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Global Health Communication: Linguistics Strategies for Translating English Medical Texts into Urdu

Khalid Ahmed [1*] , ***Muhammad Haroon Rasheed*** [2] , ***Irfan Abbas*** [2,3], ***Badriah Khaleel*** [4] , ***Naveed Ahmad Khan*** [2], ***Ruqia Saba Ashraf*** [5], ***Muhammad Asad Habib*** [6]

[1] *Faculty of Education and Liberal Arts (FELA), INTI International University, Nilai 71800, Malaysia*

[2] *Department of English, University of Central Punjab, Lahore 5400, Pakistan*

[3] *Department of Linguistics, University of Southern Maine, Gorham, ME 04038, USA*

[4] *Department of Applied Linguistics, Kinnaird College for Women University, Lahore 5400, Pakistan*

[5] *Department of English, The Women University, Multan 60500, Pakistan*

[6] *Department of English and Literature, The University of Lahore, Lahore 5400, Pakistan*

ABSTRACT

This study explores the linguistic strategies of translation of Patient Information Leaflets (PILs) from English to Urdu language to enhance global health communication. The theoretical framework of the study is based on Skopos Theory and Nida's Dynamic Equivalence, addressing linguistic complexity and cultural adaptation. Medical translations must balance technical accuracy with accessibility to ensure that non-specialist readers understand crucial healthcare information that is essential for human health. This research analyzes four PILs translated into Urdu to evaluate strategies such as paraphrasing, restructuring, selective omission, and addition. The findings of the study suggest that these techniques enhance readability while maintaining the functional purpose of medical texts. The study highlights how cultural adaptations, including region-specific terminology and tone adjustments, improve comprehension and enhance patient adherence. The comparative analysis demonstrates that Skopos-aligned translation strategies successfully adapt medical content to different linguistic and cultural contexts. Furthermore, the research emphasizes the importance of maintaining medical accuracy while simplifying

*CORRESPONDING AUTHOR:

Khalid Ahmed, Faculty of Education and Liberal Arts (FELA), INTI International University, Nilai 71800, Malaysia;
Email: khalid.ahmed@newinti.edu.my

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language to ensure that health communication remains effective. By integrating Skopos Theory's purpose-driven approach with Nida's focus on audience reception, this study provides a comprehensive framework for the translation of medical texts for global audiences. The findings have implications for medical translation, health literacy, and patient safety, emphasizing the need for communication that is both culturally and linguistically appropriate.

Keywords: Human Health; Patient Information Leaflets; Medical Translation; Skopos Theory; Cultural Adaptation; Dynamic Equivalence

1. Introduction

Patient Information Leaflets (PILs) are an essential means of communication between medical practitioners and patients, helping to explain details about medication and treatment procedures to patients among other usage instructions, in today's healthcare system. Included in these documents is health-based knowledge that creates better treatment adherence, increases patient trust and decreases the occurrence of medical error[1]. Health literacy and patient-centered communication are essential and PILs have become indispensable tools necessary to achieve this[2].

The cultural relevance in combination with ease of understanding these documents remains a challenge for the Product Information Leaflets while catering to varying consumer demands in the international markets. PIL instructions resulting in clear communication lead to greater patient satisfaction and better health outcomes combined with lower medical expenses[3]. Producing patient instructions that are universally understood and culturally adapted for use by health organizations worldwide is extremely difficult.

Inevitably, medical texts have inherently complex structures containing specialized terminology, multiple passive constructions, and extended sentences, which may all lead to difficulties when being understood by readers[4]. The imbalance between linguistic patterns and medical terminology presents a much bigger challenge for translators to make medical documents in different languages. Cultural differences in health beliefs and understanding of medications add an additional obstacle of having to translate medical text as well. There are different ideas of disease treatment based on the group-oriented societal structures that are based on shared decision-making approaches against self-oriented places which maintain individual decisions[5].

The implications of inadequately translated Patient Information Leaflets run far and wide and they are both significant. Misinformed drug use, caused by misinterpretations of medical instructions opens the way for harmful drug reactions, and subsequently patients begin to distrust healthcare providers. Miscommunication causes organizations to violate regulations and sustains business damage which leads to legal risks and financial burdens[6]. Both linguistic precision and cultural appropriateness require an interdisciplinary approach to dealing with these problems.

In the field of translation studies, Hans Vermeer's Skopos theory does reshape the way it is conceived mainly through bringing the intended purpose (or 'skopos') of a translation as the chief standard of evaluation[7]. The idea here is that Skopos theory pays heed to both literal equivalence and communicative goal of the original and its context of realia, whereas traditional models rely upon literal equivalence alone. Dynamic equivalence, according to Eugene Nida bases its theory on translations' emotional and cognitive effects; therefore, it coexists with Skopos theory. This process, named dynamic equivalence strives to generate responses in the target text corresponding to the effects which a written source text has on the readership of its native language[8]. When professionals process PIL documents, they must keep a correct textual appearance and adapt document structure and tone to cultural and emotional needs of the recipients.

In this study, Skopos theory and Nida's translating principles are used to demonstrate how Patient Information Leaflets (PILs) may be provided to international readers more effectively by solving local cultural and language barriers. This research aims to find out how to simplify medical terminology to facilitate transfer to a non-specialist audience, to examine how cultural adaptation impacts on patient information leaflet translations and whether the Skopos translation strategies are efficient to fulfill their communication target. Thus, the set objectives for the research project are followed by paving practical solutions with current theories to increase the clarity and accessibility of medical texts to

meet appropriate cultures and to ensure better understanding and adherence among international patient groups.

This study explores strategies for simplifying medical language in Patient Information Leaflets (PILs) to enhance accessibility for non-specialist readers. Techniques like paraphrasing, restructuring, and selective omission help maintain accuracy while improving clarity. It also examines cultural adaptations in translations, ensuring linguistic and social relevance to enhance patient comprehension and adherence. Additionally, the study evaluates Skopos-driven translation strategies, which prioritize the functional purpose of PILs. By analyzing real-world examples, this research highlights the effectiveness of purpose-oriented translation in balancing clarity, cultural relevance, and medical accuracy to improve global health communication.

2. Literature Review

Translation of medical texts is a tricky business, because medical language can be linguistically complex and technical, and the text needs to be understood by the audience. Translators must contend with medical terminology that is highly contextual: Latin and Greek, complex abbreviations, acronyms, and all with a strong mandate to preserve the source content. Medical terminological inconsistency, as well as the cultural differences that make it hard to translate the jargon properly, are emphasized by studies[9,10]. The emphasizes the importance of linguistic and cultural knowledge to navigate terminological challenges effectively[11]. He identified the specialized difficulties created by medical terminology, because its structures remain rigid and originate from Greek and Latin sources. The adaptation of technical terms into more comprehensible language for lay audiences[12]. Computer-aided translation has also been demonstrated to increase accuracy and reduce errors during translation processes[13].

Effective translation of medical texts into different languages demands sensitivity toward cultural differences among audiences. The cultural competence as a key element in dealing with audience specific requirements like different literacies and cultural expectations[14]. The usability strategies, such as simplifying language and tailoring content to enhance accessibility[15]. Recent studies highlight how linguistic choices shape societal perceptions in sensitive contexts: The stigmatizing language in Pakistani rape judgments[16], However the politeness strategies in ESL learners' disagreements. Parallel work on manipulative advertising[17]. The commercial discourse reinforces gendered and youth-targeted norms. Together, these findings underscore the critical role of linguistically and culturally adaptive communication[18,19].

Skopos theory plays a very important role in healthcare, advocating an audience-based, purpose-driven approach to translation. According to Reiss et al.[20], translation strategies stem from their intended function called "Skopos." Their research showed how translations must fit functional requirements of their audience which remains central to practicing PIL adaptations. From a medical perspective, the theory has to do with this need for translation in medical settings to be done for end users, healthcare professionals, or patients as dictated by their needs[21]. According to studies, Skopos principles are attested as a tool that enhances communication effectiveness through a fit between translation strategies and the intended function of the text[22]. The system has played a crucial role in the translation of patient information leaflets in which cultural and context-related issues matter most. Moreover, studies indicate that human-to-machine translation demonstrates that Skopos-aligned strategies are effective in dealing with dynamic equivalence problems in medical translation[23]. Thanks to its flexibility, Skopos theory can be successfully applied in different domains, like education and legal translation, thus proving its wider application[24].

Cultural and linguistic barriers have a profound impact on patients' comprehension as well as adherence of the medical instruction. These barriers can lead to misunderstandings and poor compliance due to disparities in health literacy and different cultural interpretations of medical terms. The concept of dynamic equivalence by stressing cultural appropriateness and comprehension in translations targeted at specific audiences[25]. The underlying concept serves as a key tool to create present-day methods which tackle cultural and linguistic problems found within medical literature. The linguistic translation requires consideration of cultural context, as translation errors emerge from cultural misalignment[26]. Larson established principles that guide recent methods of blending cultural adaptations with medical translations through Skopos-aligned translations. A translation should prioritize cultural relevance and effectiveness

in the target context over strict linguistic equivalence [27]. The expounds on why culturally sensitive translations are necessary to bridge the gaps in understanding [28]. Adapting to idiomatic expressions, metaphors, or culturally specific references can be difficult for translators to ensure that the translation is relevant and clear [29]. In addition, translations that already integrate cultural adaptation of visuals and examples integrated into them have proven to increase patient engagement and adherence [30]. To address such barriers, a multidisciplinary approach bridging the language problem faced by translators and cultural competency to translate cross-cultural medical discourse is demonstrated by studies [31]. Medical text translation thus calls for a process that can manage complexity of the language and keep the level of precision, responding to various cultural linguistic requirements. By contributing to knowledge on medical translation, this study intends to explore language adjustment, usability and adaptation of cultural nuances in translated texts.

3. Theoretical Framework

The theoretical framework for this research is anchored in two key translation theories: Skopos Theory and Nida's Theory of Dynamic Equivalence. Together, these theories provide a solid foundation for analyzing translation strategies and decision-making processes.

3.1. Skopos Theory

Skopos theory, proposed by Hans Vermeer, reflects the functionalist approach by indicating the meaning (or purpose) of the translation (i.e., Skopos) as the main determinant for the choice of the translation strategies [32]. According to Skopos Theory, translators should focus their efforts on conveying the message and its appropriate context rather than relying on word-for-word translation [7]. Experts in translation studies research assert purpose driven methods aid translators to better adjust the content to fit a cultural situation and to adjust their method of translation [33].

Scholars like Nord [7] added to the theory by outlining how translators work as bridges between cultures while staying true to Skopos Theory's practical focus. Furthermore, Reiß and Vermeer explain that cultural differences between texts make the functional domain even more critical. This is because it's more important to keep the text's meaning intact than to get every single word exactly right. This flexibility guarantees that translations attain the communicative aim with great variability of linguistic structures among languages (Pym, 2014).

3.2. Nida's Theory of Dynamic Equivalence

The Theory of Dynamic Equivalence of Eugene Nida was based on striving for an equivalence of meaning and effect where the target text has the same effect on the target audience as the source text does on the source audience [25]. According to Nida, translation is essentially a communicative act, and it should convey a natural message to the target audience, bearing in mind audience's language and cultural context. This theory connects translations' linguistic and sociocultural aspects, for example, to situations where audience receptivity prevails.

The implications for translator decision making in political or ideological thornier contexts [34]. Nida's translation studies from the early days of modern translation theory have been the champion of the principle of 'closest natural equivalent,' which proved to be very functional in translation studies, informing both practical approaches to translation and theoretical discussions on translation faithfulness and creativity [33].

By integrating together Skopos Theory and Nida's Theory, we achieve a comprehensive translation framework that combines purpose driven strategies with audience and cultural sensitivity. This approach emphasizes the balance between functioning and equivalence when a translation meets communicative, cultural, and functional goals in heterogeneous situations.

4. Methodology

4.1. Study Design

Through a qualitative research methodology, this study examines how Patient Information Leaflets (PILs) adapt to global audiences under Skopos Theory alongside Nida's Theory of Translation Studies. This research used four PILs which were taken from well-reputed online medical websites as its data source. Through examining translated leaflets researchers determine linguistic and cultural changes enabling efficient message delivery to different audience groups.

4.2. Data Collection

Four PILs were obtained from medical websites, consisting of medical information about the children's medicines. Researchers chose these leaflets to display a comprehensive range of translation difficulties and solutions. The study analyzed both original and translated healthcare documents side by side. **Figure 1** shows overall methodology overview.

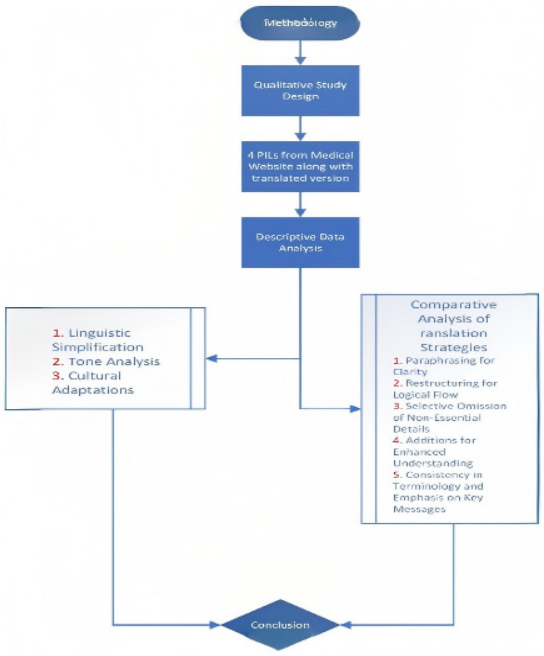

Figure 1. Research Methodology Overview.

4.3. Data Analysis

The analysis was conducted using the following methods:

4.3.1. Textual Analysis of Pils

A textual analysis method evaluated linguistic and structural properties of PILs in both source and target languages. By evaluating medical discourse transition into lay language, this analysis measures simplification using methods such as short sentences as well as basic vocabulary while utilizing clear formatting. The study assesses translation tone to maintain professionalism and friendliness while emphasizing the use opolite instruction language. The review process confirms that region-specific and culturally sensitive references undergo appropriate adjustments, including adaptations of examples and metaphors with accurate cultural imagery modifications.

4.3.2. Comparative Analysis of Translation Strategies

The comparative analysis evaluated translation approaches used to convert the PILs to suit distinct audience requirements. Through comparing original texts with their translations, the analysis reveals translation tactics which use omission alongside addition and incorporate paraphrasing with structural modifications. The research demonstrates that these translation strategies function to enhance document clarity and improve accessibility for readers. The evaluation process determines whether the translation text meets the practical objectives of Patient Information Leaflets in providing patient education through information, warnings, or guidance delivery. The evaluation looked at how significant information in the translated materials was emphasized and rearranged to boost readers' understanding.

4.3.3. Limitation

This research identifies potential limitations which consist of both its limited four PIL sample size and qualitative analysis subjectivity. Subsequent studies should enlarge their data set and investigate quantitative assessment tools for strengthening research conclusions. The analysis is subjective, based on the researcher's perspective which limits the clarification of the study. A multi-perspective approach, combined with suitable analytical tools, can enhance the reliability of the analysis and its results.

5. Linguistic Simplification

Translation of patient information leaflets is a vital process and linguistic simplification of these leaflets is one of its integral parts to make PILs accessible to the audiences who differ in literacy level. The translations are effective in simplifying complex medical jargon across the four leaflets while keeping meaning and function of the original English text.

Analysis shows that medical jargon in the original English leaflet like 'non-steroidal anti-inflammatory drugs (NSAIDs)' and 'thermostat in the brain' has made its way into the Urdu translation. To make technical terms understandable to a lay audience, the Urdu text uses clear explanations, such as " دیز آئی- اے - ایس - این ڈرکس انفلامیٹری اینٹی سیڑائیڈل نان ." Besides, the translation has avoided complex structures and uses short sentences and easy vocabulary for

good accessibility.

Urdu translations of instructions for use, including "Measure liquid doses carefully," are rendered in plain and concise Urdu as " اس سیرپ کی مقدار کو اچھی ح طر ناپ لیں." This is an example of using plain language techniques to ensure readers of limited health literacy can understand the information even more effectively.

6. Tone Analysis

In both the original and translated leaflets, tone remains professional, but approachable. In the English version, clear and polite imperatives, like 'Do not give your child two doses to make up for one missed dose,' are faithfully preserved in Urdu as "پلائیں نہ کر ملا خوراکیں دو سے خوراک ہوئی چھٹی کو. بچے اپنے بھی کبھی"

This allows for the use of culturally respectful phrasing in Urdu, like "کریں بات سے دواساز یا ڈاکٹر اپنے." This ensures the message's tone aligns with Urdu readers' cultural and linguistic expectations. Further besides, the translation carries an assuring tone in some patches that talk to side effects or safety precautions, allay the fears of the target audience emotionally.

7. Cultural Adaptations

The translation into Urdu is a result of thoughtful cultural adaptations. In all four leaflets, poison control numbers are adapted for Urdu speaking audiences to ensure that the leaflets remain useful for the target audience. However, discussions regarding the effectiveness of cephalexin on birth control pills uses culturally acceptable language in context of the norms of society to discuss reproductive health.

The language avoids words that might be misread or cause discomfort, addressing cultural sensitivity. The translated leaflet retains the contents of the original leaflet retaining the overall theme of it while cultural norms of Urdu speaking are respected.

8. Comparative Analysis of Translation Strategies

Patient Information Leaflets (PILs) translation strategies are key features of adapting PILs for global audiences. According to Skopos Theory, the main purpose of translation is to ensure that the target text letters serve the functional purpose of the source text letters, which very often makes it permissible to make flexibility in the choice of linguistic and structural devices. Examination of the Urdu translations of the four PILs reviewed shows that the translators have applied paraphrasing, restructuring, selective omission and addition successfully to make the language clear, readable and culturally aligned.

8.1. Paraphrasing for Clarity

The most utilized strategy in translations is paraphrasing, which involves rewriting very complex or technical phrases from the source text in less bothersome language while retatining the original meaning.

The English instruction, "Shake suspension well before use," is translated as "استعمال سے پہلے سسپنشن کو اچھی طرح بلالیں." The paraphrasing simplifies the sentence structure, making it easier for a broader audience to understand, while retaining the imperative tone that underscores the importance of the action.

"Your doctor or asthma nurse may give you a spacer device to use with your child's inhaler" is paraphrased as "ہے سکتا دے اسپیسرطریقہ ایک نرس یا ڈاکٹر کا آپ لیے کے کرنے استعمال کو انہیلر کے بچے کے آپ." It translates the term "اسپیسرطریقہ," conveying its purpose in a culturally familiar way, without burdening the reader with unnecessary technicalities.

Furthermore, paraphrasing is helpful in dealing with the limited technical vocabulary available in the target language, so that target language readers can access text while also maintaining informational integrity.

8.2. Restructuring for Logical Flow

Restructuring means reordering information so that the sequence of information can easily be read and understood, something important for audiences with varying reading abilities and methodologies.

Instructions about missing doses and overdose are initially presented separately, but in the Urdu translation, related information is reorganized together. For instance, "Give the missed dose as soon as you remember" and "Do not give two doses at once" are consolidated under a single heading, "کرنا چاہیے کیا تو جائے چھوٹ خوراک کی بچے کے آپ اگر," creating a

more cohesive narrative.

In the Urdu version, the language of explanation of how to administer liquid medicine is restructured as a clear sequence of steps from the English version. Through this restructuring it makes the instructions practical for caregivers.

The translations reorganize content such that the reading patterns of Urdu speaking audiences, which may favour stepwise, easily navigable instructions may benefit.

8.3. Selective Omission of Non-Essential Details

Selective omission entails leaving out details that are not directly relevant to the target audience, or that will confuse the audience without adding value.

The English text says, "Keep fluticasone at room temperature in a cool, dry place away from sunlight." The specific 'cool, dry place' instructions are left off the Urdu translation and are simplified to " درجہ کے کمرے کو سون فلوٹیکا رکھیں پر حرارت." However, doing so it loses specificity, but at the same time avoids bombarding those who do not comprehend the technicalities of ideal storage conditions.

The Urdu translation also omits information about the manufacturing origins of NSAIDs as it is not necessary for the audience's knowledge of how and when to use the medicine and its safety.

These omissions are an audience centered approach focusing on the most important information and eliminating potential distractions.

8.4. Additions for Enhanced Understanding

Translations in some cases add in clarifications to clarify ambiguity in source text. These additions give us a surety that the target language conveys the intended message.

The English text advises, "Shake the bottle well before each dose." The Urdu translation expands this instruction to " بوتل ہوئی دی کی دواساز یا چمچ خاص ہلائیں۔ طرح اچھی کو بوتل تو ہو رہا لے میں شکل کی مائع سیفالیکسن بچہ کا آپ اگر کریں پیمائش کی دوا سے." This elaboration emphasizes the correct way to measure doses in order to reduce the possibility of wrong use.

These additions are very useful for creating context and situation tuned translations, especially when dealing with new audience for original medical text. With these rewritten materials, parents can more effectively select the correct healthcare options for their kids, as the materials give clear explanations.

8.5. Consistency in Terminology and Emphasis on Key Messages

Translations present a regular attempt to standardize medical terminology and give emphasis on safety instructions.

In all leaflets, terms such as "NSAIDs," "antibiotics," and "seizures" are retained, but put into context appropriate to the target audience. For example, "seizures," which is always translated as "ےرود," a known concept in Urdu.

Each leaflet has bold vital instructions, like to watch out for double dosing and to make sure you take the full course of antibiotics. Take a closer look at "Do not stop giving this medicine without consulting your doctor," which is translated into Urdu as " کریں بات سے ڈاکٹر اپنے پہلے سے روکنے ,"استعمال کا دوا اس سے وجہ بھی کسی while preserving the urgency and importance of the statement.

9. Result Interpretations and Discussion

The Skopos theory approach to translating Patient Information Leaflets (PILs) emphasizes the importance of adapting medical texts to meet the practical needs of target audiences. An analysis of four Urdu translations of PILs highlights how various translation techniques, such as linguistic simplification, tone adjustments, cultural adaptations, and content restructuring, enhance the effectiveness of medical communication. This discussion explores the significance of these adaptations, their impact on readability and comprehension, and their alignment with the core goal of Skopos theory: ensuring that translations serve their intended purpose for the target audience.

One of the key features of the translated PILs is the simplification of complex medical terminology to accommodate readers with varying levels of health literacy. By replacing highly technical terms with clear, explanatory phrases, the translations ensure that the information remains accurate while being more accessible. The use of shorter sentences and simpler vocabulary further enhances readability, making the instructions easier to follow for a broader audience.

This focus on plain language aligns with the functionalist approach of Skopos theory, which prioritizes comprehensibility over rigid adherence to the original text structure.

Maintaining a professional yet approachable tone in the translations helps make the PILs both informative and reassuring. The Urdu translations effectively retain the instructional nature of the original text while incorporating culturally appropriate phrasing that aligns with audience expectations. Additionally, using a reassuring tone, especially in sections about safety precautions and potential side effects, helps ease concerns and build trust in the medication. This approach reflects an awareness of the importance of cultural sensitivity in medical translations, a critical factor in making health information accessible to diverse audiences.

Cultural adaptations play a crucial role in ensuring that the translated PILs remain relevant and practical for their intended audience. For instance, replacing poison control hotline numbers with locally available emergency contacts makes the information more actionable for Urdu-speaking readers. Similarly, sensitive topics, such as the impact of certain medications on reproductive health, are addressed in a way that respects cultural norms while still conveying essential information. These modifications align with the principles of Skopos theory, which emphasize tailoring translations to fit the cultural and social context of the audience.

To improve clarity and usability, translators employ several techniques, including paraphrasing, restructuring, selective omission, and strategic additions. Paraphrasing helps simplify complex sentences without altering their intended meaning, while reorganizing information, such as grouping related instructions together, improves logical flow and makes the text easier to follow. Selective omission of non-essential details prevents information overload for readers who may not be familiar with technical specifications, while well-placed additions clarify ambiguous instructions, ensuring correct medication use.

Consistency in medical terminology throughout the translated PILs enhances understanding and reduces confusion. Common medical terms are translated in a way that conveys their functional meaning rather than relying on direct linguistic equivalents, making them more accessible to Urdu-speaking audiences. Additionally, techniques such as bold text and other emphasis strategies highlight critical safety instructions, ensuring that readers can easily identify and prioritize essential information.

10. Conclusions

The translation of medical texts, particularly Patient Information Leaflets (PILs), plays a crucial role in ensuring healthcare information is accessible to linguistically diverse populations. This research has demonstrated the effectiveness of Skopos-driven translation methods in adapting English medical content for Urdu-speaking patients, ensuring the translated material fulfills its intended functional purpose. By examining key aspects such as linguistic simplification, tone alignment, cultural adaptation, and audience-specific modifications, the study highlights how Skopos theory provides a structured approach to producing practical and comprehensible translations. The theory's fundamental principle that the translation purpose should determine the methods and strategies proves particularly valuable in medical contexts where clarity and accuracy are paramount. Nida's dynamic equivalence theory further reinforces these findings by emphasizing the need for natural, fluid translations that prioritize the target audience's understanding over rigid lexical accuracy. Together, these theoretical frameworks offer a robust methodology for overcoming linguistic and cultural barriers in medical communication, creating translations that are not only accurate but also functionally effective for end-users.

One of the main findings of this study is the necessity of plain language in medical translations, particularly for populations with varying literacy levels. Medical jargon, complex syntactic structures, and dense terminology often hinder comprehension, leading to misinterpretations that can adversely affect patient health outcomes. The research demonstrates how strategic linguistic simplification techniques can significantly improve understanding. Paraphrasing complex medical terms into simpler, everyday language makes information more accessible - for instance, replacing "myocardial infarction" with "heart attack" or "hypertension" with "high blood pressure" in Urdu translations. Text restructuring that breaks down long, convoluted sentences into shorter, more digestible segments helps patients follow instructions more easily. The careful omission of non-essential technical details that don't contribute directly to patient understanding or actionability further enhances readability. These techniques

align perfectly with the Skopos theory principle that translations should be functionally appropriate for their intended audience [32]. Supporting this approach, a study demonstrates that direct and simplified language significantly enhances health literacy, particularly among non-native speakers and those with limited formal education [35]. The practical application of these principles in Urdu translations of PILs shows measurable improvements in patient comprehension and recall of medical instructions.

Beyond linguistic adjustments, cultural adaptation emerges as a fundamental requirement for ensuring medical translations resonate with the target audience. This involves several critical dimensions that go beyond mere word-for-word translation. Localizing examples and analogies ensure that medical instructions make sense in the local context; for instance, changing references to "call 911" to "call 1122" in Pakistani contexts or adapting temperature references from Fahrenheit to Celsius where necessary. Incorporating culturally familiar concepts helps patients relate to the information, such as explaining dosage instructions using locally understood measurements (e.g., "a teaspoon" rather than "5 mL" in rural areas where metric measurements are less common). Perhaps most importantly, addressing cultural sensitivities requires careful consideration, particularly for topics like reproductive health or mental illness, which may carry social stigma in certain communities. The study found that these adaptations align closely with the findings of the study, who emphasize that culturally responsive health communication fosters trust and improves patient compliance [36]. For example, a translated Urdu PIL on diabetes management that includes dietary advice tailored to South Asian cuisine proves far more effective than a direct translation of Western dietary recommendations. The cultural adaptation process also involves analyzing visual elements, colors, and symbols that may carry different connotations across cultures, ensuring the entire communication package works harmoniously for the target audience.

The study also emphasises the importance of functional equivalence in medical translation — ensuring that the translated text performs the same role for the Urdu reader as the original does for the English reader. Skopos theory's emphasis on purpose-driven adaptation proves particularly valuable here, as it allows translators to prioritize clarity and usability over rigid structural fidelity. This approach recognizes that different cultures may have varying expectations about how medical information should be presented and understood. For instance, while Western medical communication tends to be highly individualistic and direct, some Eastern cultures may prefer more contextual and community-oriented approaches to health messaging. The research found that maintaining functional equivalence often requires substantial restructuring of content while preserving all crucial medical information. This might involve changing the order of information presentation, adding explanatory notes where necessary, or even modifying the document's layout to better suit local reading patterns. The practical implementation of these principles in Urdu translations shows significant improvements in patient engagement with the material, as measured through comprehension tests and follow-up surveys.

Technological advancements in artificial intelligence (AI) and machine translation (MT) are proving increasingly transformative in the field of medical translation. Research by Zhou Bo, Lim Seong Pek, and Wang Cong [37] highlights how AI-powered tools enhance translation efficiency, consistency, and terminology accuracy, particularly in specialized fields like medicine. These technologies can process large volumes of text rapidly, maintain terminology consistency across documents, and even learn from corrections to improve over time. However, the study also reveals crucial limitations - while AI can generate useful initial drafts, human oversight remains essential for ensuring cultural appropriateness and nuanced readability. Machine translations often struggle with context-dependent meanings, cultural references, and the subtle pragmatics of medical advice. The research suggests an optimal workflow where AI handles the initial translation of technical content, followed by human experts who refine the language, adapt cultural elements, and verify medical accuracy. Emerging neural machine translation (NMT) systems show particular promise in handling complex sentence structures and medical terminology, potentially reducing turnaround times while maintaining high accuracy. However, the study cautions against over-reliance on technology, emphasizing that the human element remains irreplaceable for ensuring the translations truly meet patient needs and adhere to Skopos principles.

The implications of this research extend far beyond Urdu translations, offering a comprehensive framework

for improving health communication in numerous minority languages worldwide. One major implication is the need for standardization of medical translation guidelines across healthcare institutions. Currently, there exists significant variation in how medical documents are translated, leading to inconsistencies that can confuse patients. Developing Skopos-based protocols could ensure consistency in multilingual patient materials while allowing necessary cultural adaptations. Another critical implication involves training programs for medical translators, who require not only linguistic skills but also cultural competency and medical terminology knowledge. The study reveals that many existing translation programs focus too heavily on linguistic accuracy at the expense of functional effectiveness. There is also a pressing need for closer collaboration between healthcare providers and linguists throughout the translation process. A multidisciplinary approach that includes doctors, nurses, translators, and cultural experts ensures that translations are both medically accurate and patient-friendly. The research suggests establishing hospital translation committees that review patient materials before distribution, applying the principles identified in this study to maximize comprehension and utility.

Looking toward future research directions, while this study establishes the effectiveness of Skopos-driven methods, several important areas require further investigation. Long-term patient outcome studies could determine whether these translation methods lead to better adherence to medical instructions and improved health indicators. Future research could examine whether there are measurable improvements in medication compliance, treatment success rates, or reduced hospital readmissions when using these adapted materials. Comparative studies across different languages and cultures would help determine how universal these strategies are, such as whether they work equally well for Arabic, Swahili, or Mandarin-speaking patients, or if different language groups require substantially different approaches. Another promising research avenue involves exploring optimal collaboration models between AI and human translators in medical contexts. Future studies could investigate the optimal balance between machine efficiency and human expertise for different types of medical documents? Additionally, implementing patient feedback mechanisms could refine translations based on real-world comprehension levels - incorporating user-testing with actual Urdu-speaking patients at various literacy levels would provide invaluable data for improving materials. The potential role of multimedia adaptations also warrants investigation, such as whether video or audio explanations coupled with simplified text could further improve understanding. These research directions could significantly advance the field of medical translation and global health communication.

In conclusion, this research demonstrates that Skopos-driven translation, when combined with thorough linguistic simplification and thoughtful cultural adaptation, significantly enhances the accessibility and effectiveness of medical information for Urdu-speaking patients. By prioritizing functional clarity and cultural relevance above rigid formal equivalence, healthcare providers can bridge critical communication gaps that often hinder effective treatment. The resulting translations lead to better patient understanding, improved adherence to medical advice, and ultimately better health outcomes. The integration of AI-assisted translation tools offers exciting possibilities for scaling these efforts across multiple languages and healthcare systems, though the study emphasizes that human expertise must remain central to the process. Future research should continue to develop and refine patient-centered translation models, always with the goal of making global health communication more inclusive, accurate, and actionable for all linguistic communities. As the world becomes increasingly interconnected yet culturally diverse, the lessons from this Urdu translation study provide valuable insights for improving healthcare communication worldwide. By implementing these strategies more broadly and continuing to innovate in medical translation methodologies, we can make significant progress toward eliminating language barriers in healthcare and creating a more equitable, patient-centric global health system that serves all populations effectively, regardless of their native language or cultural background.

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Institutional Review Board Statement

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Informed Consent Statement

The participants were informed, and their consent was taken.

Data Availability Statement

The data used in this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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