), barriers might come from the patient, the doctor, and the nurses. There have been various suggestions for ways to enhance communication, and using translators has both benefits and drawbacks internationally (T Markova & B Broome, 2007). Once again, there are numerous issues that arise directly from the language barrier itself. These encompass Miscommunication (A Tiwary et al., 2019), Reduced quality of healthcare (H Al Shamsi et al., 2020), Medical Errors (D De Moissac & S Bowen, 2019), Lack of informed Consent (L Forrow & JC Kontrimas, 2017), Limited Patient Engagement (L Gerchow et al., 2021), Heightened work-related stress for nurses (A Squires, 2018). Collectively, these factors constitute a compilation of extensively documented challenges that stem from the existence of a language barrier. For instance, effective communication becomes imperative When families are vacationing in a foreign place and require medical treatment. Despite the existence of translation and language conversion tools, misunderstandings can still arise. This study introduces a mobile application designed to facilitate communication through images to mitigate such misunderstandings. The application aims to bridge the language gap between healthcare providers and patients by enabling the exchange of visual information. Through a user-friendly interface and an extensive image database, the application offers an intuitive platform for conveying medical symptoms, history, and concerns, thereby enhancing the accuracy of diagnosis and treatment. This study was conducted as a part of the first-year design thinking course for social challenge. During this course, authors visited different hospitals to understand and identify the social challenges healthcare professionals face. Out of many, the authors narrowed it down to the language barrier problem. The problem seems to be common worldwide and can mislead the nurses while treating the patients. Therefore, this study addresses this issue using the design thinking approach. Design thinking is a problem-solving methodology emphasizing a creative and innovative approach (MK Foster, 2021). Different

authors perceive the design thinking process differently such as
 “The process is firmly based on how you can generate a holistic

and empathic understanding of the problems people face” (RF Dam & TY Siang, 2021). “Design thinking can help organizations overcome rigid thinking patterns and foster a culture of continuous innovation” Section II briefly discusses a literature review on how various authors address the issue of language barriers. Section III discusses the study's methodology, followed by the results and discussions in Section IV and finally conclusion in Section V.

II. LITERATURE REVIEW

In the ever-evolving landscape of healthcare, the need for effective communication and cultural sensitivity has gained increasing attention. Several studies have delved into the intricate web of challenges posed by language and cultural barriers in healthcare settings, shedding light on potential solutions and strategies to improve patient care. Dr. Feroze Kaliyadan et al. investigated the feasibility of utilizing freely available GLT (Google Language Translator) tools to enhance doctor-patient interactions. The author conducted an empirical study involving patients and emphasized the potential of using online translation tools in clinical interactions. Even though translations provided by GLT may not always be entirely precise, they undeniably facilitate improved communication between doctors and patients (G Sreekanth, 2010). In their study, Jessica Anne Viveka and colleagues aim to gain a fresh view on the caring relationship between nurses and patients in situations where they do not share a common language. Their qualitative analysis, conducted through latent content analysis, brought to light the growing need for improving cultural competence within the healthcare sector (J.A.V Hemberg & S Vilander, 2017). Lalit Narayan et al. is dedicated towards tackling language barriers in healthcare in India. According to the author, the initial necessary step in addressing these challenges is raising awareness of the reduced healthcare outcomes in situations where there is a language mismatch. To address this issue, straightforward resources like clinical phrasebooks and patient information leaflets for educating people with various languages in the region can be readily created for common medical conditions and procedures (L Narayan, 2013). M. Jirwe, K. Gerrish and A. Emami worked on Student nurses' experiences of communication in cross-cultural care encounters. With the aim to explore student nurses' experiences of communication in cross-cultural care encounters with patients from different cultural backgrounds. An exploratory qualitative study was undertaken. Semi-structured interviews were conducted. In addition to ethnic background, students were selected because they had undertaken a course in transcultural nursing and had experience working in multi-cultural care settings, which they could draw upon during the interview (M Jirwe et al., 2010). Alberta Catherine Y et al. conducted a study addressing the issue of Cross-Cultural Relationships Between Nurses and Filipino Canadian Patients. Their aim was to explore and describe the culturally embedded values that play an implicit role in guiding interactions between Filipino Canadian patients and Canadian nurses, and how these values are important for enhancing

nurse-patient relationships. To achieve this, they conducted a focused ethnography, using a purposive sample of 23 Filipino Canadians who had received care in Canadian hospitals. Effectively communicating and providing care necessitates a deep understanding of various aspects of Filipino Canadians' cultural expressions, including language, nonverbal cues such as gaze and touch, as well as dietary preferences. By recognizing and respecting these cultural nuances, culturally safe nurse-patient relationships can be established and nurtured (ACY Pasco et al., 2004). Tehseen Ladha, et.al worked on Cross-cultural challenges between nurses-patients. They used the following tool for working with families and children. They adapted the LEARN (Listen, Explain, Acknowledge, Recommend, Negotiate) model, a framework which would help to build mutual understanding and enhance patient care. By recognizing and addressing cultural differences, healthcare experts can optimize patient care and promote inclusivity and understanding in medical encounters (T Ladha et al., 2018). Azar Gashasb et al. conducted a study on Cross-cultural care encounters in pediatric care, focusing on the experiences and expectations of minority ethnic parents in Swedish pediatric care. The data from this study were subjected to manifest content analysis. In a multi-ethnic society like Sweden, effective communication and increased parent satisfaction in cross-cultural care encounters can be taken care of with the help of improved language skills and the presence of multilingual nurses (AG Tavallali et al., 2017). Parveen Azam Ali et al. conducted an analysis of language barriers and their effect on healthcare provision for patients with limited English proficiency, as seen through the perspective of nurses. Their study aimed to delve into nurses' viewpoints regarding language barriers and their cons when caring for patients from diverse linguistic backgrounds. With the help of a thorough thematic analysis of the data, it was observed that language barriers, irrespective of the country or healthcare region, can significantly affect nurses' capacity to communicate effectively with their patients. This, in turn, can lead to various negative impacts such as compromising the delivery of appropriate, timely, safe, and effective care that aligns with the patients' specific needs (P.A. Ali & R Watson, 2018).

III METHODOLOGY

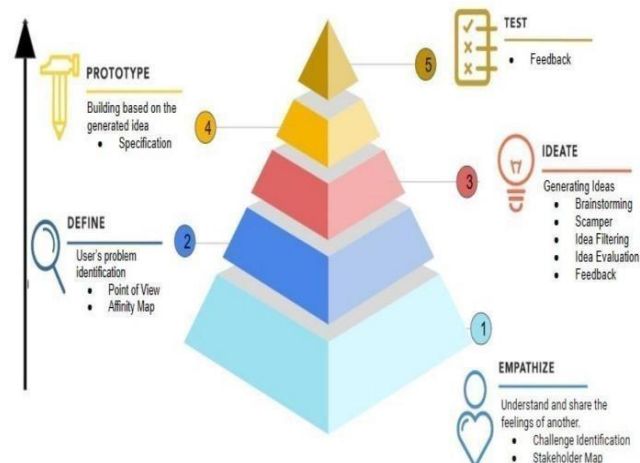


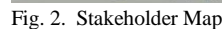
Fig. 1. Design Thinking Process

Design Thinking for social innovation is a compulsory 2 credit course offered to all first-year undergraduate students at KLE technological university. The course was delivered using the Project Based Learning (PBL) pedagogy. The course consisted of lectures, discussions and community visits. Community visits were important aspects of this course where students are expected to engage and identify the social challenges within the identified community. Course content and execution included the 5 phases of Design thinking, which are described in the below section.

The design thinking (DT) process strongly emphasizes empathy and user research to fully comprehend patients' cultural backgrounds and communication requirements (RF Dam & TY Siang, n.d.). In order to learn more about the cultural practices, beliefs, and preferences of patients, this phase entails conducting interviews, surveys, and observations. The participants of this study were the 10-15 nurses working at one of the multispecialty hospitals located in Hubballi. During this phase, authors of this paper visited the location to observe, engage and understand the problem faced by the nurses. A qualitative approach is used to frame the problem during the empathy and define phase of the DT process. Table I shows the open-ended questions posed to the participants. The interview responses were audio recorded during the process and further transcribed by the authors for analysis.

Sl.no:	Questions asked for stakeholders:
1	How do you feel while communicating with the patients?
2	What difficulties are encountered in communicating with patients and their relatives?
3	How do you deal with patients who don't understand your language?
4	What do you think must be our goal/priority in seeking a solution?
5	How do you feel while communicating with the nurses?
6	How do you deal with nurses who don't understand your language?

They are a visual representation that categorize the various stakeholders involved in the project. As shown in Figure 2: Primary stakeholders include Nurses and Mono Lingual Patients. Secondary stakeholders include Hospitals and NGO. Tertiary Stakeholders include Developer and Multi Lingual Individuals.



This is the second phase of the DT process in which the problem analysis and formation are done. The transcribed interview was analyzed using the affinity map and empathy map to identify the potential themes. Based on the participant's details and the themes generated the following problem definition was framed.

● Empathy Map

[illegible]

Affinity Map

Before beginning the affinity map creation process, an initial activity is conducted to list all possible problems. As a part of the affinity map creation process, these problems are then Challenges," "Goals and Needs of Nurses for Patients," and "Lack of Awareness."

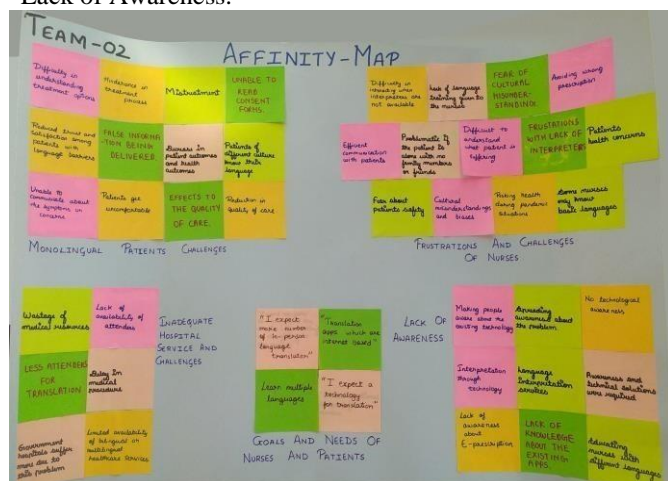


Fig. 4. Affinity Map

C. Ideate

The ideation phase concentrates on generation of multiple ideas based on POV. To generate multiple ideas, authors used the brainstorming technique followed by the SCAMPER technique.



Fig. 5. Brain Storming and Scamper

The ideas generated through brainstorming and SCAMPER as shown in the table. Considering POV as the starting point, this study's authors brainstormed possible ideas to address the problem. Around 28 ideas were generated as shown in Fig 5. Some of the ideas are as listed in the below table. To enhance the ideas further, SCAMPER technique was used to refine the ideas as shown in table-II.

TABLE-II SCAMPER						
Substitute	Combine	Adopt	Modify / Magnify / Maximize	Put into other use	Eliminate	Rework / Rearrange / Restore
Substitute (21) Use Google Translator	Combine (7) (20) (26) (30) Maximizing the hiring of medical interpreters and nurses who have knowledge about the local languages and local culture	Adopt (18) Map of the hospital's layout labelled in multiple languages, available in hard copy and soft copy in website for patient use	Modify (18) Localized names given to the diseases fixed by medicines (e.g : Paracetamol helps with fever, 25z C)	Put into other use (2) Utilize the various skills of the nurses in different work	Eliminate (27) Explaining the staff about basic sign language through interactive online sessions	Reuse (8) Create a website for tracing nearby hospital locations

TABLE-III Idea Evaluation: Factors versus Suitability											
Criteria	Ranking (1 to 5)	Spreading awareness about the seriousness of the problem through social media and by disturbing pamphlets		Use google translator		Setup a volunteering system for translation		Sharing the QR code of the app and stick it at entrance of the hospital		Development of an app (usage of medical videos and pictures by patients to explain nurses about their problems)	
	A	Score B	C = A * B	Score D	C = A * D	Score E	C = A * E	Score F	C = A * F	Score F	C = A * F
Capability	5	3	15	4	20	2	10	4	20	5	25
Affordability	4	3	12	5	20	5	20	4	16	5	20
Longevity	3	2	6	4	12	3	9	3	9	4	12
Adoptability	5	3	15	4	20	4	20	5	25	4	20
Reachability	3	4	12	5	15	3	9	5	15	5	15
Total		X	60	X	87	X	68	X	85	X	92
Selected Idea is:								Development of a translating application			

FINALIZED IDEAS	
Sl.no:	Finalized Ideas
1	Spreading awareness about the seriousness of the problem through social media.
2	Set up a volunteering system for translation.
3	Use google translator.
4	Share the QR code of the app and stick it at the entrance of the hospital.
5	Development of app.

Around 28 ideas were generated. Some of the ideas are as listed in the table IV. All ideas generated through brainstorming and scampering were filtered using the "Impact vs Feasibility" tool. It is a 2-dimensional plane divided into 4 quadrants as shown in the table V.

The first quadrant (Can be chosen) consists of the ideas those have high impact on solving the problem but are low feasible; the second quadrant (Yes) consists of the ideas that have high impact to solve the problem and are high feasible, the third

quadrant (No) consists of the ideas which have a low impact on the problem and are low feasible and the fourth quadrant (Maybe) consists of the ideas which have a low impact on the problem but are highly feasible to implement. All ideas were filtered by assessing every idea for its feasibility and impact. The ideas that fall in the second quadrant-"Yes" are selected for the evaluation process to select one finalized idea. The below table II shows the list of finalized ideas for evaluation of the selected ideas, following criteria's such as Capability, Affordability, Longevity, Adaptability and Reachability was selected based on the POV statement and the applicability. All the selected ideas were evaluated using the "Factor vs Suitability" tool. Each factor is assigned a weigh between 0-10 based on its suitability to the idea generated. The results are often displayed on a map that is used to highlight areas from high to low suitability depending upon various factor. Figure 7 shows the process of idea evaluation. It is seen that the idea is selected as a finalized idea due its high score.

TABLE-V IDEA FILTERING VERSUS FEASIBILITY MATRIX			
Degree of Impact	High Impact	<ol style="list-style-type: none"> 1) A separate call service number for information. 2) Create a bicultural environment to avoid discomfort for patients. 3) Encouraging the use of electronic prescribing. 4) Spread awareness about many channels on YouTube, teaching different languages. 5) Knowledge provided to the common folk about the basics of medical procedure (for cooperation). 6) Explaining the staff about basic sign language. 	<ol style="list-style-type: none"> 1) Set up a volunteering system for translation 2) Use Google Translator 3) Share QR code of an app and stick it at entrance of hospital 4) Spreading awareness about the seriousness of the problem through social media and by distributing pamphlets 5) Development of an application (usage of medical videos or pictures by patients to explain the nurses about their problem)
		High Impact & Low Feasibility	High Impact & High Feasibility
	Low Impact	<ol style="list-style-type: none"> 1) Avoid asking family members to translate to avoid miscommunication. 2) Segregation of attenders for various for various situations 3) Avoid Idioms, Slangs and Jargon (Confusion) 4) Maximizing the hiring of medical interpreters and nurses who have knowledge about the local languages and cultures 5) Having a comprehensive language access 6) Hospital should implement a technology which converts voice into sign language 	<ol style="list-style-type: none"> 1) Localized names given to the diseases fixed by medicines (e.g.: Paracetamol helps with fever, $\approx \# \odot$) 2) Utilize the various skills of the nurses in different departments 3) Create a website with some interactive language sessions 4) Map of the hospital's layout labelled in multiple languages available as hard copy and soft copy in website for patient use
		Low Impact & Low Feasibility	Low Impact & High Feasibility
	X	Low Feasibility	High Feasibility
Feasibility			

IV RESULTS

A. Prototype

Prototypes of the suggested communication solutions are created at this phase. These prototypes might be anything from interactive technology that promote comprehension and conversation to communication aids like visual instructions or multilingual materials. We came up with a finalized solution of building a 100% image-based offline application to solve this issue. In order to obtain input and iteratively improve the solutions, the prototype was tested with a number of patients and nurses. Image-e-cation is our concept of an application that could potentially help in avoiding the issues caused by cross-cultural communication. Due to the difference in problems faced by the two genders we have a gender selection slide. On carefully selecting the type of body part, the type of problem and duration of the problem, the data is recorded and displayed on the next slide for the nurse's understanding and is submitted to the doctor for further treatment. This is how the application helps to minimize the communication between the nurses and the patient. The app is designed to overcome communication obstacles like language barriers between nurses and patients who speak different languages. It features a wide range of images and diagrams that can be used to illustrate various medical conditions. The app heavily relies on the visual diagrams like body diagrams (to identify the area of discomfort), since when (referring to the number of days the patient is suffering from the particular medical condition or disease), problem duration (selecting a time period in a day when the patient feels the pain is more), pain scaling illustrations (depicting the level of pain on a scale of 1 to 10) and to choose if they have any allergies. All these functions add up to 19 slides of the app and its wireframe is supported by Adobe XD.

TABLE-VI

List of Questions asked for Feedback

Question Asked	Feedback from Stakeholder
1.How do you think that the idea will help in solving the problem?	By showing the images it is easy to recognize the patient's problem and to treat accordingly.
2.What are your opinions on the idea?	It's creative and helpful to understand the patient's situation.
3.Which feature in the idea do you think will be most helpful and why?	Images and emojis are helpful for understanding the patients' medical condition easily.
4.What suggestions would you provide to improve the idea?	To ask about which allergies does the patients have.
5.Are there any features to which you feel was unnecessary?	No all the features were necessary.
6.What do you think might be some necessary features that are missing in the idea?	The translation of prescription and food diet manually input by the doctors/nurses.
7.What are the impacts you are expecting through the idea as a solution?	This is the best way that people can understand and give us the correct way of their illness.

8.What do you think might be other alternative ideas to solve the problem?	Other alternative idea like google translation will be solve the problem.
9. Do you have any questions related to the idea?	Yes, I have one question" If the patient has vision problem". Ans: This is one of the drawbacks our app and the solution is we can take help of the attenders in such situation.

B. Testing

Testing the prototype is a critical step in the Design Thinking process, involving user interaction to collect feedback on the prototype. We conducted a survey in which nurses evaluated the application and provided insights as shown in the fig 6. The survey comprised essential questions about the application. Table VI comprises collective information for the given questions. The nurses told us that "The application is very good." "The images are very good and properly express the physical condition of the patient." On the nurse's advice we created a page to indicate the allergies. They said "This application can be a great help to numerous nurses, and the patients can express better through pictures rather than explaining the severity of pain in the different parts of the body."

And as shown in table VI. one major drawback is that the visually impaired cannot use this application.



Fig-6: Live testing of the application.

V CONCLUSION

Cross-cultural communication is a significant problem, incorporating several challenges. Among these, the language barrier stands out as a prominent issue in cross-cultural communication. This challenge emerges when two individuals of distinct languages attempt to interact. "Image-e-cation," developed as a mobile application, was proposed to address this problem. The application is designed using the design thinking approach. This application is entirely based on images. It incorporates a gender selection feature, recognizing the differing challenges faced by each gender. The application has been tested with several nurses and patients and found effective in usage. Because of its image-based nature, this application provides collaborative efforts between doctors, nurses, and patients, creating an environment to provide precise outcomes. This application is an effort to eliminate the issue faced by numerous people in the healthcare community.

REFERENCES

- 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.
- 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.
- Dam, R. F., & Siang, T. (5). Stages in the design thinking process. Interaction Design Foundation.
- De Moissac, D., & Bowen, S. (2019). Impact of language barriers on quality of care and patient safety for official language minority Francophones in Canada. *Journal of Patient Experience*, 6(1), 24-32.
- Dunne, D. (2018). Implementing design thinking in organizations: An exploratory study. *Journal of Organization Design*, 7(1), 1-16.
- Fadyl, J. K. (2021). How can societal culture and values influence health and rehabilitation outcomes? *Expert Review of Pharmacoeconomics & Outcomes Research*, 21(1), 5-8.
- Forrow, L., & Kontrimas, J. C. (2017). Language barriers, informed consent, and effective caregiving. *Journal of general internal medicine*, 32, 855-857.
- Foster, M. K. (2021). Design thinking: A creative approach to problem solving. *Management Teaching Review*, 6(2), 123-140.
- Gerchow, L., Burka, L. R., Miner, S., & Squires, A. (2021). Language barriers between nurses and patients: A scoping review. *Patient education and counseling*, 104(3), 534-553.
- Groeger, L., Schweitzer, J., Sobel, L., & Malcom, B. (2019, June). Design thinking mindset: Developing creative confidence. In *Academy of Design Innovation Management Conference 2019*.
- Hallenbeck, J. (2006). High context illness and dying in a low context medical world. *American Journal of Hospice and Palliative Medicine*, 23(2), 113-118.
- Hallenbeck, J. L. (2022). *Palliative care perspectives*. Oxford University Press.
- Hemberg, J. A. V., & Vilander, S. (2017). Cultural and communicative competence in the caring relationship with patients from another culture. *Scandinavian journal of caring sciences*, 31(4), 822-829.
- Interaction Design Foundation, Dam, R. F., & Siang, T.
- Jirwe, M., Gerrish, K., & Emami, A. (2010). Student nurses' experiences of communication in cross-cultural care encounters. *Scandinavian journal of caring sciences*, 24(3), 436-444.
- Ladha, T., Zubairi, M., Hunter, A., Audient, T., & Johnstone, J. (2018). Cross-cultural communication: Tools for working with families and children. *Pediatrics & Child Health*, 23(1), 66-69.
- Leben, W. R. (2018). Languages of the World. In *Oxford Research Encyclopedia of Linguistics*.
- Markova, T., & Broome, B. (2007). Effective communication and delivery of culturally competent health care. *Urol Nurs*, 27(3), 239-242.
- Narayan, L. (2013). Addressing language barriers to healthcare in India. *National Med J India*, 26(4), 236-8.
- Okpala, P. (2021). Addressing power dynamics in interprofessional health care teams. *International Journal of Healthcare Management*, 14(4), 1326-1332.
- Pasco, A. C. Y., Morse, J. M., & Olson, J. K. (2004). Cross-cultural relationships between nurses and Filipino Canadian patients. *Journal of Nursing Scholarship*, 36(3), 239-246.
- Ravi, P., & Vethabothagam, H. S. (2021). Significance of Non-Verbal Communication in Effective Healthcare Management. *Telecom Business Review*, 14(1).
- Rivenbark, J. G., & Ichou, M. (2020). Discrimination in healthcare as a barrier to care: experiences of socially disadvantaged populations in France from a nationally representative survey. *BMC Public Health*, 20(1), 1-10.
- Sofaer, S., & Firminger, K. (2005). Patient perceptions of the quality of health services. *Annu. Rev. Public Health*, 26, 513-559.
- Squires, A. (2018). Strategies for overcoming language barriers in healthcare. *Nursing management*, 49(4), 20.
- Sreekanth, G. (2010). The use of Google language tools as an interpretation aid in cross-cultural doctor-patient interaction: a pilot study. *Informatics in primary care*, 18(2), 141-43.
- Tavallali, A. G., Jirwe, M., & Kabir, Z. N. (2017). Crosscultural care encounters in paediatric care: Minority ethnic parents' experiences. *Scandinavian journal of caring sciences*, 31(1), 54-62.
- Tiwary, A., Rimal, A., Paudyal, B., Sigdel, K. R., & Basnyat, B. (2019). Poor communication by health care professionals may lead to life-threatening complications: examples from two case reports. *Wellcome open research*, 4. [13] 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.
- Tutunea, G. (2021). *Acquiring Intercultural Communicative Competence through Virtual Exchange*. Acta

