Approaching machine translation in the medical and health field: An exploratory study

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ABSTRACT

This paper presents the results of a qualitative exploratory study in which freelance and in-house medical translators working with the English-Spanish language pair were interviewed to explore their use of machine translation (MT): how and why they have introduced this technology into their workflow, what quality MT offers and what it depends on, to what extent MT has changed the way they approach the translation process, what impact it has on their professional profile and tasks, how MT influences the competences to be acquired, or what they think about how future translators should be trained. Considering the specificities of medical and health translation, the results obtained provide an overview of the impact of MT on this professional activity from the perspective of practising translators. They also raise interesting questions regarding the redefinition of the translator's roles (e.g., the promotion of the role as a specialist in the medical field and that of a language consultant in a broader sense), their potential training needs (which emphasise the development of language and writing skills, critical and ethical use of technology, and thematic competence), and the future of the profession (taking into account sensitive areas where there is still no room for automation).

KEYWORDS

Machine translation, post-editing, medical and health translation, qualitative study, semi-structured interviews, medical translators.

1. Introduction

Machine translation (MT) is a reality in the translation sector. A growing number of language service providers and freelance translators are adopting this technology, generally with post-editing (PE), due to the improved performance of neural MT (NMT) compared to previous MT systems, and to the increased productivity, which helps to streamline work processes and meet tighter deadlines (Collantes Fraile et al., 2018). Many international organisations with in-house translation services are also successfully incorporating MT to cope with large translation volumes. For instance, the United Nations has implemented the eLUNa system, which integrates computer-assisted translation (CAT) and MT tools, and the European Patent Office employs a fully customised NMT system, Patent Translate, which has been developed in collaboration with Google.

This situation has increased the number of studies focused on MT with different purposes. We find studies that assess MT output against human translation (Briva-Iglesias, 2021; Jia & Sun, 2022; Popović et al., 2021), gather the opinion of different stakeholders (Cadwell et al., 2018; Nitzke et al., 2024; Vercher García, 2021), determine the competences of translators/posteditors (Konttinen et al., 2020; Robert et al., 2022; Sánchez-Gijón, 2016), or analyse the influence of MT on training (Guerberof-Arenas & Moorkens, 2019; González Pastor & Rico Pérez, 2021; Kenny, 2020), among others. One area of interest for researchers in recent years has been to determine the impact of MT in specific languages pairs (Kasperė et al., 2023; Toral et al., 2023), as well as translation specialties and modalities — e.g., legal translation (Prieto-Ramos, 2024), literary translation (Guerberof-Arenas & Toral, 2022),

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https://doi.org/10.26034/cm.jostrans.2025.8453

audiovisual translation (de los Reyes & Mejías-Climent, 2023). There is evidence that MT performs very differently in a technical instruction manual than in a novel, in a well-resourced language than in a language with less available training data, to name just a few examples. Therefore, it is necessary and relevant to design studies according to translation specialties and/or language pairs.

This paper focuses on medical and health translation, a "safety-critical domain" (Canfora & Ottmann, 2020, p. 58) — i.e., a domain where translation errors can lead to serious damages for end users — which requires a high level of accuracy and specialised knowledge. An increasing number of research works are beginning to explore the usefulness of MT in medical and healthcare settings, albeit still in an incipient and focused way: from studies that analyse the performance of different MT systems in specific text genres and contexts (e.g., Alvarez-Vidal et al., 2021; Yeganova et al., 2021), to the techniques for training MT engines (e.g., Khan et al., 2018; Skianis, et al., 2020), to the use of MT to disseminate multilingual medical knowledge and enable doctor-patient communication (Haddow et al., 2021). However, little research has explored MT from the perspective of practising translators. Although some studies have investigated the use of MT by medical translators (Trujillos-Yébenes & Muñoz-Miquel, 2022; Vidrequin, 2022, 2023), there is still a gap in understanding the extent to which this technology is influencing their professional performance, and also the competences and training of (future) translators.

This situation led us to ask the following questions: To what extent do medical translators use MT? Why and how do they use it? Which text genres are translated better and worse with MT? To what extent does MT influence the way they work? What impact does it have on their professional profile or the tasks they perform? Are there any differences in the use of MT between freelancers and in-house translators? Does MT affect the competences that need to be acquired and put into practice? What is the impact of MT on medical translators' training? This article aims to address these questions by presenting the results of a qualitative exploratory study in which ten medical translators with different training and professional backgrounds have been interviewed. As the MT performance may vary depending on the languages involved, this study focuses specifically on the use of MT from English to Spanish. The aim is to explore the translators' use of and opinions on MT, as well as its impact on their professional profile, tasks, and competences. Given the lack of studies addressing MT in medical translation from the perspective of practising professionals, an initial qualitative and exploratory approach is necessary to gather rich and diverse insights from key participants (Creswell & Plano Clark, 2011). The objective is not to generalise findings to a broader population but rather to gain an in-depth understanding of medical translators' perspectives. This exploration will inform the development of a quantitative instrument in future stages to test these initial findings and generate more generalisable data.

The rest of this article is structured as follows: Section 2 reviews the specificities of medical and health translation as well as some of the studies conducted on MT in the medical field; Section 3 describes the methods and participants of this exploratory study; Section 4 explains the results obtained; Section 5 discusses the findings; and Section 6 presents the main conclusions, limitations, and future lines of research.

https://doi.org/10.26034/cm.jostrans.2025.8453

2. Machine translation in the medical and health field

Medical and health translation is a highly demanded field (ELIA et al., 2023) which involves two closely related dimensions (Montalt, 2021): the biomedical dimension (expert discourses that shape and convey specialised knowledge) and the health dimension (which is primarily focused on public health and health communication). Its specific features include, among others: interdisciplinarity and thematic breadth (it covers a wide range of topics and fields of knowledge), specialised terminology of Greco-Latin origin, and a variety of genres (package leaflets, clinical trial protocols, treatises, informed consents, fact sheets for patients, public health campaigns, etc.) that can be translated in very diverse communicative situations, ranging from clinical practice to research, education and the dissemination of medical knowledge to a lay audience.

These characteristics pose all kinds of challenges for translators (Montalt et al., 2024; Montalt & González-Davies, 2007; Muñoz-Miquel, 2023; Navarro, 1997): high specialisation of texts, which can hinder comprehension; need for terminological precision; wide variety of audiences with different backgrounds and expectations (medical experts, chronic patients, children, general public); cultural asymmetries (differences in health systems, in beliefs about health and illness); poor wording of some original texts, which are often written by non-linguists; polysemy, synonymy and register mismatches; confidentiality, especially when dealing with sensitive texts such as medical reports; strong influence of English as the international language of medicine on the lexis, morphosyntax and typography of the target language (TL); and others. These aspects, together with the serious consequences of a translation error in this field (Canfora & Ottmann, 2020; Montalt & Muñoz-Miquel, 2024; Vieira et al., 2021) and the concern about the accuracy and reliability, have meant that the use of MT in medical and health contexts is still limited and not without controversy. This is because the effective and risk-safe use of MT poses multiple challenges that are still unresolved (Dew et al., 2018; Khoong & Rodriguez, 2022; Zappatore & Ruggieri, 2024).

One major area of MT research in the medical field is the assessment of MT outputs and systems. A relevant stream of studies comes from the WMT, the annual conference on MT research[1]. In the WMT, through the so-called *shared tasks*, custom models of MT systems are evaluated on different biomedical texts and language pairs. These works are particularly useful because they help identify MT errors. For example, in the English-Spanish language pair, MT output of specialised genres such as abstracts or clinical case reports is considered to be of relatively high quality, although it does not outperform reference (human) translations (Neves et al., 2023, pp. 52-53). Some recurring errors are identified: mistranslation of abbreviations and domain-specific terminology, lack of register adaptation, word order problems, lack of overall consistency, literal translations of syntactic structures (e.g., use of the passive voice instead of the passive reflexive construction), among others (Neves et al., 2022; Neves et al., 2023; Yeganova et al., 2021).

Reviews of the use of MT in clinical and public health settings are particularly useful for assessing the extent to which this technology is suitable in these contexts. Haddow et al. (2021) conduct a review of projects using MT and find three applications where it would be useful: 1) to assist in the translation of specialised genres for experts; 2) to

https://doi.org/10.26034/cm.jostrans.2025.8453

enable doctor-patient communication in live interactions; and 3) to disseminate health-related information to the general public. Herrera-Espejel and Rach (2023) focus on the third application and examine the use of MT in public health and epidemiology. Their review shows that most studies focus on MT accuracy errors in specific sample texts, with fewer focusing on the reliability of this technology for specific settings or target audiences. The work by Zappatore and Ruggiere (2024) is particularly useful, as it proposes a methodological multi-criteria literature review on the use of MT in the healthcare and medical sectors (language combinations, MT systems used, target population, MT training approaches, evaluation processes employed, etc.). The study provides a method of analysis to determine the extent to which MT can be used, trained, tested and perceived.

The studies mentioned so far come to similar conclusions: although MT is a "low-cost solution" (Zappatore & Ruggiere, 2024, p. 1) that can help make medical and health information accessible to linguistically diverse populations and can be a resource in the absence of professional translators/interpreters, it can only be used as a complementary tool, not as a replacement for professionals with adequate content knowledge and language skills. The lack of precision in the translation of terminology, and the risk of inaccurate and unnatural translations increase the need for intensive and mandatory PE work to ensure that the results are fluent, accurate and domain-adequate — especially when dealing with ethically sensitive texts (Herrera-Espejel & Rach, 2023; Zappatore & Ruggiere, 2024). It is essential to have specifically trained MT systems with in-domain training text corpora, and to employ translators who are able to detect and correct different types of errors, especially those that are critical for user safety (Zappatore & Ruggiere, 2024). This is particularly evident for low-resource languages, where investment in data acquisition and machine learning is reduced. It should be noted that all these conclusions are largely drawn from studies that assess MT quality and performance by analysing MT output almost exclusively, without considering other determining factors such as the perspectives of professional users (e.g., translators) of this technology. As a result, insights are gained into the linguistic performance of MT, but a comprehensive understanding of how translators interact with MT, the challenges they face, and their views of its practical usefulness in their professional practice is still lacking.

Research on the perceptions of MT users in medical contexts is rather scarce. While we find interesting papers that question the views of health professionals (Mehandru et al., 2022) and postgraduate students (Accogli, 2023), there are few that focus on professional translators. Some exceptions can be found in the works by Trujillos-Yébenes and Muñoz-Miquel (2022), Vidrequin (2022, 2023) and Chereji (2024). Trujillos-Yébenes and Muñoz-Miquel (2022) interview in-house English-to-Spanish medical translators who use a MT system trained on medical texts to explore their perceptions of its advantages, disadvantages and challenges. The translators interviewed have a generally positive view of MT, as it produces fairly high-quality results for some text genres; however, they also feel that it limits their translation decisions, increases the risk of source text (ST) interference, and is not always cost effective. Vidrequin (2022, 2023) interviews and surveys freelance French-speaking medical translators to investigate the extent and forms of MT usage, and to identify factors related to its acceptance. Translators who accept MT see its benefits in increased productivity, while those who reject it report concerns about accuracy and quality. It is noteworthy that in the interview study (Vidrequin, 2023) the majority of

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translators (80%) accept and use MT, whereas in the survey study (Vidrequin, 2022) most (51%) reject it. Chereji (2024) conducts a survey to identify the challenges that medical translators face when translating texts for patients as well as their use of technology, particularly CAT and automatic speech recognition tools. Although the study does not focus on MT, the results show that this technology is used quite extensively, as most translators (67%) have PE experience and use MT with their CAT tools.

As can be seen, the findings of these three studies suggest that MT is increasingly being used by medical translators. However, there are different levels of acceptance of this technology, which may depend on a variety of factors such as the MT system used, the working conditions, or the genres translated. These findings provide valuable insights into translators' perceptions, but further research is needed to assess the impact of MT on their professional tasks, competences, and training. These aspects, which have not yet been discussed in detail, are the focus of this paper, in which the perspectives of some of the most common profiles in the medical translation field will be considered.

3. Methods

As mentioned in Section 1, this paper aims to explore medical translators' use of and opinions on MT in the English-Spanish language pair, as well as its impact on their professional performance and competences. Among the various instruments available for collecting qualitative data, semi-structured interviews were chosen. This type of interview follows a predefined schedule while allowing flexibility in the order of questions and the inclusion of additional questions to explore relevant issues in greater depth (Saldanha & O'Brien, 2013, pp. 172–173).

Participants were selected using a maximum variation sampling strategy (Moser & Korstjens, 2018), which involves identifying key criteria relevant to the study and selecting participants who meet them in order to capture the diversity within the population. These selection criteria were as follows:

- Using or having used MT in medical and health texts, irrespective of the years using it.
- Representing the professional and training profiles that have been shown to be predominant in the medical translation market: staff translators and freelancers with scientific and/or linguistic backgrounds (see Muñoz-Miquel, 2018; Rigouts Terryn et al., 2019).
- Working with the English-Spanish language pair, although not necessarily on an exclusive basis.

Translators were recruited through professional and academic networks, particularly Tremédica (International Association of Translators and Writers of Medicine and Related Sciences) and the online Master's Degree in Medical and Healthcare Translation at Universitat Jaume I, Spain. These networks provided access to practising medical translators who met the study's inclusion criteria. A total of ten medical translators (five women and five men) from Spain, Mexico, Argentina, Dominican Republic and Venezuela were interviewed. Thematic saturation — the point at which no new insights emerge — was observed in the final interviews, which

https://doi.org/10.26034/cm.jostrans.2025.8453

indicated us that the number of participants was sufficient for the study's exploratory aims. In fact, qualitative interview studies typically include between five and 25 informants (Kvale, 1996, p. 102), and research suggests that saturation is often reached within the first twelve interviews (Guest et al., 2006).

Table 1 shows the main characteristics of the respondents. We interviewed six translators with a linguistic/translation background, two translators with a scientific/medical background, and two translators with a background in both fields. In terms of their employment status, six were self-employed, while four worked in-house at international health organisations. The freelancers worked for different types of clients: pharmaceutical companies, contract research organisations (CROs), private hospitals, publishing houses, medical journals, language services providers, individuals, etc. Both in-house and freelance translators translated a wide range of text genres, including textbooks, epidemiological reports, fact sheets for patients, informed consents, research articles, clinical trial protocols, popular science articles, marketing authorisation applications, and others. While freelancers translated a wider variety of genres and topics, staff translators were more likely to work with institutionalised texts (speeches, public health plans, board meetings, etc.). In relation to their experience with MT, the informants ranged from those who had only been working with this technology for a few years to translators who had been using it for more than ten years and had employed different MT systems.

Identification code	**Formal training**	**Employment status**	**Years using MT**
T1	• Degree in Translation • PhD in Modern Languages	Freelancer	8
T2	• Degree in Translation	Freelancer	12
T3	• Degree in Biology • PhD in Biology	Freelancer	2
T4	• Degree in Classical Philology • Master's Degree in Latin	In-house translator	1.5
T5	• Degree in Translation • Master's Degree in Medical and Health Translation	Freelancer	4
T6	• Degree in Translation • Master's Degree in Medical and Health Translation	In-house translator	15
T7	• Degree in Medicine • PhD in Medicine	Freelancer	4
T8	• Degree in Pharmacy • Degree in Translation and Interpreting	In-house translator	2
T9	• Degree in Medicine	Freelancer	4

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	• Degree in Modern Languages • Master's Degree in Specialised Translation		
T10	• Degree in Translation • Degree in English Language • Master's Degree in Medical and Health Translation	In-house translator	19

Table 1. Characteristics of the informants.

The interviews, which were conducted in Spanish, took place in 2022 via Google Meet and were recorded with the written consent of the participants, who voluntarily took part in the study without receiving financial compensation. The questions, available in the Appendix, were organised into thematic blocks and covered the following aspects:

- Socio-professional profile (training received, tasks performed, clients, genres and topics translated, etc.).
- Experience with MT, quality of MT, and PE process (reasons for using MT, tools used, quality of MT output, advantages and disadvantages of MT, influence of MT on their profile and work process, etc.).
- Training, competences and future perspectives (competences and training required for PE, perceived training needs, influence of MT on translator training, future of the profession, etc.).

The interviews lasted an average of one hour and seven minutes and were transcribed using Sonix software. All data were anonymised, and identifying details were removed. The transcripts were analysed thematically by generating codes based on the research questions (see Section 1) and interview blocks. Due to the nature of the interview, additional categories emerged that had not been considered initially (e.g., how participants entered the medical translation market; what experience, if any, they had in training translators, etc.). These aspects are not discussed in this paper due to space limitations.

It should be noted that the use of generative artificial intelligence (GenAI) such as ChatGPT was not addressed in this study, as the interviews were conducted before this technology became widely available to the public. The impact of GenAI on medical translation and the translation industry is complex and deserves its own discussion in future research.

4. Results

This section presents the results obtained. To facilitate the analysis, they have been divided into two main sections: 1) experience with MT, quality of the MT output, and influence on the translation process, and 2) competences, training, and future profiles and tasks.

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4.1. Experience with MT, quality of the MT output, and influence on the translation process

4.1.1. Reasons why translators use MT

Most translators (N = 8) use MT on a daily basis for a variety of reasons: because clients request PE services (T1, T2, T3), because the translation interface they work with integrates this technology (T6, T9, T10), or because it helps them to be more productive (T1, T5, T7). However, T4 and T8 refuse to use it systematically because they like translating from scratch, and PE "takes all the pleasure out of translating," as T8 put it[2].

We find some differences between freelancers and in-house translators in the way they use MT. Among freelancers, there are two main trends: those who offer PE as a professional service (T1, T2, T3), and those who refuse to offer PE services because of lower rates and tighter deadlines but who use MT as any other tool (T5, T7) —e.g. they use it to have a first draft of the translation or to search for translation alternatives. Freelancers usually work with commercial engines —mostly with DeepL Pro; T5 also work with MyMemory in its paid version— or with their clients' engine but always connecting it to their CAT tool. DeepL web is only occasionally used because of confidentiality issues. T3 is the only translator who does not interact directly with the MT system, as he/she works directly by comparing two Word files: one with the ST and the other with the MT output provided by his/her client.

In-house translators normally use the translation interface of the institution where they work, which usually includes translation memories, terminology databases, and MT engines based on a commercial engine (generally DeepL or Microsoft) but fed with the institution's texts. T6 and T10 also work with a well-established rule-based system that is used in their organisation. T6 and T10 always translate using MT, while T4 and T8 use it only occasionally —for example, when deadlines are very tight.

4.1.2. Text genres[3] that are post-edited and quality of the MT output

While T5, T6 and T9 use MT in virtually all types of texts, most translators (N = 6) decide whether to use MT —and which engine to use— depending on the genre to be translated. T3 only performs PE on biomedical patents.

The informants consider the quality of the NMT systems they use (see Section 4.1.1) to be "good" or "very good" and admit that they did not expect it to improve so quickly. However, they also feel that the fact that NMT output generally sounds correct and fluent is a double-edged sword because errors are much more difficult to detect (see Section 4.1.3) —especially when compared to the output of earlier systems such as statistical MT (SMT) or rule-based systems, where mistakes were typically easy to identify. T1, T2, T6 and T10, who have worked with SMT/rule-based MT and NMT, agree that the former produced worse translations from a grammatical and syntactical point of view but "it didn't make things up, something that can happen with NMT, even while sounding fluent," as T2 put it. In fact, in the translators' opinion, this is one of the main drawbacks of NMT (see Section 4.1.5).

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In the translators' experience, the medical genres in which MT produces quality output are those that:

- Have a simple syntactic structure and no lexical ambiguity, and deal with 'easy' topics (e.g. popularising texts about public health).
- Have a recurrent structure/content or are highly conventionalised (e.g. package leaflets, instructions for use, institutional texts, certain pharmaceutical documents, research articles, etc.).

The genres in which MT output is of much lower quality are those that:

- Are addressed to or involve patients and use an empathetic and personalised style (e.g. patient narratives, fact sheets for patients).
- Have a creative and stylistic component (e.g. popular science articles, where metaphors or puns abound).
- Are for marketing purposes and use language to reach the reader (e.g. leaflets to sell medical products).
- Are highly specialised and full of technical terminology (e.g. medical manuals or treatises).
- Deal with very new topics.

It is worth noting that all informants point out that when they work with systems that have been specifically trained with quality resources and texts of the same genre or topic as the one to be translated (e.g., those created and provided by their clients), the output is of a much higher quality than when they use a generalist MT. Other factors influencing quality include the engine used (some systems work better than others for certain genres) and the language combination (T1, T2, T3 and T9 also work with language combinations other than English-Spanish and find that the closer the languages, the higher the quality of the MT).

4.1.3. Most frequent MT errors, and PE guidelines

Although all informants point out that the errors in the MT output depend mainly on the genre to be translated, they consider that the most common errors are as follows:

- Incorrect translation of specialised terms (e.g., terms are mistranslated or do not comply with the recommendations of reference works or with the style guidelines or term bases of the institution for which the text is intended).
- Incorrect translation of specific terminology of the international health institution they work for.
- Incorrect translation of acronyms and abbreviations (e.g., chemical compounds).
- Incorrect translation of ambiguous and polysemic terms (e.g., *failure*, *record*)
- Calques of all kinds: grammar, lexis, syntax, punctuation (e.g., avoidable passives and anglicisms; excessive nominalisation; keeping the same number of sentences as in the ST, when in Spanish sentences should be joined to sound more natural).
- Meaning errors ("it seems to be correct, but, when you compare it with the ST, it's not quite the same meaning, and you realise that the MT misinterpreted it," as T10 put it).

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- Lack of register adaptation, either because the MT output does not maintain the medical register required by the genre in question ("it does not sound like it was written by a medical professional," as T9 put it), or because it colloquialises the text inappropriately (e.g., translating *people* for *gente* instead of *personas* in certain contexts).
- Unjustified omissions.
- Unnecessary repetition of the subject in the Spanish translation or failure to make the subject explicit when necessary.
- Failure to detect errors in the ST.
- Typographical errors (spelling of chemical compounds, formatting of laws and organisms, etc.).

Regarding the use of PE guidelines, it is worth noting that none of the informants have access to or use them. Their employers and clients are unclear about the criteria translators should follow —with a few exceptions, such as a pharmaceutical company for which T2 works, which explicitly asks translators not to "waste time changing the style" and only to check that the content is "complete and understandable." Consequently, translators use their own criteria for PE based on their experience with the MT engine or the text genre in question. However, they would appreciate to be provided with some guidelines to know which changes can and should be made to certain genres so as to ensure that the translation is of a high quality and that the PE process is cost-effective.

4.1.4. Influence of MT on the translation process and the working conditions

There are different views on the extent to which MT has changed the translation process. While the majority of informants believe that the steps they take are largely the same as when they translate from scratch, we have identified different perspectives. T6, T7 and T9 consider that working from a draft does modify their approach to translation, since the initial mental effort required to translate, namely "the first grasp of the text" (as T7 put it), is done by the machine. T10 even considers that it is no longer necessary to read the ST completely in order to start PE.

Regarding documentary consultation, most informants (N = 7) think that MT does not reduce the need for research, as they always have to check the MT output. T6 even notes that one of the risks of NMT is "not realising that more research is needed, or at least as much research as if it were a human translation." T2, T9 and T10 are the only translators who suggest that MT can save some searches: T2 and T9 point out that fewer resources need to be consulted when translating those genres in which they know that MT produces quality results, and T10 states that MT can save some searches for terms in general dictionaries. All translators continue to use key resources for medical translation —Cosnautas, RANM's *Diccionario de Términos Médicos*, parallel texts, their own glossaries, specialised databases, etc.—, and T2 and T9 even use documentary sources on paper.

In terms of the impact of MT on working conditions, there are differences between freelancers and in-house translators. Freelancers are quite dissatisfied with the lower rates and shorter deadlines that PE entails, particularly because the use of MT does not always lead to increased productivity, according to their experience; "For me, it's a cheat; we lose out," said T2. For this reason, T5 and T7 do not offer PE services. Staff

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translators have not noticed any substantial changes in their working conditions. However, the organisations they work at are starting to consider increasing the required productivity, which would entail translating more words in the same amount of time.

4.1.5. Advantages and disadvantages of MT

Most informants (N = 9) see advantages in MT. T9 and T10 are of the opinion that translation without MT is simply not an option; they consider that it makes no sense to translate without a tool that can help save time. The exception is T2, who sees little difference between a MT system and a good translation memory in terms of speed and productivity.

The most frequently cited advantages of MT are as follows:

- It increases productivity and speed.
- It saves typing, which has a positive impact on the translator's physical well-being.
- It saves the initial mental effort required when translating, as the translator works from a draft.
- It improves terminological consistency, provided that the engine has been properly trained with quality resources.
- It allows translators to focus on more creative texts, leaving MT to handle more mechanical and "stupefying" texts, as T7 called them.
- It can provide translators with useful alternatives for complex segments.

In terms of drawbacks, all informants agree that the main disadvantage is that with NMT it is very easy to overlook errors, because the output (in terms of content, terminology, style) is apparently good. This means that more attention should be paid when PE than when translating from scratch, as in the medical field a single mistake can have serious consequences. As the informants stated: "you don't see the danger, because the text seems perfect" (T1), "the human brain switches off when you check so many words in such a short time and, even if you pay close attention, it is sometimes difficult to detect errors" (T2), "the output reads well, and you trust it" (T6). Other disadvantages that translators have identified are as follows:

- The essence of translation is lost and there is no room for creativity in writing; MT is not for professionals who enjoy the challenge of thinking about the best way to express ideas in another language (as paraphrased from T2 and T8).
- It "blocks the translators' mind" (T2) and makes them "intellectually lazy" (T8), as they may accept translation solutions that are not optimal.
- It can have a negative impact on the target text (TT) and the TL, especially when translators are under pressure to edit the TT as little as possible for the PE to be cost-effective.
- Professional conditions can be negatively affected if translation service providers or employers misuse MT or use it unethically. This can happen when the former provide a machine-translated text without PE as a human translation service; or when the latter lower rates and tighten deadlines too much to reduce costs.
- It could lead to the disappearance of the need to train translators.

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4.2. Competences, training, and future profiles and tasks

4.2.1. Competences required

According to the informants, there are no significant differences between the competences required for traditional translation and those required for PE: "The reason why I can evaluate the result of a MT output today is because I know how to translate in the traditional way," said T5. However, the emphasis placed on them changes with PE. In particular, the informants consider that the following competences need to be developed more strongly:

- Linguistic and transfer competences: excellent writing skills in the TL; ability to dissociate the two languages at all levels (lexical, syntactic, grammatical, typographical) in order to detect all types of calques and unidiomatic structures.
- Editing competence: ability to detect 'hidden' errors; attention to detail; knowledge of the types of errors commonly made by MT depending on the genre, domain or topic to be translated; ability to pre-edit texts.
- Thematic competences: sound medical knowledge (and the ability to acquire it *ad hoc* as required) to understand complex texts and detect content errors.
- Technological competences: highly advanced knowledge of the most relevant tools and technologies (search engines, corpus-based tools, text analysis tools, CAT tools, bitext generation tools, advanced office software) and ability to use them effectively according to the assignment or genre in question; understanding of the basics of MT systems (how they work or can be fed), their possibilities and limitations, and their impact on the translation process; ability to advise clients on the use of technologies in order to avoid lack of awareness and misuse.
- Ethical and critical competences: ability to critically assess and ethically use MT (in terms of confidentiality of information, power imbalances, professional implications, gender biases, data gathering and reuse, etc.).
- Versatility to adapt to changes in the market and the profession.

4.2.2. Training needs in MT and PE

None of the informants have had any formal training in MT or PE — apart from attending short seminars organised by professional associations — but all, except for T2, feel that some training is needed. The translators suggest that university education should focus on the acquisition of the competences mentioned in Section 4.2.1, of which critical and advanced use of technology and mastery of the TL are paramount. T2 emphasises that, while some training in technologies is necessary, this should not be the aim of university education, which should focus on "teaching students how to think critically."

The informants suggest some ways of integrating technologies into the classroom:

- Including MT tasks in specialised translation subjects (comparison of human and MT output of the same text, critical analysis of MT output of different text genres, etc.).
- Having courses that focus specifically on technologies.

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- Having courses that focus specifically on rhetoric and writing in the TL.
- Encouraging dialogue between teachers of different subjects and courses to discuss how and when it is appropriate to incorporate technology (and which technologies) into teaching.

It is worth noting that the informants suggest that one of the main challenges of integrating MT into university education is how to teach basic translation skills. As T10 put it:

> When you were faced with a blank sheet of paper, you had to be able to work it all out somehow; you had to be sure that you fully understood the text and that you could express it consistently in the TL. Now these tools may give the false impression that these skills are no longer necessary, but they are still as necessary as when we were working with a blank sheet of paper.

Finally, regarding the acquisition of PE competences, the case of T9 is particularly noteworthy, as it suggests that properly performing PE first requires learning how to translate without the influence of MT:

> When I began to work for [international health organisation], my proofreaders advised me against using MT; otherwise, my style would be contaminated by what DeepL suggests, and I would end up translating like DeepL and not in the same way as [international health organisation] does. This process, combined with extensive reading to internalise the organisation's style, ultimately helped me develop PE skills more effectively.

4.2.3. Impact on their (future) profile and tasks

The informants agree that the increasing automation of tasks will change the way translators work, who will focus more on revision and editing than on translation *per se*. In terms of future profiles, they see the need for two different roles:

- The *specialist in the medical field with excellent linguistic skills*, since it is in the translation of highly specialised medical texts that human intervention will be most needed.
- The *language consultant*, whose role will go beyond the mere translation/PE of a document. The ability to advise clients on the most effective way to manage their communication and translation needs and resources will be one of the added values of the human translator compared to automation.

The tasks that the informants are starting to carry out or think that are likely to be performed by translators are related to the improvement of MT systems: writing feedback reports in which they assess the performance of a given MT engine, creating resources such as corpus or glossaries to feed the MT systems, or training MT systems and large language models — although this last task will require specific training on the part of translators.

4.2.4. Future perspectives

Opinions differ on whether MT is an opportunity or a threat to the profession. T2 and T8, who have a more negative view, believe that MT will lead to precariousness and less need for translators (“only literary translators will resist,” said T2). They also think that those who really like translating in the traditional way will look for another career

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opportunity. T4 and T5 even believe that, if they had to choose a career today, they would not study a translation degree.

However, the general tendency is to think that, although there will be a redefinition of tasks and profiles, the translator will continue to be needed as editor and advisor. They consider that MT should be seen as any other tool. However, they stress that, in order for this not to be a threat, it is essential to understand how translators can use this tool to enrich their work. Furthermore, all stakeholders (translators, employers, clients) should use it correctly and ethically.

5. Discussion

As seen throughout the paper, medical and health translation is a highly specialised field in which accuracy, clarity and reliability are paramount, as even the slightest error can pose safety risks for end users, especially patients. As previous works have shown (see Section 2) and as our informants have also highlighted, MT has undergone a significant transformation that paves the way for its promising use in the medical and health translation field. However, in this increasingly automatised scenario, the translator's work remains central, possibly more so than ever.

The results have shown that the quality of MT output greatly depends on several factors: the text genre to be translated, the resources used to train and feed the MT systems, the language pair, and the translator's expertise and competences. This aspect, which is in line with the conclusions of previous research works and reviews (Trujillos-Yébenes & Muñoz-Miquel, 2022; Zappatore & Ruggiere, 2024), reinforces the need for studies on MT not only in general terms, but also on specific translation domains and language pairs such as the one presented in this paper, since both the MT output and the translators' views may vary considerably depending on such variables.

The fact that most translators decide whether to use MT depending on the text genre to be translated shows that they have intuitively developed the ability to "assess the risk of the text" and determine whether it is suitable for MT based on its characteristics. This competence is considered by Nitzke et al. (2019, p. 248) to be one of the most important for post-editors. In highly conventionalised and standardised genres that are neither very complex nor creative (e.g., package leaflets, instructions for use, institutional texts, research articles), the use of MT is cost-effective because the output is of quality. However, MT seems to perform more poorly in specialised genres dealing with complex medical topics or with a lot of terminology. These results are aligned with other exploratory studies on this matter (Montalt & Muñoz-Miquel, 2024; Trujillos-Yébenes & Muñoz-Miquel, 2022). To respond to this reality, the informants suggest that a profile of a translator with a sound medical knowledge and excellent linguistic skills who is able to detect content errors hidden behind apparent correctness should be pursued and developed.

Other genres in which the usefulness of MT is still questionable are those for marketing purpose (where the creative component is fundamental), and those aimed at patients where aspects such as communicating with empathy are key (e.g., patient's narratives, fact sheets for patients). Although there are already studies that show the deficiencies and risks of using MT in these areas where the *human* factor is crucial (Vieira et al.,

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2021, Ferrer Jiménez, 2020), an aspect that needs to be further explored is how automation and humanisation can complement each other (Muñoz-Miquel, 2023) in order to respond to demands for immediacy and productivity while at the same time adopting a humane and patient-centred approach (Montalt, 2017) — for instance, in emergency situations, medical consultations or public health campaigns.

The translator's expertise in identifying errors is crucial. The results suggest that even in genres where MT produces good results, certain recurring errors persist. These findings are consistent with the results of the WMT shared tasks, and of other studies in which translators have reported the types of errors they typically correct (Trujillos-Yébenes & Muñoz-Miquel, 2023; Vidrequin, 2022), such as mistranslation of domain-specific terminology (terms, abbreviations), lack of register and context adaptation, calques of all kinds, among others. It is therefore essential that translators are aware of the types of errors they can expect to encounter when PE medical texts. In the context of NMT, particular emphasis should be placed on learning how to identify errors that are not "obvious" (Nitzke et al., 2019, p. 250); the translator/post-editor "has to be trained in spotting exactly these more fine-grained problems" that are typical of NMT compared to SMT (Nitzke et al., 2019, p. 250).

In terms of attitudes and usage patterns towards MT, the results have shown that while some informants reject MT due to concerns about the loss of translation essence and the lack of room for creativity, the majority accept it as a complementary tool to be used in their translation process. The word 'complementary' is key in this context, since they continue to follow the same steps as if they translated the traditional way, but with a substantial change: the initial cognitive effort required to translate is now done by the machine. The negative impact of MT on the working conditions of freelancers (lower rates and tighter deadlines), in contrast to in-house translators, is an important factor influencing the reluctance of some of them to provide PE services as such, despite their growing demand from employers and clients. Thus, a challenge when providing PE services is to achieve a quality TT by making as few corrections as possible during the PE process so that it is truly cost effective. The provision of clear and satisfactory PE guidelines, which in the experience of the informants are practically non-existent, could help to increase translators' satisfaction with PE tasks, as recent studies suggest (Rico Pérez, 2024).

MT is undoubtedly redefining translators' tasks and roles, as well as the way they work. Translators are now more focused on their role as revisers/posteditors. However, there seems to be a trend towards their involvement in the whole MT process, and not only in the final revision of a given text, since some informants are being asked to assess the performance of a given MT engine or to create feeding resources. In this regard, as suggested by the informants, a role of a language consultant, capable of both translating texts and advising clients on how to manage their multilingual communication needs and resources (which may even involve the use of MT), is another professional profile that should be promoted. This broader perspective of roles and responsibilities (Sánchez-Gijón, 2016) requires translators to perceive themselves "not only as mere proofreaders of machine translation output, but as competent language consultants and experts in creating PE processes" (Nitzke et al., 2019, p. 251). To this end, translators should enhance their MT literacy, which includes:

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> […] actively shaping the implementation of technology by deciding when to use MT, developing strategies to preserve and foster creativity, and being aware of the complementarity of human and artificial intelligence. MT literacy also presupposes the capacity to engage self-confidently in constructive collaboration with MT developers and to promote appropriate use of MT by providing advice. […] [MT literacy] encompasses an understanding of the basics, risks, and benefits of the technology (Ehrensberger-Dow et al., 2023, p. 407 & 393).

One of the most highlighted aspects among the informants is the need to be aware not only of the benefits, but also of the risks and limitations of MT. This knowledge will help (trainee) translators not only to distrust the machine so as to be able to identify hidden errors, but also to avoid an unethical and improper use of it. Increasing MT literacy and raising awareness not only among translators but also in society at large (Vieira et al., 2021), as well as understanding the wider implications of using MT are key. Research efforts should therefore be devoted to developing an ethical framework for this technology (Moorkens, 2022). This is particularly important in the current context where GenAI — a technology that has not been addressed in this study — is rapidly expanding into all areas of our lives and professions, including translation.

In addition to fostering ethical competences, the informants suggest that emphasis should be placed on the development of basic competences: language and transfer skills (especially in relation to the TL), technological skills, editing skills, critical thinking, thematic knowledge, and adaptability to change. Having an excellent command of both the SL and the TL, a sound medical knowledge, an advanced knowledge of technologies and an effective and critical use of them will help trainee translators to detect different kinds of errors and to avoid interferences that affect the TL. This may involve adopting two different approaches to translator training: on the one hand, to provide basic skills (at bachelor's level), and, on the other hand, to promote specialisation in the medical field (at master's level). For the purposes of specialisation, competence frameworks such as the one published by the European Master's in Translation (EMT Board, 2022) can be useful as starting points that would need to be refined and prioritised according to the field (Montalt & Muñoz-Miquel, 2024). The challenge is to teach basic translation skills to students who will be trained with MT (and currently also with AI technologies) around them from the start. Indeed, an increasing number of conferences and forums are beginning to address these issues (González Pastor, 2022), because trainers need to know which technology should be taught and when to ensure that the essence of the challenge of translating is not lost.

6. Conclusions, limitations and future work

In this qualitative exploratory study, in which ten medical translators with different training and professional profiles were interviewed, we have obtained rich and varied data on how and why the informants have integrated MT into their workflows, what quality MT offers, how this technology has changed the way they approach the translation process, what impact it has on their tasks and profile, or what they think about translators' competences. However, the study has several limitations that mean that our findings must be interpreted with caution.

Firstly, the exploratory nature of the study and the small sample size prevent the results from being generalisable or representative of the whole population of medical translators. Therefore, they can only be considered as a preliminary approach to the topic. Secondly, the recruitment channels may have introduced sampling bias (e.g., a

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preponderance of translators belonging to a professional association or linked with an academic setting), and access to other sources could have yielded different results. Thirdly, this study focuses on a single language pair (English-Spanish). While some of the findings coincide with studies on other languages (e.g., English-French; see Vidrequin, 2022, 2023), the use and impact of MT might be different in other combinations, particularly those involving low-resource languages. Thus, future research could replicate this study with other language pairs to explore convergences and divergences.

Despite these limitations, the results obtained will serve as a starting point for designing a quantitative study with a survey targeting a larger number of medical translators (mixed-methods research). This will allow us to obtain quantifiable data on the tasks and profiles associated with PE, the MT tools used, the types of errors depending on the text genre, or the specific competences required for PE. This future study will also examine the use of GenAI by professional translators (how extensively it is used, what difficulties it presents, what training challenges it poses) as well as trainers' perspectives on the use of these technologies in the classroom. The ultimate aim is to gain a better understanding of the impact of MT and AI on both the profession and university training.

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Data availability statement

The raw data are not publicly available, as the participants did not consent to the transcripts and dataset being shared openly. These data are protected by non-disclosure agreements between the researcher and the participants.

Appendix – Interview questions[4]

Block 1 – Socio-professional profile

- What did you study (including postgraduate education, if any)?
- What is your employment status?
- How long have you been working as a professional translator?
- What percentage of your work activity is devoted to the medical and healthcare field?
- What tasks do you carry out (translation, post-editing, interpreting, etc.)?
- What types of medical and healthcare texts do you usually translate?
- What topics do you usually translate?
- What other language combinations do you work with, apart from English-Spanish?

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- What clients do you work for?
- What technological tools do you use in your daily work?

Block 2 - Experience with MT, quality of MT, and PE process

- How many years have you been using MT or doing post-editing?
- Why do you use MT? How have you introduced MT into your workflow? Do you offer PE services?
- Which MT engines do you use? When and how do you use them?
- Does the client provide you with any guidelines or instructions for post-editing?
- Have your working conditions changed with the use of MT? If so, why and how?
- Has the use of MT changed the way you approach a translation? Does it modify the translation process in any way?
- In which medical texts do you use MT? In which texts does MT work well? In which texts is MT quality worse? Are there any texts in which you wouldn't use MT? Why?
- What type of errors do you usually correct?
- What factors affect the quality of the MT output?
- What advantages does MT have?
- What drawbacks does MT have?

Block 3 - Training, competences and future perspectives

- What competences do you put into practice when post-editing? Are these different from the competences required for translation?
- Have you received any training in PE? Do you think specific training is required? How should this training entail?
- Does the use of MT influence translator training and competences? In what way?
- Has your professional profile or the tasks you carry out changed with the use of MT?
- What impact do you think MT will have on the (future) profile of medical translators?
- Do you think this technology is a threat or an opportunity? How do you see the future of the profession?

Notes

[1] WMT stands for Workshop on Machine Translation. The first WMT was held in 2006. In 2016, with the rise of NMT, WMT became a conference of its own, the Conference on Machine Translation, although it is still known as WMT. (For further information, see: https://machinetranslate.org/wmt).

[2] All quotes from participants have been translated from Spanish by the author.

[3] Text genres are "Categories of texts that share similar purposes, structures and conventions. These categories help to classify and analyse texts based on their function, content and form." (Montalt et al., 2024, p. 166).

[4] The questions were adapted to each participant's profile and responses; therefore, not all questions were asked in the same way to every translator.

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