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Interactional metadiscourse in translated and non-translated medical research article abstracts: a corpus-assisted study

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ABSTRACT

This study examines the linguistic and rhetorical characteristics of English medical research article abstracts (RAAs), a crucial medium for the global dissemination of medical information. Two corpora were compiled for analysis: the first consisting of non-translated English medical RAAs sourced from ten leading English-language medical journals, and the second of English medical RAAs translated from ten prominent Chinese medical journals. The findings of the study reveal several key points: 1) Translated medical RAAs exhibit lower levels of tentativeness, primarily due to a significant underrepresentation of hedges (e.g. likely); 2) Translated medical RAAs display higher levels of assertiveness, as indicated by the more frequent use of boosters (e.g. significantly); and 3) No significant difference was observed between the two types of medical RAAs in terms of their use of attitude markers, indicating a similarity in the attitudinal approach when presenting medical research findings in both translated and non-translated medical RAAs. These divergences can be attributed to the unique rhetorical and disciplinary conventions that govern the dissemination of medical knowledge in China compared to Western countries, highlighting the influence of cultural and linguistic norms on scientific communication. This investigation offers novel insights into the translation of medical RAAs, shedding light on cross-cultural divergences in the presentation of medical findings and enriching the discourse on scientific communication across languages.

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Interactional metadiscourse; translation; corpus analysis; research article abstracts

1. Introduction

Communication transcends the act of simply exchanging information, as it involves the intricate interplay of communicators' personalities, attitudes, and assumptions (Hyland, 2005a, p. 3). In this dynamic process, individuals rely on metadiscourse devices as efficient means of expressing and organizing discourse, thereby facilitating meaningful interactions. In this context, Hyland (2005a, p. 49) proposed a metadiscourse framework comprising two dimensions: the interactive dimension, which addresses ways of organizing discourse, and the interactional dimension, which concerns ways of interacting with

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readers. Hyland demonstrated that interactional metadiscourse (IM) serves as a crucial tool for engaging readers, reinforcing argumentative stances, and effectively conveying the writers' perspectives on both the subject matter and the audience, particularly in scholarly writing (Hyland, 2010). IM's relevance extends to research article abstracts (RAAs), which, as Gillaerts and Van de Velde (2010, p. 129) suggest, are not strictly characterized by particular lexis or syntax but instead arise from interactive processes within social and institutional contexts. This means that RAAs, as a distinct genre, embodies an interpersonal dimension that can be analyzed through the IM framework developed by Hyland (2005a). Recent research in translation studies has highlighted significant distinctions between translational language and native writing across various genres and dimensions (Chen et al., 2024; Fan & Jiang, 2019, 2023; Liu et al., 2022a, 2022b; Liu & Afzaal, 2021; Su et al., 2023). Moreover, translated RAAs show distinctive differences from original RAAs in aspects such as modality (Huang & Li, 2023) and syntactic complexity (Liang & Sang, 2022). However, the investigation into translated medical RAAs remains notably underexplored, highlighting a significant gap in academic research.

Medical RAAs, especially those composed in English, play a pivotal role in medical communication by acting as a crucial means for the dissemination of medical knowledge across cultures (Papanas et al., 2012, p. 297). The prominence of English as the primary scientific lingua franca is evident, with over 90% of indexed scientific articles in the natural sciences and more than 70% of articles in the social sciences being published in English in recent decades (Ammon, 2012). This emphasizes the central role of English in facilitating the global dissemination of scientific research findings, particularly within the realm of medical science. Several studies have been conducted on the use of IM within RAAs, with researchers such as Akbas (2012) and Ozdemir and Longo (2014) exploring IM from a cross-cultural perspective, and Gillaerts and Van de Velde (2010) examining the distribution of IM elements in RAAs versus full article texts. Despite these significant insights, there exists a significant research gap in the exploration of IM in medical RAAs. Ghahremani Mina and Biria (2017) underscored distinctions in IM distribution in academic texts, specifically between medical and social science articles. Although numerous studies have delved into the linguistic aspects of medical RAAs, the majority have focused on structural elements, often neglecting the interpersonal dimensions. A notable exception is Salager-Meyer's (1992) examination of modality in medical abstracts. In her study, modal verbs were identified as crucial markers for conveying cautious, speculative, and author-specific perspectives, particularly in sections related to conclusions, data synthesis, and recommendations. This cautious tone is consistent with the inherent nature of research findings, which are typically suggestive rather than definitive. Scientists commonly avoid making absolute statements, acknowledging the potential for multiple interpretations and the importance of not committing unwarrantedly to a single viewpoint.

Due to English's dominance as the academic lingua franca, there has been an increasing demand for English abstracts in Chinese research journals (Friginal & Mustafa, 2017; Hu & Cao, 2011). To meet this demand, Chinese authors often employ translators to translate their abstracts into English (Luo & Hyland, 2019). The main goal of this translation process is to make the research accessible to international readers. However, the translation can pose challenges, especially regarding the use of IM features that align

with disciplinary norms. This study explores the use of three IM features, namely hedges, boosters, and attitude markers in medical RAAs, as categorized by Hyland (2005a). These IM features play a crucial role in shaping the tone and interpretability of RAAs (Gillaerts & Van de Velde, 2010). Through this investigation, we aim to gain a more nuanced understanding of how the use of IM can impact cross-linguistic communication in the dissemination of medical research across diverse cultural contexts.

2. Functions of interactional metadiscourse

IM involves 'the writer's efforts to control the level of personality in a text and establish a suitable relationship to his or her data, arguments and audience, marking the degree of intimacy, the expression of attitude, the communication of commitments, and the extent of reader involvement' (Hyland, 2010, p. 128). According to Hyland (2005a, p. 3), IM is categorized into five sub-categories: hedges, boosters, attitude markers, self-mentions, and engagement markers, primarily derived from Halliday's (1994) interpersonal metafunction. Hyland (2005a) systematically demonstrated that IM is a significant means to promote communication, support positions, improve readability, and build relationships with audiences, particularly in academic writing. Among the five sub-categories of IM, Gillaerts and Van de Velde (2010) found that the use of self-mentions is highly conventionalized and engagement markers are rarely used in RAAs, whereas hedges, boosters, and attitude markers are directly relevant to the writing of RAAs. Following their approach, the present study also focuses on these three IM features and examined how they might be differently represented in translated and non-translated medical RAAs. The functions of hedges, boosters, and attitude markers are detailed in Table 1 (Hyland, 2010).

3. Research gap and research questions

Although numerous scholars have explored the phenomenon of IM across different registers (Al-Subhi, 2022; Birhan, 2021; Chen & Li, 2023; Herriman, 2022; Lee, 2021), disciplines (Hyland, 2010; Rashidi & Alihosseini, 2012), learners (Yoon, 2021), and languages (Yu & Wen, 2022), it is only recently that its significance and representation in translated texts have attracted scholarly attention (Chou et al., 2023). IM has been widely researched in second-language writing and academic discourse (Hyland, 2010; Kim & Lim, 2013). Owing to its important role in communication, IM, recognized as a crucial component of RAAs, has garnered significant scholarly attention due to the perceived importance of RAAs in disseminating scientific knowledge (Akbas, 2012; Gillaerts & Van de Velde, 2010; Liu & Huang, 2017; Ozdemir & Longo, 2014; Rashidi & Alihosseini, 2012). Existing research has underscored that the proper use of IM to present a persuasively constructed argument to readers is vital for effective communication and successful academic writing (Gillaerts & Van de Velde, 2010; Hyland, 2005a, 2010).

Table 1. The functions and instances of hedges, boosters, and attitude markers (Hyland, 2010).

IM	Functions	Instances
hedges	hold back writer's commitment to proposition	may / possible / about
boosters	emphasize writer's certainty in proposition	definitely / obvious
attitude markers	show writer's attitude to proposition	important / surprisingly

Prior research has also revealed that writers from different language backgrounds employ IM differently, and EFL speakers tend to employ hedges less frequently in academic writing (Yoon, 2021). Considering that the translators of medical RAAs in Chinese-medium journals are primarily the Chinese authors themselves or other Chinese translators, it is assumed that hedges would be underused, and boosters would be overused in the translated medical RAAs. However, as of now, no research has explored how IM is depicted in translated medical RAAs in comparison to non-translated ones. The following review of relevant studies establishes the essential background for the current study.

In examining the representation of IM in translated RAAs, various studies have illuminated distinct aspects of this linguistic phenomenon. Pérez-Llantada (2010) uncovered a comparable presence of IM in English medical articles authored by both English and Spanish speakers, emphasizing the influence of normative conventions governing research article writing. Martikainen (2018) delved into the translation of modal markers within medical abstracts, revealing how translation can impact readers' interpretations of treatment effectiveness and compromise the intended communicative purpose of the research articles. Dagnev (2019) demonstrated how professional non-native English translators adhere to the language norms of their native tongue, specifically focusing on tense, voice, and sentence structure when translating Bulgarian medical RAAs into English. Furthermore, studies have explored how the process of translation can influence the objectivity and interpersonality conveyed in the text. Galvão (2009) found that translation from Romance languages (e.g. Portuguese) to Germanic languages (e.g. English) enhances the objectivity of the translated abstracts. Hu and Cao (2011) analyzed hedges and boosters in English and Chinese abstracts in applied linguistics research articles, revealing differences in their use between abstracts from English and Chinese journals. Escudero and Swales (2011) investigated author-translated RAAs, finding variations in epistemic commitment and the use of attitude markers in Spanish and English abstracts. Friginal and Mustafa (2017) observed differences in the use of hedges, indicating variations in directness between US-based English RAAs and Iraqi ones. Li (2020) identified distinct rhetorical preferences in RAAs originally written in English versus Chinese and emphasized the influence of translation strategies on IM representation. Collectively, these studies indicate that compared to academic texts in other languages, academic texts in English tend to utilize more hedges, and the representation of IM in English translation is influenced by the language of the original text. However, a comprehensive systematic study examining how IM is specifically represented in translated English abstracts within the medical field is lacking (Li, 2020).

Through our review of these studies, we have pinpointed several research gaps. Firstly, there is a noticeable lack of research on IM within medical RAAs. Secondly, many studies rely on relatively small, self-compiled corpora, typically consisting of around 100–200 abstracts. Thirdly, the majority of studies concentrate on language pairs within the Indo-European family and seldom explore typologically distinct languages, such as Chinese and English. Given these gaps in research, our objective is to investigate how IM is represented in translated medical English RAAs from Chinese and compare them with non-translated ones. The present study aims to address the following three research questions:

RQ1: How do the three IM features (i.e. hedges, boosters, and attitude markers) manifest in translated and non-translated medical RAAs?

RQ2: In what ways do translated medical RAAs differ from non-translated medical RAAs concerning the utilization of the three IM features?

RQ3: What practical and pedagogical implications emerge for the translation of medical English upon identifying these divergences or convergences?

4. Material and methods

4.1. Corpora

We selected ten international medical journals with the highest Journal Impact Factor indexed in the Web of Science Core Collection (WoS) and ten Chinese medical journals with the highest Journal Impact Factor indexed in the Chinese Academic Journal Network Publishing Database (CAJD) (see Appendix A). As the international impact factor is not applicable to the Chinese journals, we referred to the impact factor data published by the China National Knowledge Infrastructure (CNKI). Next, we collected the abstracts of the top 100 articles with the highest citations from each English journal to create the Non-translated Medical Research Abstract Corpus (NMRA Corpus). Similarly, we collected the translated Chinese-English abstracts of the top 100 articles with the highest citations from each Chinese journal to form the Translated Medical Research Abstract Corpus (TMRA Corpus). Consequently, each corpus comprises 1000 English medical RAAs. The NMRA Corpus comprises a total of 289,419 words, whereas the TMRA Corpus contains 172,499 words (see Table 2). In addition, to aid our qualitative analysis, we also collected the native Chinese abstracts of the NMRA Corpus.

To ensure maximum comparability between the two corpora during compilation, we implemented the following measures. Firstly, we carefully selected all abstracts from reputable international and Chinese medical journals, aiming to maintain comparability in terms of text type, subject matter, professional community, and communicative function.

Secondly, we specifically chose journals with the highest Journal Impact Factor in the medical field based on impact factor data published by official institutions. The research articles we selected had the highest citations in each journal, thus representing the pinnacle of medical research practice both internationally and in China. This approach helped to guarantee the quality of the RAAs.

Thirdly, we focused on ten reputable international medical journals based in the UK and the USA. Given that the selected articles had high citations, they were primarily authored by renowned researchers in the medical field (Yoshikane, 2013; Yu, 2015).

Table 2. Descriptive statistics of NMRA Corpus and TMRA Corpus.

Corpus	Number of abstracts	Tokens	Word types	Mean length of text	Note
NMRA	1000	289,419	14,131	289	The Non-translated Medical Research Abstract Corpus
TMRA	1000	172,499	12,091	172	The Translated Medical Research Abstract Corpus
Total	2000	461,918			

Moreover, these top journals follow a rigorous review process, ensuring that the RAAs are written in standard English (Hu & Cao, 2011). Consequently, publications in international English medical journals serve as a representation of how medical English should be written in the L1 English context.

4.2. Analysis

Our analysis employs both quantitative and qualitative approaches to compile statistical occurrences and thoroughly examine the usage of these three types of IM within the two corpora. For quantitative analysis, we used the Authorial Voice Analyzer (AVA), an automated processing tool developed by Yoon (2017), to calculate the normalized frequency (NF, i.e. occurrences per 1000 words) of linguistic items based on Hyland's (2005a) IM categories. AVA features 164 items in the hedge list, 174 items in the booster list, and 640 items in the list of attitude markers (see Yoon, 2017, for a comprehensive discussion of the items). AVA employs a variety of regular expressions to capture the linguistic variability of IM. For example, the expression '(?<!in|un)(arguable|arguably)' is specifically designed to match and retrieve instances of 'arguable' and 'arguably' as hedges while excluding similar forms like 'inarguable' or 'unarguable' (Yoon, 2021). This regular expression syntax effectively excludes words or phrases that are similar in form but not relevant (Yoon & Römer, 2020). Another example of a regular expression is 'it (is|was|'ll be|will be|would be|can be|could be|may be|might be)\s\w*\s?assumed*', which efficiently and comprehensively retrieves a wide range of hedge expressions in large-scale corpora. AVA reports a correlation coefficient of 0.921 for hedges and 0.892 for boosters with hand-coded results, affirming AVA's reliability for studying IM (Ibid.). During the analysis, we observed some attitude markers overlapping with certain medical terms. For instance, 'absolute risk reduction' refers to 'a measure of the treatment effect that compares the probability or mean of a particular outcome in the control group with that of the treatment group.' Therefore, the term 'absolute' should not be considered a booster item. To ensure data accuracy, we conducted a careful manual review of occurrences within the corpus, identifying and excluding entries that, while mentioned in the content descriptions of medical RAAs, did not align with the specified IM categories, such as 'abnormalities,' 'effective,' and 'aggressive.' This selective process was crucial for maintaining the relevance and accuracy of our analysis. Illustrative examples of the exclusions are as follows:

(1) The most common ADEs were gastrointestinal, renal, and hematologic **abnormalities**, accounting for 78 (42%), 45 (24%), and 28 (15%) 30-day ADEs, respectively. (NMRA-666)
(2) BNT162b2 was 95% **effective** in preventing Covid-19 (95% credible interval, 90.3–97.6). (NMRA-130)
(3) Meanwhile, severe cytologic atypia and/or any other more **aggressive** malignant tumor can also play a role. (TMRA-477)

Next, we performed searches for the IM items from the three lists using the corpus analysis freeware AntConc (Anthony, 2019), leveraging its 'Word' and 'Key-Word-In-Context' (KWIC) functions. These functions facilitated the assessment of the frequency of the IM items and their common usage within each corpus. Importantly, the 'Collocate'

function allowed us to retrieve words that frequently collocate with the IM items, providing valuable contextual insights. Furthermore, the 'Keyword' function assisted in identifying words with significantly higher frequency compared to the reference corpus. Building upon the quantitative results, we selected some typical examples showcasing the utilization of IM features for further qualitative analysis.

5. Results

5.1. Distribution of interactional metadiscourse in TMRA and NMRA

IM is quite prevalent in both translated and non-translated medical RAAs, as revealed by quantitative analysis. Table 2 illustrates the statistical distribution of hedges, boosters, and attitude markers in the two corpora. In NMRA, the occurrence of IM is 24.63 per 1000 words, totaling 6206 items, which is more frequent than in TMRA, with 23.88 per 1000 words and a total of 2924 items. The result of the Mann–Whitney U test indicated that there were no significant differences in the frequency of overall IM between the translated and non-translated medical RAAs (see Table 3).

However, the Mann–Whitney U tests reveal significant differences in the distribution of hedges and boosters (ps < 0.01) between the translated and non-translated medical RAAs. Table 3 shows the mean (SD) for hedges in NMRA is 10.15(9.79), higher than the 5.59(9.08) found in TMRA. In contrast, the mean (SD) for boosters in NMRA is 8.07(7.30), which is lower than the 10.17(9.51) in TMRA. No significant difference was found in the use of attitude markers between the two corpora. These results indicate that TMRA uses boosters more frequently and hedges less often compared to NMRA.

Figure 1 provides a visual comparison of the representation of three IM features across the two corpora. Non-translated medical RAAs show a significant overrepresentation of hedges compared to translated ones, whereas boosters are more prevalent in the translated medical RAAs than in their non-translated counterparts. This trend aligns with existing research, which suggests that Chinese authors tend to employ more boosters, fewer hedges, and maintain a similar number of attitude markers in economics RAAs compared to their English counterparts (Liu & Huang, 2017). Similarly, abstracts published in English-medium journals exhibit more hedges and fewer boosters compared to Chinese abstracts in Chinese-medium journals within applied linguistics (Hu & Cao, 2011). Despite the disciplinary differences, these findings consistently suggest that translated English medical RAAs assert claims more strongly than non-translated medical RAAs by using fewer hedges and more boosters. However, both translated and non-translated medical RAAs display an equal level of

Table 3. Statistical description of IM in the two corpora.

	NMRA Corpus			TMRA Corpus			Mann-Whitney U test	
IM	Token	%	Mean (SD)	Token	%	Mean (SD)	Z	*p*
Hedges	2668	42.99	10.15 (9.79)	810	27.70	5.59 (9.08)	−14.80	0.00*
Boosters	1915	30.86	8.07 (7.30)	1043	35.67	10.17 (9.51)	−4.27	0.00*
Attitude markers	1623	26.15	6.41 (7.92)	1071	36.63	8.12 (11.01)	−1.15	0.25
Total	**6206**	**100**	**24.64 (17.52)**	**2924**	**100**	**23.87 (17.78)**	**−1.19**	**0.23**

Note: '%' indicates the total percentage; 'Mean (SD)' refers to the average value per 1000 words (Standard Deviation); '*' highlights significance determined by Mann-Whitney U tests ($p < 0.05$).

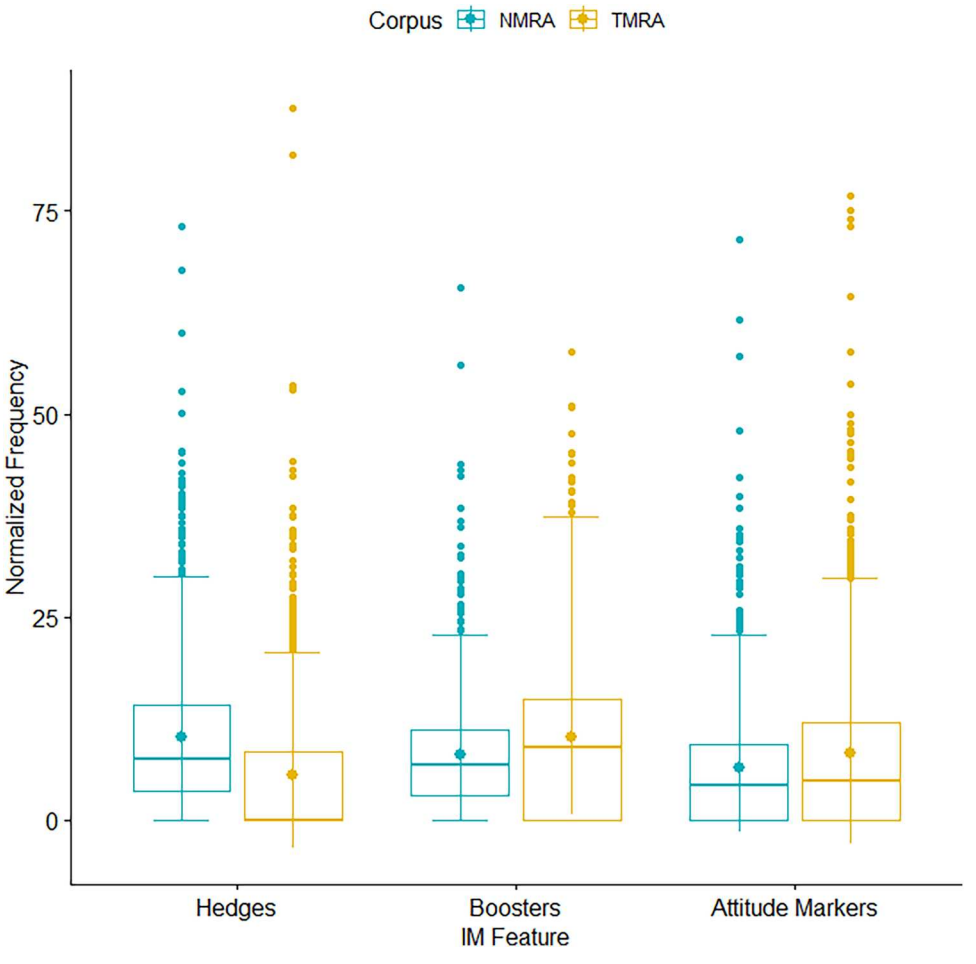

Figure 1. Statistical description of the three kinds of IM in the two corpora.

affection, exhibiting an equivalent presentation of attitude markers. These results indicate that Chinese medical scientists adopt a distinct approach in conveying their research findings compared to their international peers who publish in high-impact English medical journals. To further investigate these differences, we conducted a detailed analysis of the frequency and textual usage of specific linguistic items. In the following section, we provide an in-depth discussion of the three IM features and examine their unique representations in the two corpora through illustrative textual examples.

5.2. Ranked frequency of hedges, boosters and attitude markers in the two corpora

5.2.1. Hedges

Hedges, as defined by Hyland (2005b, p. 178), encompass words like 'might,' 'probably,' and 'about that' that express the writer's uncertainty about a statement, signaling a decision to 'withhold complete commitment to a proposition.' Hedges suggest that the

propositions are grounded in the writer's plausible reasoning, allowing readers to hold differing views, thereby involving them in the communication process.

In Examples 1 and 2, modal verbs such as 'might' and 'may' are carefully utilized in the conclusion sections of the RAAs to convey the weight that writers assign to the assertion. These hedging items imply the writers' judgment regarding the impact of 'innovative tactics for public health surveillance' on supplementing 'conventional diagnostic testing' and the effect of 'the 'quick in-slow out' enhancement pattern' on 'predicting and diagnosing the well-differentiated HCC.' (see Examples 1 and 2) These judgments are not presented as assertive knowledge but are based on plausible reasoning. It is noteworthy that both instances originate from the conclusion sections, aligning with Salager-Meyer's observation (1992) that the inherent nature of research findings tends to be indicative rather than definitive. Consequently, researchers exercise caution by acknowledging multiple interpretative possibilities and avoiding unwarranted commitment to singular viewpoints.

Example 1:
Conclusion: To supplement conventional diagnostic testing, which is constrained by capacity, cost, and its one-off nature, innovative tactics for public health surveillance, such as crowdsourcing digital wearable data and monitoring sewage sludge, **might** be helpful. (NMRA-585)

Example 2:
Conclusion: The 'quick in-slow out' enhancement pattern **may** be helpful for predicting and diagnosing the well-differentiated HCC. (TMRA-455)

The frequencies of the top five hedging items in the two corpora are presented in Table 4. In the non-translated medical RAAs, these top five items constitute approximately 34% of all hedging expressions, whereas in the translated medical RAAs, they make up about 54%. Notably, the top two hedging items, 'may' and 'could,' contribute to approximately 41% of all hedges in the translated corpus, indicating a relatively restricted spectrum of hedging expressions in the translated medical RAAs (TMRA).

Hyland's (1996, p. 438) taxonomy classifies hedges into two main types: content-oriented and reader-oriented hedges. Content-oriented hedges focus on a statement's adequacy conditions, representing the relationship between the proposition and a

Table 4. Top five hedging items and their frequencies in the two corpora.

Corpus	Item	Token	Per 1000 words	Range
NMRA	may	289	1.05	220
	reported	253	0.92	172
	could	144	0.52	120
	likely	131	0.47	96
	would	92	0.33	67
TMRA	may	213	1.21	166
	could	117	0.66	87
	mainly	55	0.31	51
	might	28	0.16	22
	reported	28	0.16	23

Note: Range = the number of abstracts that each item appears in.

representation of reality (p. 439, emphasis in the original). Examples of content-oriented hedges include 'may,' 'possible,' 'appear,' and 'seem.' Conversely, reader-oriented hedges are associated with a statement's acceptability to readers (Ibid.). Hedge items in this category, such as 'in my opinion' and 'would,' reflect the writer's caution and carefulness by appealing to readers' judgments and evaluations. Almost all the hedging items presented in Table 4, excluding 'would,' fall under the content-oriented hedges category. This suggests that both translated and non-translated medical RAAs share a certain level of genre homogeneity. For researchers, it is crucial to manage the level of subjectivity and establish an appropriate relationship with their data, arguments, and audience. While the reader-oriented hedge 'would' is also utilized in both corpora, it is more prevalent in the non-translated corpus compared to the translated corpus.

Our analysis reveals that the translated medical RAAs not only employ a lower number of hedges but also exhibit less variety. Consequently, we conducted a keyword analysis to investigate which hedges are disproportionately utilized in the non-translated compared to the translated corpus, and vice versa. Table 5 displays ten hedging items that are statistically more prevalent in the non-translated medical RAAs than in the translated ones. The log likelihood values indicate that most hedging items in the translated corpus also appear in the non-translated corpus, implying that these hedges are not significantly underrepresented in the non-translated corpus. To ascertain if the disparities stem from the source texts or the translation process, we conducted a search for the Chinese equivalents of the hedging items in the original Chinese corpus. The results indicate 112 instances of '可能 *keneng*' (likely / possible / possibly / probable / probably / may / maybe), 14 instances of '约 *yue*' (about / approximately / around), and only one instance of '不确定 *bu queding*' (uncertain / uncertainty). Further review of the Chinese corpus revealed that other hedges are seldom used in the Chinese abstracts. A comprehensive list of Chinese hedges is provided in Appendix B. The findings demonstrate a tendency among Chinese authors to refrain from using hedge expressions in their original Chinese texts. Based on these results, it can be concluded that the scarcity of hedge expressions in the translated medical RAAs primarily originates from the Chinese source texts. This observation underscores that translators (occasionally the authors themselves) may lack genre awareness when conveying medical findings in English.

Table 5. Overused and underused hedging items, their raw frequencies (normalized frequencies) and log likelihood in TMRA compared with NMRA.

Overused item	TMRA RF(NF)	NMRA RF(NF)	LL	Underused item	TMRA RF(NF)	NMRA RF(NF)	LL
mainly	55(0.32)	39(0.13)	17.24	reported	28(0.16)	253(0.87)	109.46
briefly	8(0.05)	0(0)	15.76	likely	9(0.05)	131(0.45)	73.41
could	117(0.68)	144(0.50)	6.11	potentially	2(0.01)	65(0.22)	46.73
may	213(1.23)	289(1.00)	5.46	would	13(0.08)	92(0.32)	33.00
hardly	2(0.01)	0(0)	3.94	approximately	5(0.03)	62(0.21)	32.25
seldom	2(0.01)	0(0)	3.94	uncertainty	0(0)	34(0.12)	31.79
tendency	6(0.03)	3(0.01)	3.17	often	17(0.10)	86(0.30)	21.62
quite	3(0.02)	1(0.00)	2.35	uncertain	0(0)	23(0.08)	21.51
slightly	7(0.04)	5(0.02)	2.16	reports	12(0.07)	71(0.25)	21.44
somehow	1(0.01)	0(0)	1.97	primarily	4(0.02)	43(0.15)	20.73

Note: RF = Raw frequency; NF = Normalized frequency; LL = Log Likelihood.

5.2.2. Boosters

Boosters are devices such as 'always,' 'certain,' and 'find' that signify the writer's conviction and confidence in their statements. They convey a singular voice, reducing the array of potential viewpoints and fostering solidarity with readers against opposing perspectives. The utilization of boosters serves to fortify statements, showcasing the writer's authority and confidence. For instance, in Example 3, the use of 'should' in the conclusion aligns the writer with their audience. Similarly, in Example 4, 'obviously' is employed to underscore results assertively, demonstrating a strong commitment to the research data. This highlights that using boosters appropriately in the results and conclusion sections of abstracts can enhance the credibility and reliability of the paper.

Example 3:
Conclusion: Aerobic exercise reduces blood pressure in both hypertensive and normotensive persons. An increase in aerobic physical activity **should** be considered an important component of lifestyle modification for prevention and treatment of high blood pressure. (NMRA-557)

Example 4:
Result: Incidence of postoperative complications in patients with observation group was **obviously** lower than control group ($p < 0.05$). (TMRA-942)

The results indicate a significant difference in the usage of boosters, with the translated medical RAAs containing notably more boosters than the non-translated ones ($p < 0.01$). Table 6 provides an overview of the top 5 boosters in both corpora. Interestingly, the top five boosting items make up 33% of all boosters in the non-translated corpus, while this proportion significantly rises to 98% in the translated corpus. This further underscores that, similar to the use of hedges, the translated medical RAAs exhibit a restricted range of boosters in comparison to their non-translated counterparts.

Table 7 presents the boosting items that are overused and underused, along with their raw frequencies (normalized frequencies) and log likelihood in TMRA compared to NMRA. One notably frequent item is 'significantly,' which is considerably more prevalent in the translated corpus than in the non-translated one (753 vs. 254). A thorough investigation revealed that 'significantly' is frequently employed to report statistical data analysis. As highlighted by Hyland (2005b, p. 147), boosters are commonly used in reporting experimental results in empirical studies to bolster arguments' strength and predict results'

Table 6. Top five boosting items and their frequencies in the two corpora.

Corpus	Item	Token	Per 1000 words	Range
NMRA	significantly	254	0.92	182
	should	197	0.71	157
	especially	59	0.21	56
	substantially	54	0.20	47
	highly	53	0.19	47
TMRA	significantly	753	4.28	317
	should	140	0.79	110
	obviously	49	0.28	45
	obvious	41	0.23	37
	especially	40	0.23	38

Note: Range = the number of abstracts that each item appears in.

Table 7. Overused and underused boosting items, their raw frequencies (normalized frequencies) and log likelihood in TMRA compared with NMRA.

Overused item	TMRA RF(NF)	NMRA RF(NF)	LL	Underused item	TMRA RF(NF)	NMRA RF(NF)	LL
significantly	753(4.37)	254(0.88)	583.44	substantially	1(0.01)	54(0.19)	42.46
obviously	49(0.28)	0(0)	96.53	strongly	2(0.01)	36(0.12)	21.93
obvious	41(0.24)	4(0.01)	57.51	increasingly	3(0.02)	39(0.13)	20.76
totally	18(0.10)	2(0.01)	24.33	particularly	8(0.05)	51(0.18)	16.61
remarkably	18(0.10)	3(0.01)	21.04	extreme	0(0)	15(0.05)	14.03
markedly	21(0.12)	9(0.03)	13.13	notably	0(0)	12(0.04)	11.22
seriously	16(0.09)	7(0.02)	9.80	critically	4(0.02)	27(0.09)	9.28
manifestation	8(0.05)	2(0.01)	7.62	none	5(0.03)	30(0.10)	9.19
excessive	15(0.09)	8(0.03)	7.31	never	1(0.01)	15(0.05)	8.51
evidently	3(0.02)	0(0)	5.91	evident	2(0.01)	16(0.06)	6.34

Note: RF = Raw frequency; NF = Normalized frequency; LL = Log Likelihood.

certainty. The overuse of 'significantly' indicates that Chinese writers demonstrate even greater assertiveness and certainty in this context. Furthermore, the synonymous terms 'obvious' and 'obviously' are utilized to demonstrate the authors' confidence and commitment by eliminating other potential options for causes (refer to Example 4). Their overrepresentation in the translated medical RAAs also suggests that Chinese authors tend to present strong claims, showcasing the writer's authority and assertiveness. For a comprehensive list of Chinese boosters, please refer to Appendix B.

Our analysis reveals a tendency for the translated medical RAAs to overuse certain boosters while displaying a lack of variety. For instance, boosters like 'increasingly,' 'strongly,' and 'substantially,' frequently used to report statistical data analysis (see Example 5), are more prevalent in the non-translated medical RAAs compared to the translated ones. This trend extends to the common boosting item 'significantly' in TMRA, which is expressed in a more varied manner in the non-translated medical RAAs. This greater diversity of boosters in the non-translated medical RAAs, as opposed to their translated counterparts, indicates a broader repertoire for conveying arguments and propositions among authors in English-medium journals.

Example 5:
Result: Male sex and obesity were **strongly** associated with the presence of sleep-disordered breathing. (NMRA-116)

5.2.3. Attitude markers

Attitude markers in a text reflect the writer's affective stance and emotions regarding the arguments being made (e.g. 'agree,' 'correctly,' 'essential'). Unlike hedges and boosters that address the probable reliability of statements, attitude markers convey emotions such as agreement, importance, and surprise, contributing to the construction of interpersonal engagement. In example 6, the attitude marker 'important' is employed to convey the writer's affective attitude regarding the significance of 'inflammation'.

Example 6:
Background: Inflammation may be **important** in the pathogenesis of atherothrombosis. We studied whether inflammation increases the risk of a first thrombotic event and whether treatment with aspirin decreases the risk. (NMRA-177)

Table 8. Top five items of attitude markers and their frequencies in the two corpora.

Corpus	Item	Token	Per 1000 words	Range
NMRA	important	146	0.53	127
	best	43	0.16	38
	strong	42	0.15	35
	accurate	40	0.15	37
	essential	36	0.13	30
TMRA	important	162	0.92	146
	effectively	66	0.38	65
	great	39	0.22	37
	essential	29	0.17	16
	superior	25	0.14	23

Note: Range = the number of abstracts that each item appears in.

The results revealed no significant differences in the use of attitude markers between the two corpora. Hyland (2005a, p. 151) indicated that attitude markers are typically less prominent in 'hard' sciences compared to 'soft' sciences. This finding is consistent with Hyland's research, which observed that among the three IM features, attitude markers are used least frequently in hard sciences, including biology and astrophysics. The use of attitude markers reflects the writer's affective attitude rather than an epistemic one, serving to either attenuate or reinforce the writer's judgments and attitudes towards results, behaviors, or entities (ibid., p. 149). These markers encompass attitude verbs (e.g. 'expect,' 'prefer'), adverbs (e.g. 'disappointingly,' 'importantly'), and adjectives (e.g. 'desirable,' 'essential,' 'important'). Hyland (2005a) notes that the explicit judgments conveyed by attitude markers place the author at the forefront of their interaction with the disciplinary community. Consequently, the humanities and social sciences tend to utilize attitude markers more frequently than the fields of science, technology, and engineering, which emphasize demonstrable generalizations over individual interpretations. These latter fields focus more on research practices, methods, procedures, and the equipment used (ibid., p. 149-150). This trend is also observed in the field of medical science, as confirmed by the results of this study. Medical science, recognized as a rigorous discipline, emphasizes empirical and experimental methodologies, prioritizing research design and procedures above the personal credibility and influence of the researcher.

Table 8 illustrates the top 5 attitude markers in each corpus. In the non-translated corpus, these top five markers account for approximately 19% of all attitude markers, whereas in the translated corpus, they make up around 30%. This implies a narrower range of attitude markers in the translated corpus compared to the non-translated one, similar to the observed trend with hedges and boosters. Notably, nine out of the ten highlighted attitude markers are adjectives, reflecting the authors' emotions related to importance and emphasis. The attitude marker 'important' holds the top position in both corpora, indicating a commonality between the translated and non-translated medical RAAs. Despite certain preferences for specific expressions, the two corpora overall do not significantly differ from each other.

6. Discussion

In this study, we observed a distinction in the communication of medical findings between translated and non-translated medical RAAs, as indicated by the representation

of IM features. The findings have yielded new insights into how medical communication in English might be subject to cultural and social variations. In the following, we discuss the findings from three perspectives: (1) rhetorical and disciplinary conventions governing academic writing in medical science between the West and China; (2) directionality of medical translation; (3) pedagogical issues in relation to the language training of medical and healthcare-related professionals as well as translators.

6.1. Rhetorical and disciplinary conventions

According to Hyland (2005a, p. 90), 'writers have to ensure that their claims display a plausible relationship with reality using the epistemic conventions and argument forms of their disciplines.' In the medical field, medical scientists and researchers also adhere to disciplinary norms and conventions to effectively communicate their medical findings. However, despite both translated and non-translated medical RAAs being written in English, they diverge in their nature and assumptions, deeply rooted in their respective cultural values and epistemic frameworks. The translated medical RAAs, although intended for English-speaking readers, are often literal translations of the corresponding Chinese abstracts (Li, 2020), reflecting Chinese disciplinary practices rather than international ones. Confucianism, a fundamental aspect of Chinese social structure, places significant emphasis on respecting authority and upholding the social hierarchy. Consequently, the hierarchy of power and the authority of experts in Chinese academia are widely accepted culturally. It is considered a cultural taboo for individuals to challenge or dispute the claims and findings of authorities. Thus, Chinese medical scientists tend to maintain an authoritative tone when communicating their medical findings, conveyed through more assertive boosting items. As a result, translated medical discourse is characterized by a limited use of hedges and an abundance of boosters, aligning with Chinese disciplinary norms and rhetorical practices (Gong et al., 2021; Hu & Cao, 2011). On the other hand, researchers publishing in English-medium medical academic journals often adopt a more tentative stance to present their findings, frequently qualifying their statements. Our findings align with previous comparative studies on translated and non-translated abstracts across various disciplines, highlighting that hedges are more prevalent in the latter (Escudero & Swales, 2011; Friginal & Mustafa, 2017; Gong et al., 2021; Hyland, 2000, 2005b; Mu et al., 2015). This trend is deeply rooted in Socratic and Aristotelian philosophical traditions that value epistemological practices such as engaging in debate and argumentation as a process of constructing knowledge (Tweed & Lehman, 2002). As noted by Hu and Cao (2011), Anglo-American academic writers use hedges to demonstrate an appropriate degree of prudence, tentativeness, and commitment to make their propositions and arguments more acceptable to their disciplinary communities.

'Translation of science is as old as science itself' (Montgomery, 2010, p. 299). Translation plays an indispensable role in disseminating scientific knowledge, including medical research discoveries, to a global audience. However, due to distinct epistemic traditions, medical findings published in translated and non-translated medical journals may vary in the effectiveness of disseminating medical knowledge. Despite medical English being increasingly seen as a lingua franca, it should not be perceived as a

homogeneous variety; rather, it exhibits significant variations based on socio-cultural contexts, epistemic frameworks, and rhetorical conventions.

6.2. Directionality of medical translation

According to House (2013), globalization processes have not only led to the ascent of English as a lingua franca but have also substantially increased translation activities worldwide. This trend is evident in medical translation, particularly because a significant majority of medical scientists belong to the outer circle (English as second language speakers) and the expanded circle (English as foreign language speakers) of the Kachruvian three-circle model (Kachru, 1985). Medical scientists, most of whom may not be proficient in English, heavily rely on translation to effectively communicate their research findings and interpretations in a reliable and cost-effective manner. The question arises: should the English rendition of medical academic literature adhere to the rhetorical norms of the source language or align with the translation conventions of English? Li (2020) emphasizes that the standards and stylistic aspects of academic communication are inherently tied to cultural contexts. For example, Chinese abstracts of research articles may exhibit distinct norms and rhetorical strategies compared to prevailing English discourse criteria. Our current study highlights that Chinese writers and translators seem to overlook English rhetorical conventions when presenting medical RAAs in English. The prevalent overuse of boosters and underuse of hedges in translated medical RAAs deviate from the rhetorical and disciplinary norms that underlie the Anglo-American epistemic frameworks.

Li (2020) further elaborates that the Chinese scholarly community might not find it necessary to extensively elaborate on research methodologies or emphasize research findings as a means to establish the validity of their contributions. This tendency could be attributed to various factors. For instance, Peterlin's study (2014) delves into the performance of novice translators, their awareness of, and perspectives on, academic rhetorical norms. The study reveals that an excessive reliance on expressions from the source text often leads to the use of grammatically flawed, unidiomatic, or stylistically inadequate solutions. Furthermore, translators may exhibit reluctance to introduce alterations beyond linguistic aspects, encompassing grammatical or lexical modifications. Thus, a literal translation of Chinese textual and rhetorical conventions into English discourse would create incongruities with the expectations of the target discourse community, potentially impeding comprehension and effective communication.

6.3. Pedagogical implications

Moreover, this study sheds new light on the training of translators. Traditionally, translator training has predominantly emphasized direct translation (translation into one's native language) over inverse translation (translation out of one's native language) (Horcas-Rufián & Kelly, 2020). However, inverse translation is prevalent in the translation industry (Mraček, 2018). Given that English has emerged as the academic lingua franca in the scientific community, the ramifications of translation into one's native language (commonly done by native English speakers) and out of one's native

language (commonly done by non-native English speakers) can be distinct. If direct translation is solely recognized as the valid approach to translation, it may further entrench Anglo-American academic and disciplinary conventions, potentially marginalizing the voices of non-native English speakers. Effective communication of medical knowledge requires the participation of non-native English researchers, who represent a significant portion of the scientific community. Translators, who share the epistemic knowledge and practical concerns of these researchers, are ideally situated to express their perspectives. Therefore, inverse translation should be given proper consideration. Just as medical professionals undergo language training, translators should be made aware of the epistemic and ontological traditions of various cultural communities that influence the construction and dissemination of medical knowledge.

7. Conclusion and limitations

The primary aim of this study was to compare the usage of IM in translated English medical RAAs versus non-translated ones. The analysis reveals that translated medical RAAs typically exhibit greater assertiveness and lower reader-orientation than their non-translated counterparts. This difference in language usage is attributed to the divergent socio-cultural and academic norms. The study's findings emphasize the distinct use of hedges and boosters in the two types of medical RAAs, highlighting the impact of socio-cultural and academic norms. These findings prompt discussions on the implications of translation in effectively conveying and disseminating medical knowledge.

This study is not without its limitations, as it primarily focused on medical RAAs, providing a narrow perspective on the textual characteristics of medical translation. Future research can extend the scope to encompass full medical research articles and various types of medical discourse. Additionally, the study concentrated on a specific set of IM features, offering a limited view on the conveyance of interpersonal meaning. Future investigations could include mood and modality as further linguistic indicators. Lastly, the study's findings are specific to the language pair of Chinese (L1/Source language) and English (L2/Target language), with the translated medical RAAs originating from Chinese. Expanding the research to incorporate different language pairs would broaden the generalizability and applicability of the results.

Author notes

Corpus data concerning the study are publicly available on Open Science Framework (https://osf.io/nxad5/).

Disclosure statement

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

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Appendices

Appendix A

Table A1. Sources of the non-translated abstracts.

English journals	2021 JIF	Region	Number of abstracts
Lancet	202.731	UK	100
New England Journal of Medicine	176.079	USA	100
JAMA-Journal of the American Medical Association	157.335	USA	100
BMJ-British Medical Journal	93.333	UK	100
Nature Reviews Disease Primers	65.038	UK	100
Annals of Internal Medicine	51.598	USA	100
JAMA Internal Medicine	44.409	USA	100
Journal of Travel Medicine	39.194	USA	100
Lancet Digital Health	36.615	UK	100
Journal of the Royal Society of Medicine	18	UK	100
Total			1000

Data source: (Web of Science) https://jcr.clarivate.com/jcr/browse-journals

Table A2. Sources of the translated abstracts.

Chinese journals	2019 CNKI IF	Region	Number of abstracts
Medical Journal of Chinese People's Liberation Army	1.666	China	100
National Medical Journal of China	1.639	China	100
Medicine and Society	1.614	China	100
Medical and Pharmaceutical Journal of Chinese People's Liberation Army	1.496	China	100
Medical Journal of Peking Union Medical College Hospital	1.484	China	100
Anhui Medical and Pharmaceutical Journal	1.438	China	100
Journal of Medical Postgraduates	1.424	China	100
Medical Recapitulate	1.191	China	100
Anhui Medical Journal	1.159	China	100
Chinese Journal of the Frontiers of Medical Science (Electronic Version)	1.13	China	100
Total			1000

Data source: (CNKI) https://navi.cnki.net/knavi/

Appendix B

Table B. Frequencies of Chinese hedges and boosters in Chinese source texts.

Chinese hedges	Raw frequency	Chinese boosters	Raw frequency
认为(hold)	37	会(will)	26
可能(may/might)	112	要(shall)	34
觉得(feel)	0	必须(must)	15
倾向(tend to)	3	表明(show)	43
尝试/试图(attempt)	3	发现(find)	97
相对(relatively)	19	指出(point out)	10
主要(mainly)	227	实际上/事实上(in fact)	1
比较(kind of)	3	明显(obviously)	482
在一定程度上/一定程度上 (to a certain/some extent)	6	总是(always)	0
总体来说(in general)	1	不可否认(undeniably)	0
似乎(seem)	0	普遍认为(it is well known)	2
几乎(nearly/almost)	5	尤其是(particularly)	14
不确定(uncertain / uncertainty)	1	值得一提的是(worth mentioning)	0
约(about / around)	14	强调(emphasize)	6
		甚至(even)	14
		经常 (often)	5
		显著(significantly)	545
		应(should)	112

Note: Source of Chinese hedges and boosters: Hu & Cao, 2011; Gong et al., 2021; Mu et al., 2015; Yu & Wen, 2022.