# How Doctors Report: A Corpus-based Contrastive Analysis of Reporting Verbs in Research Article Introductions Published in International and Thai Medical Journals

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**OBJECTIVES:** This study aims to explore the differences in the use of reporting verbs between medical research article introductions published in the international and Thai medical journals, using a corpus-based approach.

**MATERIALS AND METHODS:** Two comparable corpora were compiled from 50 medical research article introductions published in English language during 2005-2009: 25 introductions from 5 international journals and 25 introductions from 5 Thai journals. All reporting verbs were identified and categorized into 3 types: experimental, discourse and cognition verbs. The differences in the list of these reporting verbs and their usage were examined.

**RESULTS:** The frequency of occurrence of reporting verbs in the international corpus was 12.61 per 1,000 words, while that of the Thai corpus was 9.87 per 1,000 words. The international journals used 40 reporting verbs, whereas 24 reporting verbs were identified in the Thai journals. In all three categories, the international journals used more reporting verbs than the Thai medical journals.

**CONCLUSION:** Reporting verbs were used in the international medical research articles with higher frequencies and a wider variety than the Thai medical research articles. The list and examples from both corpora would assist medical researchers in using reporting verbs to write their research articles appropriately.

The function of the introduction section in a research article is to attract the readers' interest by providing sufficient information that encourages the reader to read the rest of the article.[1] Manske recommends that authors should start their introduction by providing a focused review of that research topic and then state the purpose of the research.[2] For the first part, reviewing related literature is important. After doing extensive research, the author will select relevant studies and refer to them in the manuscript. A reporting verb is normally used in a sentence referring to previous studies. As each reporting verb conveys a different meaning, authors should select the verb appropriate to the object, noun, and tone of the sentence.[3] For example, the reporting verb *"conduct"* is used with an *"experiment"*, not a *'question'*.

According to Thomas and Hawes, reporting verbs can be divided into 3 categories: experimental, discourse, and cognition verbs.[4] The first group, experimental verbs, is used when an author refers to the method or procedures of the cited research. These verbs include **show, find, conduct, observe, demonstrate,** and **establish.** Next, discourse verbs refer to any activities related to speech or writing. Some of the discourse verbs are **report, describe, suggest, recommend,** and **conclude.** For the last group, cognition verbs are reporting verbs referring to mental activities.

These verbs include **believe, consider, think, assume, and recognize.** This classification is useful for writers when choosing a reporting verb appropriate to the cited information.

Over the last 50 years, linguists have been greatly interested in using corpus as a tool in language studies.[5] A corpus is a collection of written or spoken texts that represent authentic examples of language in use. A corpus-based research has been conducted in various fields including medicine.[6-11] For example, Nwogu used corpus to study the structures and functions of medical research papers.[6] Wang et al.[7] developed a Medical Academic Word List (MAWL) from online medical research articles. In 2007, a corpus-based study was conducted to explore syntactic structures of medical research article titles.[8]

As English is increasingly important in medical communication worldwide, English is regarded as the international language of medicine.[12] Most international journals accept only research articles published in English. In Thailand, although authors can submit Thai manuscripts, some national journals also require manuscripts in English. Some journals will accept a Thai research article with an English abstract. This emphasizes the importance of English in medical research writing at both national and international levels. Several studies point out that authors who are non-native English speakers face difficulties concerning writing English research articles.[13-15] In addition, English knowledge may affect linguistic characteristics of English manuscripts written by authors who are non-native English speakers Moreover, although manuscripts are written in English and related to medical field, different contexts may affect the writing method that the authors use when referring to previous studies. However, there has to date been no contrastive study of English research articles published in international and Thai medical journals.

Therefore, this study aims to explore the differences in the use of reporting verbs between medical research article introductions published in the international and Thai medical journals using a corpus-based approach

The results will be valuable to medical researchers aiming to publish their manuscripts in national and international journals. Besides, the data from this study can also be used as a guide for teachers of medical writing as well as those developing learning materials and courses.

## Materials and Methods

In this study, two comparable corpora were compiled from 50 medical research article introductions, published in the English language during 2005-2009. The research articles in this study had to be from original research articles. The introduction section of each article was examined, as reporting verbs are more frequently used here than in other sections of a paper.

The criteria for selecting medical journals was based on representivity, reputation, and accessibility.[6] The list of international medical journals is the same as those of previous corpus-based medical discourse studies.[6, 16] With regard to the Thai journal corpus, the journals had to be representative for the national level. Although there are a considerable number of journals published in Thailand, some journals are identified as international journals; while some are identified as national journal. Thus, to make sure that the Thai corpus consisted of only national journals, only journals categorized as approved national journals by the Office of the Higher Education Commission were included in this study.[17]

The international corpus consisted of 25 introductions from 5 international peer-reviewed medical journals. These journals chosen were: **The Lancet**, **The British Medical Journal**, **The New England Journal of Medicine**, **The Journal of Clinical Investigation**, and **The Journal of the American Medical Association**. For the Thai corpus, 25 introductions from 5 Thai peer-reviewed medical journals were selected. These journals were **Thai Journal of Hematology and Transfusion Medicine**, **Thai Journal of Health Research**, **Srinagarind Medical Journal**, **Songklanagarind Medical Journal**, and **Thammasat Medical Journal**. The general information of both corpora is shown in Table 1.

**Table 1:** The characteristics of the international and Thai corpora

| Characteristic | International corpus | Thai corpus |
|---|---|---|
| Total number of introductions | 25 | 25 |
| Average number of paragraphs per introduction | 3.52 | 2.76 |
| Average number of sentences per introduction | 15.00 | 15.44 |
| Average number of words per introduction | 387.00 | 344.36 |
| Total number of words in the corpus | 9,675 | 8,609 |

**Table 2:** Frequency of reporting verbs in two corpora

| Corpus | Frequency of occurrence | Total words in corpus | Frequency of occurrence per 1,000 words |
|---|---|---|---|
| International | 122 | 9,675 | 12.61 |
| Thai | 85 | 8,609 | 9.87 |

**Table 3:** Top 5 reporting verbs in two corpora

| Rank | International corpus | | Thai corpus | |
|---|---|---|---|---|
| | Reporting verb | Frequency of occurrence per 1,000 words | Reporting verb | Frequency of occurrence per 1,000 words |
| 1 | show | 2.17 | show | 1.86 |
| 2 | suggest | 1.76 | report | 1.74 |
| 3 | report | 0.93 | find | 1.16 |
| 4 | find | 0.62 | demonstrate | 0.81 |
| 5 | think | 0.52 | associate | 0.46 |
| | | | study | 0.46 |

After the corpus compilation, all reporting verbs were identified and categorized into 3 types: experimental, discourse and cognition verbs.[4] To compare the results from two corpora accurately, the frequencies of occurrence were normalized to a basis per 1,000 words. The frequencies of occurrence and the list of reporting verbs identified from both corpora were compared and the differences were examined.

## Results

Twenty-five international research article introductions (100%) used reporting verbs; while reporting verbs were used in 21 Thai research article introductions (84%). Regarding frequency of occurrence, the international corpus had a higher frequency of occurrence of reporting verbs than the Thai corpus (12.61 per 1,000 words vs. 9.87 per 1,000 words) as shown in Table 2.

The 5 most prevalent reporting verbs in the international corpus were **show**, **suggest**, **report**, **find** and **think**. In the Thai corpus, the 6 most prevalent reporting verbs included **show**, **report**, **find**, **demonstrate**, **associate** and **study** (The verbs "associate" and *"study"* were in the same rank.). **Show, report** and **find** were frequently used in both corpora (Table 3)

Forty reporting verbs were identified from international research article introductions; whereas only 24 reporting verbs were identified from Thai research article introductions, as shown in Figure 1. In term of the categories of reporting verbs, both international and Thai medical journals used experimental verbs in the highest percentage (52.50% and 50.00%, respectively). Discourse verbs were used in the second rank (37.50% and 41.67%, respectively) and cognition verbs were used in the lowest percentage (10.00% and 8.33%, respectively).

For the first category, 21 experimental verbs were found in the international research article introductions; while only 12 experimental verbs were identified in the Thai research article introductions. Nine experimental verbs found in both corpora included **show, find**, **demo strate**, **associate**, **identify**, **prove**, **reveal**, **conduct**, and **observe** (Table 4). Twelve experimental verbs were found only in the international corpus; whereas 3 experimental verbs were found only in the Thai corpus.

As shown in Table 5, the international research article introductions used more discourse verbs than the Thai research article introductions. Eight discourse verbs used in both corpora were **suggest**, **report**, **recommend**, **provide**, **conclude**, **describe**, **indicate**, and **predict**. Seven discourse verbs were found only in the international corpus; while 2 discourse verbs were found only in the Thai corpus.

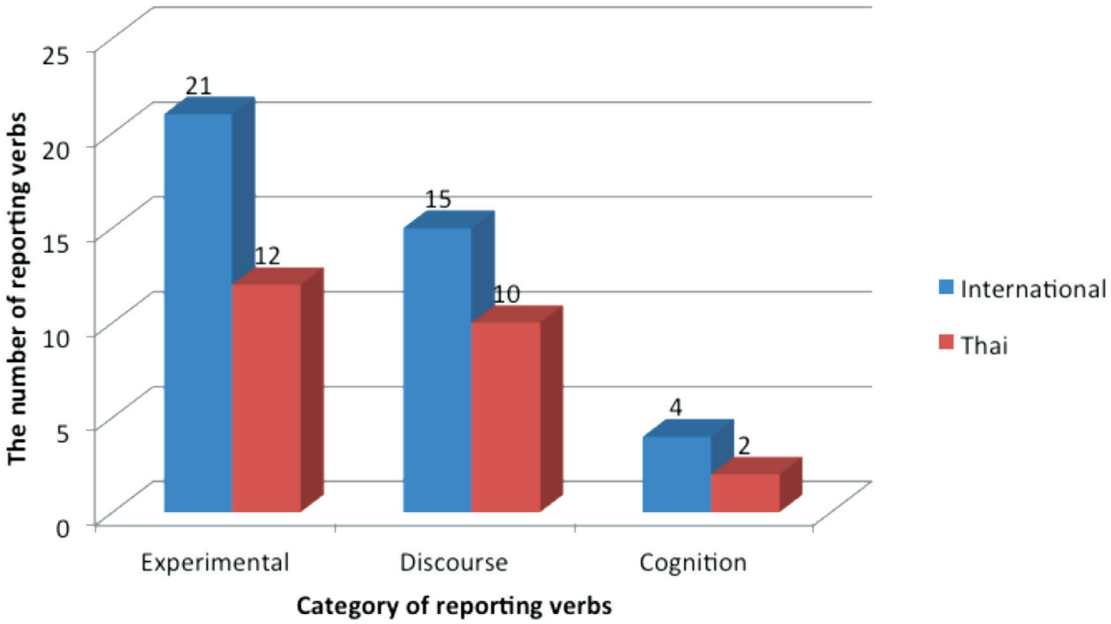


***Figure 1:*** *The number of reporting verbs found in both corpora in each category*

**Table 4:** Experimental verbs in both corpora (listed according to the frequency of occurrence)

| Experimental verbs | | |
|---|---|---|
| Both corpora | Only international corpus | Only Thai corpus |
| show | detect | study |
| find | compare | assess |
| demonstrate | estimate | correlate |
| associate | evaluate | |
| identify | investigate | |
| prove | see | |
| reveal | analyze | |
| conduct | attempt | |
| observe | establish | |
| | illustrate | |
| | perform | |
| | set up | |

**Table 5:** Discourse verbs in both corpora (listed according to the frequency of occurrence)

| Discourse verbs | | |
|---|---|---|
| Both corpora | Only international corpus | Only Thai corpus |
| suggest | agree | document |
| report | ascribe | put forward |
| recommend | discount | |
| provide | emphasize | |
| conclude | note | |
| describe | say | |
| indicate | support | |
| predict | | |

**Table 6:** Cognition verbs in both corpora (listed according to the frequency of occurrence)

| Cognition verbs | | |
|---|---|---|
| Both corpora | Only international corpus | Only Thai corpus |
| focus on | think | none |
| believe | consider | |

Table 6 shows that 2 cognition verbs, **focus on** and **believe**, were found in both corpora; while **think** and **consider** were found only in the international corpus. No cognition verb was found only in the Thai corpus.

From both corpora, 207 sentences using reporting verbs can be used as examples for practice of research writing. They represent real use of reporting verbs in authentic documents. All these sentences would be beneficial for novice researchers as a guide to start writing their manuscripts. Examples of sentences using three prevalent reporting verbs in top 5 lists of both corpora are shown in Table 7. The examples vary in terms of tense and voice.

**Table 7:** Examples of sentences using reporting verbs, show, report and find, from both corpora

| Reporting verb | Corpus | Example |
|---|---|---|
| Show | International | *Earlier studies have shown community occupational therapy given in the home can improve the functional independence of patients with dementia and decrease the burden on the care giver.* (Sentence 1) |
| | | *Aspirin started soon after acute MI and continued for a few weeks has been shown to reduce 1-month mortality by about a quarter and the risks of non-fatal reinfarction and stroke by about half.* (Sentence 2) |
| | | *In this setting, torcetrapib not only increased levels of HDL cholesterol and apolipoprotein A-I but also decreased levels of LDL cholesterol and apolipoprotein B-100 (the latter especially at higher doses) and also showed favorable effects on increasing the size of both HDL and LDL particles.* (Sentence 3) |
| | Thai | *One study showed that music significantly reduced the sensation of labor pain and the distress of labor pain.* *(Sentence 4)* |
| | | *a) Several comparative studies, both in vitro and in vivo, in animals and in human, have been shown that lenograstim is more active than filgrastim on a weight-by-weight basis.* *b) Several comparative studies, both in vitro and in vivo, in animals and in human, have shown that lenograstim is more active than filgrastim on a weight-by-weight basis.* *(Sentence 5)* |
| | Thai | *It has been shown that Bifidobacterium bifidum and Lactobacillus acidophilus stimulate the systemic immune response (macrophage function and number of immunoglobulin secreting cells) as well as the local immune response (IgA secretion into the intestine).* *(Sentence 6)* |
| Report | International | *Studies in various countries have reported long-term rates of event-free survival (EFS) of 28–45%.* *(Sentence 7)* |
| | | *In a recent review, Lievense et al reported that radiological features were the main mediators of progression of hip osteoarthritis; however, all the included studies had a small study population, follow-up was short, and the studies were hospital based.* *(Sentence 8)* |
| | | *Furthermore, opportunistic infections of all etiologies have been reported in such patients.* *(Sentence 9)* |
| | Thai | *Amongst type 2 DM, plasma total homocysteine (tHcy) levels in patients with macrovascular complications have been reported to be higher than in those without and in healthy non-diabetic controls.* *(Sentence 10)* |

| Reporting verb | Corpus | Example |
|---|---|---|
| | | *In 1998, Kuldip, et al. had reported that the optimal dose of vaginal misoprostol for pre-abortion cervical priming was 400 micrograms and its efficacy was dose-dependent.*<br><br>*(Sentence 11)*<br><br>*It has been reported that 40-50% of infertility is due to a male factor.*<br><br>*(Sentence 12* |
| Find | International | *A systematic review found non-pharmacological interventions to produce effect sizes in behaviour similar or larger to those seen with cholinesterase inhibitors, the currently available drug treatment, but without any side effects.*<br><br>*(Sentence 13)*<br><br>*Firstly, the cerebral cortex from fetuses with Down's syndrome was found to have increased activity of superoxide dismutase without a compensatory increase in glutathione peroxidase activity.*<br><br>*(Sentence 14)*<br><br>*Notably, two epidemiology studies among older individuals have found a dose-response relationship between lower extremity function and serum 25(OH)D concentrations, with one study identifying a threshold of 50 nmol/l for optimal function.*<br><br>*(Sentence 15)* |
| | Thai | *In Japan, Kohno found that low dose of rhG-CSF (2 μg/kg or 50 μg/m2 of lenograstim) enables the efficient collection of peripheral blood stem cells after disease-oriented conventional dose chemotherapy in breast cancer patients.*<br><br>*(Sentence 16)*<br><br>*a) Each 5 μmol/l increment of tHcy after adjustment for the others known CVD risk factors has found to increase the risk of coronary events by 28 % with the hazard ratio of 1.28.*<br><br>*b) Each 5 μmol/l increment of tHcy after adjustment for the others known CVD risk factors has been found to increase the risk of coronary events by 28 % with the hazard ratio of 1.28.*<br><br>*(Sentence 17)*<br><br>*a) According to a health status and exercise survey of 7,763 elders from 12 provincials public health offices and 1 Bangkok metropolitan public health office, osteoarthritis/rheumatoid arthritis/joint pain were found in 26.4% of the elderly, muscle fatigue & pain were found 18.6%, within 1 month prior to survey muscle fatigue & pain in 23.9% and osteoarthritis/rheumatoid arthritis/joint pain for 22.7%.*<br><br>*b) According to a health status and exercise survey of 7,763 elders from 12 provincials public health offices and 1 Bangkok metropolitan public health office, osteoarthritis/rheumatoid arthritis/joint pain was found in 26.4% of the elderly, muscle fatigue & pain was found 18.6%, within 1 month prior to survey muscle fatigue & pain in 23.9% and osteoarthritis/rheumatoid arthritis/joint pain for 22.7%.*<br><br>*(Sentence 18)* |

## Discussion

This contrastive analysis demonstrated that authors of the international medical journals used a wider variety of reporting verbs than those of the Thai medical journals. Additionally, the frequency of occurrence of reporting verbs in the international corpus was higher than the Thai corpus. These findings are similar to an investigation of lexical bundles used by native and non-native English speakers.[18] More varied lexical bundles were found in academic essays written by native speakers than those of non-native speakers. Thus, the lack of language knowledge may be the cause of this limited reporting verb capacity of the authors of the Thai corpus. This also affects variety of verb choices in writing a research article.

Moreover, wrong grammatical usage of reporting verbs was found in the Thai corpus. Some of these mistakes are presented in Sentence 5a, 17a, and 18a in Table 7. The correct versions of these sentences are shown in Sentence 5b, 17b, and 18b, respectively. From this wrong usage, we can see that the Thai authors tend to make mistakes in passive voice (Sentence 5a and 17a) and subject-verb agreement (Sentence 18a) when using reporting verbs. According to an error analysis of Thai undergraduate writing[19], error in passive voice was found with the highest percentage (80.55%) comparing to other grammatical errors including participial phrase (42.85%), relative clause (49.68%), and subject-verb agreement (5.77%). These findings demonstrate that passive voice is a highly confusing grammatical point for Thais.

Thep-Ackrapong[20] points out that the differences in passive voice structure of English and Thai cause Thai students to make a number of errors in their writing. English passive voice is recognized by using verb to be and the past participle; while Thai passive voice is interpreted by its contextual clues because there is no comparable change in the form of the Thai verb. Error in subject-verb agreement can also be explained by the differences in the use of Thai and English verb form. Unlike Thai, an English verb has to agree with its subject. Despite having learnt the rule, Thais still make the subject-verb agreement error due to first language interference. These differences explain the grammatical mistakes Thai authors make in their articles.

Scully and Jenkins[21] note that some manuscripts submitted from non-English speaking countries may be written in poor English, below the expectations of a scientific publication. They recommend the authors use automated language checking tools and professional language editing services before submission. Also, Iverson[22] suggests that authors should ask for help from professional editors or their peers. According to Breugelmans and Barron[23], in-house medical communications centers provide useful language supports for both native and non-native speaking authors. This can be seen from the Mayo Clinic Section of Scientific Publications and the International Medical Communications Center of Tokyo Medical University. They also emphasize that the collaboration between clinicians and language professionals produce the best manuscripts. Besides, several institutions have developed training program to increase the authors' knowledge and skills in research writing. For instance, the UCSF Neurological Surgery Biomedical Publications Program was designed to help their residents write better research reports.[24] This kind of support can help improve the quality of submitted manuscripts.

Among three categories, experimental verbs were most frequently used in both corpora. This finding accords with the finding of Thomas and Hawes.[4] This may result from the characteristic of the medical field. As medicine is a scientific discipline, the concept and approach is experimental-based. Therefore, it is unsurprising that experimental verbs appeared in the corpora more than discourse and cognition verbs.

The differences in reporting verb use from this study provide useful information to research writers. Although a research article has standard four-section structures: Introduction, Methods, Results, and Discussion, the linguistic characteristics, such as reporting verbs, in these sections may vary in different journals. The international medical journals generally have more manuscripts submitted for publication than national journals, so the authors aiming to publish in high-ranked peer-reviewed journals must put in enormous effort in developing a high quality and convincing manuscript. Using appropriate reporting verbs to present the cited data is a strategy that medical researchers should employ to improve the quality of their writing. The non-native English speaking authors should seek help from professional language editors to ensure that their manuscripts meet the standard of written English. Moreover, medical writing teachers may use the reporting verbs and sentences collected in this study as parts of a useful vocabulary list or sentence examples for their students. Linguists who are interested in medical texts may extend this study to explore other linguistic characteristics of medical research articles.

## Conclusion

Although reporting verbs in three categories were found in both corpora, the authors of the international medical journals used a wider variety of reporting verbs than those of the Thai medical journals. Additionally, the frequency of occurrence of reporting verbs in the international corpus was higher than the Thai corpus. Medical researchers, English teachers and materials developers should take these differences into account.

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