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An Analysis of Medical Students' Performance on the Word Stress Patterns in English Polysyllabic Medical Terms

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Abstract

Word stress instruction has increasingly become a focus among EFL teachers. Owing to the phonological differences between the learner's first language and English, EFL learners of different nationalities encounter varying degrees of difficulty when pronouncing English polysyllabic words. The majority of EFL students studying medicine tend to find it particularly challenging to pronounce English polysyllabic medical terms correctly. To gain better insights into this issue, this study aims to assess Thai medical students' ability to correctly mark stress in English polysyllabic medical terms and to analyze their errors in identifying their stressed syllables. A purposive sampling was employed to recruit seventy-five mixed-ability first year medical students enrolled in the course entitled "Foundation English for Medical Profession II" of the academic year 2020 in a public university in Thailand to participate in the study. The participants were asked to pronounce 40 medical terms via Zoom, and the quantitative data were analyzed statistically. Nine students of mixed English ability took part in the semi-structured interviews, and thematic analysis was employed to analyze the qualitative data. In light of the key findings, pedagogical implications and recommendations are discussed and highlighted in the study, which found it evident that word stress instruction should be integrated in the EAP/ESP courses for medical students either as part of the core lessons or through supplementary online resources.

INTRODUCTION

Background and statement of problems

In Southeast Asia, the ASEAN Economic Community (AEC) has enabled free movement of all types of skilled labour and professionals in the region, with English being used as the lingua franca for communication. The medical field is one of the professional fields included in the 'free flow labour pattern' of the AEC Mutual Recognition Agreements (MRA). Considering the fact that Thailand is also striving to be the 'medical hub' of Asia and a 'world class healthcare destination', it is important that Thai medical workers are able to overcome language barriers and have a certain level of proficiency in English (Sukhom, 2018). In other words, it has become

essential for medical workers to communicate effectively in English with native speakers of English and other non-Thai speakers. In line with this, Kanoksilapatham (2014) asserted that with the AEC integration and the spread of English as a medium of communication around the world, the ability to communicate orally in English has become more important and the mastery of effective English pronunciation has become a vital skill for success in the globalized community.

Medical students and doctors regularly encounter countless medical terms and use them extensively in their study and profession. Most Thai medical students and doctors feel they articulate medical terms correctly; nevertheless, native English speakers and/or other non-native speakers often struggle to understand them. This communication breakdown can often be attributed to medical students or doctors not having pronounced certain terms incorrectly. Watanapokakul (2009) pointed out that placing incorrect word stress when pronouncing medical terms is considered one of the medical students' main problems in oral communication. It has been stated that in order to be understood by others, all non-native speakers should comply with standard English pronunciation as intelligible pronunciation is the key to effective oral communication (Maharani et al., 2020).

In English classes, great emphasis is usually placed on covering all four of the macro skills of listening, speaking, reading and writing. Pronunciation is often not emphasized or neglected in many teaching and learning contexts in Thailand (Kanoksilapatham, 2014). A number of scholars (e.g., Greenwood, 2002; Silveria, 2002) have stated that this neglect could be attributed to the belief that suprasegmental features of language seem to be unteachable and thus unlearnable. Furthermore, many EFL teachers consider pronunciation as a sub-component of the macro skill of speaking, rather than a skill in its own right (Kanoksilapathm, 2010; Zhang & Yin, 2009). Consequently, the majority of Thai EFL learners, including the first-year medical students in this study, might not have formally studied English pronunciation. This would explain why many Thai medical students fail to pronounce English polysyllabic medical terms with correct word stress patterns despite their awareness of the importance of word stress in English for effective communication (Luksaneeyanawin, 2005; Watanapokakul, 2009).

Previous research studies have proposed that there are several contributing factors affecting Thai EFL learners' ability to pronounce English words correctly (e.g., Kanoksilapatham, 2010; Khamkien, 2010; Israkura, 2018; Varasarin, 2007; Watanapokakul, 2009), and most scholars see first language (L1) interference is a major contributing factor in the pronunciation difficulties of Thai EFL learners. According to (Luksaneeyanawin, 2005), Thai EFL learners' pronunciation problems tend to arise from the differences between the respective L1 and L2 phonological systems, which can be seen as language interference. In addition, McKenzie-Brown (2006) pointed out that English has many linguistic features which cause difficulties for Thai learners.

English word stress is considered one of the major problems in the pronunciation of English among Thai EFL learners due to the differences between English and Thai stress systems (Isarankura, 2018). The position of stress in a word depends on certain general rules applicable in the language, and word stress can be categorized into fixed stress and free stress. The free-stress system applies to language where the primary stress is not fixed to a particular syllable. Since the position of stress in English words is not fixed, Thais often find it difficult to place

stress on the correct syllables of English polysyllabic words (Isarankura, 2018). Likitrattanaporn (2014) affirmed that incorrect stress placement of English words can affect prosodic structures at the sentence level, resulting in the obstruction of understanding in communication. When a word is incorrectly stressed, it is likely to pose problems (Altmann, 2006). In the medical profession in particular, incorrect stress placement can potentially be fatal as it can cause a serious breakdown in communication since native English speakers depend primarily on their perception of familiar accentual prominences (Maharani et al., 2020). Thus, it is important that medical students use the correct stress when pronouncing English polysyllabic medical terms if they are to be understood (Watanapokakul, 2009). In the same vein, Jahara & Abdelrady (2021) asserted that without correct pronunciation, verbal communication cannot be done effectively and may be severely impaired.

As pronunciation is a global construct consisting of segmental (e.g., consonant and vowels) and suprasegmental (e.gs., stress, intonation, rhythm, rate, volume) elements, over the past decades, a number of studies have been carried out by leading scholars (i.e. Celce-Mureia et al., 2000; Derwing & Munro, 2005; Kanoksilapatham, 2014) to investigate various aspects of English pronunciation. This is because it is recognized that EFL learners should acquire pronunciation as a fundamental skill because it can affect both accuracy and comprehension. Although research studies on pronunciation are common in EFL, this line of research in regards to Thai EFL learners is underexplored. Furthermore, the area of Thai medical students' performance concerning word stress patterns of English polysyllabic medical terms has been even less investigated. Consequently, more research examining Thai medical students' ability to correctly pronounce English polysyllabic medical terms with correct stress patterns and their errors in identifying stress in those terms should be conducted to help EFL teachers gain better insights into this issue.

Definition of terms

1. **English polysyllabic medical terms** refer to medical terminology in English which contains more than one syllable. These terms generally include Latin and/or Greek roots.
2. **Medical students** refer to first year medical students at a major university enrolling in the course entitled Foundation English for Medical Profession II in the academic year 2020.
3. **Word stress** is a suprasegmental feature of utterances which applies not to individual vowels and consonants but to whole syllables (Ladeforged, 2006).

LITERATURE REVIEW

A number of research studies have indicated that word stress is one of the major problems in the pronunciation of English among Thai EFL learners due to the different stress patterns between Thai and English (e.g., Khamkhien, 2010; Isarankura, 2018), and this leads to a negative transfer of the students' first language (L1) when pronouncing words in English. Word stress, or lexical stress, is the emphasis given to a particular syllable of a word (Isarankura, 2018). It is marked by vowel duration, loudness, and/or pitch height (Field, 2005; Ladefoged, 2006).

Kreidler (2004) pointed out that "stress is a property of a word" (p. 70). For example, the word *paper* has the stress on the first syllable, whereas the word *review* has the stress on the second syllable. Word stress is particularly important in speech processing (Field, 2005). In order to identify words, native speakers of English or competent listeners rely on word stress patterns. Learners of English need to master English word stress patterns in order to be able to communicate in the target language intelligibly. Ur (2003) further argued that word stress misplacement could lead to misunderstanding in oral communication.

As the position of stress in English words in not fixed, Thai speakers of English often find it difficult to place stress on the right syllables of English polysyllabic words (Isarankura, 2018; Watanapokakul, 2009). This is because in standard Thai, as many linguists (e.g., Luksaneeyanawin, 2005; Peyasantiwong, 1986; Vairojanavong, 1984) seem to agree, the syllable in the word-final position is the most prominent and has the strongest stress. In other words, stress always falls on the last syllable in Thai words, irrespective of the number of syllables the word has (Isarankura, 2018). Thai learners who adopt the Thai stress patterns when they articulate English words often find themselves not being understood by English native speakers. In essence, incorrect stress placement when pronouncing English words can affect prosodic structures at the sentence level and it can also impede communication (Ur, 2003).

In the past few decades, several prominent scholars have conducted research studies focusing on Thai learners' pronunciation. For example, Kanoksilapatham (1992) carried out an insightful study on Thai learners' pronunciation of English, and the findings of her study revealed that Thai learners of English had difficulty with English pronunciation, particularly in pronouncing four-syllable English words. Among the four types of the words used in her study: nouns, verbs, adjectives and adverbs, verbs were found to be least-well pronounced, whereas nouns with an *-ity* ending were most correctly pronounced. The findings clearly demonstrated that incorrect placement of word stress was evident among Thai language learners who tend to put the stress on the final syllables rather than the first syllables. In another study conducted by Khamkhien (2010) which explored pronunciation competence in regards to the relationship between the perception and the production of English word stress by Thai ELF learners, it was found that the learner's English experience played a pivotal role in the perception and the production of English word stress.

As regards English for Specific Purposes (ESP), there has also been a growing interest in studying stress patterns of English polysyllabic words used specifically in the medical field with an emphasis on the pronunciation and stress patterns of medical terms among Thai medical students (e.g., Vairojanavong, 1984; Watanapokakul, 2009). The findings of these studies suggest that the negative transfer of the students' first language (L1) is the main cause of medical students' errors in the stress placement of these terms. Although medical students realized the importance of using word stress correctly, they admitted that they had difficulty with stress placement, and they felt that the more syllables a medical term had, the more difficult it was for them to pronounce the word with the correct stress. Despite the fact that there has been an increasing number of research studies on pronunciation and stress patterns in general English, the research of this area with Thai ESP learners is underexplored. In fact, the aspect of pronunciation, particularly medical students' performance on word stress patterns

in polysyllabic medical terms, is even less explored. In light of the gap in this line of research, the present study is aimed at identifying first year Thai medical students' ability to correctly stress English polysyllabic medical terms and examining their errors in stress patterns when pronouncing those terms.

This research aims to answer the following questions:

1) To what extent do medical students have the ability to correctly identify stress in English polysyllabic medical terms?
2) What are the word-stress pattern errors in pronouncing English polysyllabic medical terms made by medical students?

METHODOLOGY

The present study was designed based on a mixed-methods approach. The quantitative data were obtained from medical students' performances on pronouncing 40 selected medical terms, and the qualitative data were obtained from semi-structured interviews (Creswell & Plano Clark, 2018).

Participants

The population of the study was 308 first-year medical students at a public Thai university in the academic year 2020. All of the first-year medical students enrolled in the Foundation English for Medical Profession II course were grouped into 10 class sections based on their midterm test scores obtained from two English courses namely Experiential English I and Foundation English for Medical Profession I. Section 1 is classified as a high-ability group of EFL learners, while Section 10 is viewed as a low-ability group of learners. According to Yamane (1973)'s sample size formula with 90% confidence level, as the sample size of the population is 308, 75 students served as the sample of the study. In recruiting mixed-ability EFL learners, a purposive sampling was adopted. In the study, 25 students in Section 1 represented a group of high-ability EFL learners, 23 students in Section 5 represented a group of mid-ability EFL learners, and 27 students in Section 9 represented a group of low-ability EFL learners. The total number of students from the three selected sections is 75, and all the students from these three sections voluntarily participated in the study.

Instruments

The two research instruments used in the study include a list of most frequently found English polysyllabic medical terms and semi-structured interview questions.

(1) The list of English polysyllabic medical terms (Appendix A) consists of 40 words. There are medical terms which contain 2, 3, 4 and more than 4 syllables, and each category has 10 words. These terms were systematically selected by the *Concordancer* program from a corpus. The corpus obtained words from 52 articles in four selected medical e-journals in the category of "General Works" in the university's Reference Databases.

(2) The semi-structured interviews were conducted with three randomly selected students from each section, so nine participants took part in the interviews in total. Six guided questions were used to obtain in-depth information from each participant. The interviews were conducted in both Thai and English depending on students' preference and were audio-recorded for further analysis.

Research procedure

There were two phases of the research procedure: the preparation phase and the experimentation phase. The preparation phase entailed preparing the instruments: a list of 40 English polysyllabic medical terms and semi-structured interview questions. The medical e-journals in the university's Reference Databases were used as a corpus. There were 185 medical e-journals included divided into 13 categories. Only the e-journals in the category of "General Works" were selected to be used in the main study since the articles in this category contained general medical terms which are normally found and used by medical students and professionals. After checking, there were 35 e-journals that were actually accessible. The titles of those e-journals were listed in the questionnaire which was distributed to five medical doctors to choose 4 journals according to the following criteria: (I) they should contain useful content for medical students; (2) they are likely to be frequently used by medical students; (3) medical students can apply the content in these e-journals in their profession. The findings from the questionnaires showed that *The New England Journal of Medicine* (NEJM) was the most selected e-journal (80%), followed by *Journal of American Medical Association* (JAMA), *Annals of Internal Medicine* (AIM), and *British Medical Journal* (BMJ), representing 60%, 60%, and 40% respectively. A summary of the number of articles is presented in Table 1.

Table 1

The number of articles published in January 2020

NEJM (Frequency: Weekly)		**JAMA** (Frequency: Weekly)		**AIM** (Frequency: Weekly)		**BMJ** (Frequency: Weekly)	
Issues	No. of articles	Issues	No. of articles	Issues	No. of articles	Issues	No. of articles
Jan 2: *382*(1)	3	Jan 7: *323*(1)	3	Jan 7: *172*(1)	3	Jan 11: *368*(8228)	7
Jan 9: *382*(2)	3	Jan 14: *323*(2)	3	Jan 21: *172*(2)	3	Jan 18: *368*(8229)	4
Jan 16: *382*(3)	5	Jan 21: *323*(3)	4			Jan 25: *368*(8230)	4
Jan 23: *382*(4)	4	Jan 28: *323*(4)	3				
Jan 30: *382*(5)	3						
TOTAL	18	TOTAL	13	TOTAL	6	TOTAL	15

All of the fifty-two articles in the four selected e-journals were published in January 2020 and used as sources for the polysyllabic medical lexicon. These articles were processed by the *Concordancer* program. Medical terms containing 2, 3, 4 and more than 4 syllables were taken into account. Twenty terms of the highest frequency for each category were selected. Later, three doctors were asked to select ten words from each category which are frequently encountered and used in the medical field. These forty terms were then randomly mixed and presented in 4 columns on a worksheet (Appendix A).

Regarding the guided interview questions used in the semi-structured interviews, three teachers in the field of English Language Teaching took part as experts in the Index of Item-Objective Congruence (IOC) and checked the interview questions to enhance the validity and reliability of the qualitative data. The IOC from the experts indicated the following: Q1 = 0.67, Q2 = 1.00, Q3 = 0.67, Q4 = 0.67, Q5 = 1.00, Q6 = 0.67). The mean score of the IOC of the six questions was 0.78, suggesting as acceptable value (Rovinelli & Hambleton, 1977). A modification was made according to the experts' comments and suggestions. Finally, there were six guided semi-structured interview questions (Appendix B).

Prior to conducting the study, a research proposal was submitted to the Institutional Review Board of the Faculty of Medicine for ethical approval to protect the participants' rights and well-being. The Institutional Review Board approved the study in compliance with the International guidelines for human research protection as Declaration of Helsinki, The Belmont Report, CIOMS Guideline and International Conference on Harmonization in Good Clinical Practice (ICH-GCP).

In the experimentation phase, the following steps were adopted:

1. The researchers contacted all the students in Sections 1, 5 and 9 to firstly inform them about the research study and their right to voluntarily participate or not participate in the research. As the study was conducted after the course had finished, students did not feel obliged or pressured to take part. Once students had agreed to take part in the study, a consent form was sent to them via emails.

2. After receiving the students' completed consent forms, the researchers arranged Zoom meetings with them. The meetings were scheduled at the participants' convenience and the meeting links details were sent to the participants. During each Zoom session, the list of 40 English polysyllabic medical terms were displayed on the screen. Each student was invited to the Zoom meeting to pronounce 40 polysyllabic medical terms (Appendix A). Students could switch off their camera if they preferred. While the students were pronouncing the medical terms, the researchers remain silent. Each Zoom session with the individual students was recorded in one mp4 file. The researchers used a code of 101 for the first student, 102 for the second and continued in this fashion up to the last student who agreed to participate in the study.

3. The two researchers listened to the audio-recordings and then marked the primary stress of the medical terms on a list corresponding to each student's pronunciation. Data were coded

as 101, 102, etc., and the data contained no other identifiers. This means there would not be any association between the students' actual identities and the data referring to their pronunciation of the 40 polysyllabic medical terms. The data were kept confidential for 1 year and then deleted.

4. The researchers employed convenience sampling to recruit three students from each section to take part in the interviews via Zoom. Each interview lasted for 10-15 minutes. The interviews were conducted in both Thai and English and also audio-recorded. The researchers started by asking the students to pronounce some medical terms from the word list (one from each category) and asked the participants to explain why they pronounced them the way they did—no matter whether they pronounced the terms the same or different from their first attempt recorded. Then, the six guided semi-structured interview questions were asked. For the nine interviews conducted, only two students answered in Thai, while the other seven students responded in English. The recorded audio files for the interviews were coded as 201, 202, etc. The file, which was kept confidential for one year, was later deleted.

Data analysis

The correct stress pattern of all 40 words was checked using an online medical dictionary (http://medical-dictionary.thefreedictionary.com/) and two printed medical dictionaries, namely Medical Sciences Dictionary 40th Edition (Thiengburanathum, 2010) and Webster New World Medical Dictionary 3rd Edition (WebMD, 2008), as well as by consulting a native speaker. The students' word stress patterns, which both researchers obtained from listening to the recordings, were checked against the aforementioned dictionaries and the English native speaker's enunciation for correctness. The inter-rater reliability, obtained from using the Pearson product-moment correlation coefficient (Bachman, 2004, p. 85), was 0.9 at the significant level of 0.01. The findings from the students' word stress patterns were analyzed and categorized using frequency and percentage.

For the semi-structure interviews, the students' responses were qualitatively analyzed using thematic analysis. All nine interviews were transcribed verbatim. Then each transcript was analyzed based on the thematic analysis proposed by King et al. (2019). The thematic analysis consisted of three stages namely descriptive coding, interpretive coding and overarching themes. For quality checks at each stage of data analysis to enhance the validity and reliability of the findings obtained from the interviews, independent coding was used as recommended by King et al. (2019). To serve the purpose of the study, the code-confirming approach was adopted, and a second coder was asked to critically evaluate the transcripts and codes created by the first coder.

To answer research question 1, the researchers checked the correct stress patterns from an online medical dictionary (http://medical¬dictionary.thefreedictionary.com) and two medical dictionaries; namely Medical Sciences Dictionary 40th Edition (Thiengburanathum, 2010) and Webster's New World Medical Dictionary 3rd Edition (WebMD, 2008), and by two native speakers who were English teachers at a language institute in a public university in Bangkok. Then, the students word stress patterns, derived from listening to the audio recordings by the researchers,

were checked against the aforementioned dictionaries and the native speakers' enunciation for correctness. Later, the stress-marking patterns in each term were categorized according to the position (marking in the first, second, third, fourth, or fifth syllable). The data were analyzed using frequency and percentage.

To answer research question 2, the researcher analyzed the errors in stress marking patterns from the students' pronunciation. Thematic analysis was used to analyze the interview data obtained from nine students of mixed abilities to identify types of errors and their contributing factors.

RESEARCH FINDINGS

Findings based on pronunciation of the medical terms

The students' performance in pronouncing words from the word list are presented in the following tables. The selected medical terms (see Appendix A) were rearranged according to the number of syllables and presented with the number of correct responses and percentage as stated in Tables 2, 3, 4 and 5.

Table 2
Students' performance in pronouncing 2-syllable medical terms

2-syllable words	Sec 1 N=25	Sec 5 N=23	Sec 9 N=27
central	24 (96.00%)	23 (100.00%)	24 (88.00%)
symptoms	25 (100%)	22 (95.65%)	22 (81.48%)
patients	23 (92.00%)	22 (95.65%)	22 (81.48%)
hazard	21 (84.00%)	13 (56.62%)	17 (62.96%)
abscess	8 (32.00%)	4 (17.39%)	6 (22.22%)
organ	14 (56.00%)	13 (56.52%)	16 (59.26%)
fatal	22 (88.00%)	21 (91.30%)	24 (88.89%)
chronic	25 (100.00%)	21 (91.30%)	26 (96.30%)
di***sease***	22 (88.00%)	19 (82.61%)	26 (96.30%)
ef***fect***	18 (72.00%)	19 (82.61%)	18 (66.67%)

For the 2-syllable medical terms, there were eight words with first syllable stress, and two words with second syllable stress. As illustrated in Table 2, for the medical terms with first syllable stress, the majority of students from all three sections could pronounce "***cen**tral*", "***symp**toms*", "***pa**tients*", "***fa**tal*" and "***chro**nic*" correctly. However, only 81% of high-ability EFL learners (those in Section 1) could articulate "***ha**zard*" correctly, and 56.62% of mid-ability learners and 62.96 low-ability learners made a correct primary stress for "***ha**zard*". For the remaining 2-syllable words including ***ab**scess, **or**gan*, the data revealed unexpected performance even in the high-ability students. The correct stress articulated by students in Sections 1, 5 and 9 for "***ab**scess*" were 32%, 17.39% and 22.22% respectively. For the term "***or**gan*", students performed slightly better as the percentage of articulation accuracy was 56%, 56.52% and 59.26% respectively. For the medical terms with second syllable stress, namely "*di**sease***" and "*ef**fect***", most students from Sections 1, 5 and 9 could pronounce them correctly with high percentages of correctness of 88%, 82.61% and 96.30% for "*di**sease***", and 72%, 82.61% and 66.67% for "*ef**fect***", respectively.

Table 3

Students' performance in pronouncing 3-syllable medical terms

3-syllable words	Sec 1 N=25	Sec 5 N=23	Sec 9 N=27
***me**dical*	25 (100.00%)	23 (100.00%)	24 (88.89%)
phy***si**cian*	18 (72.00%)	7 (30.43%)	3 (11.11%)
throm***bo**sis*	19 (76.00%)	15 (65.22%)	5 (18.52%)
a***bor**tion*	25 (100.00%)	23 (100.00%)	26 (96.30%)
de***pres**sive*	25 (100.00%)	23 (100.00%)	27 (100.00%)
***vas**cular*	22 (88.00%)	18 (78.26%)	20 (74.07%)
ma***lig**nant*	4 (16.00%)	4 (17.39%)	3 (11.11%)
***he**parin*	22 (88.00%)	14 (60.87%)	12 (44.44%)
***prog**nostic*	10 (40.00%)	7 (30.43%)	10 (37.04%)
ge***ne**tic*	7 (28.00%)	16 (69.57%)	22 (81.48%)

For the 3-syllable words, there were four words with the primary stress on the first syllable, and six words with the primary stress on the second syllable. From the data presented in Table 3, it can be concluded that high ability students could still pronounce most of the 3-syllable words correctly: "*phy**si**cian*" (72%), "*throm**bo**sis*" (76%), and "***he**parin*" (88%). Students from the low-ability group, on the other hand, could not articulate those words correctly, and this

is clearly shown in the accuracy percentages of "*phy**si**cian*" (11.11%), "*throm**bo**sis*" (18.52%), and "*ma**lig**nant*" (11.11%). The data also revealed that low-ability learners tended to put the stress on either the first or last syllable. For example, 59.26% of Section 9 students put a stress on the first syllable for "*phy**si**cian*", and 29.63% of them put a stress on the last syllable (See the details of students' performance in Appendix C).

Table 4

Students' performance in pronouncing 4-syllable medical terms

4-syllable words	Sec 1 N=25	Sec 5 N=23	Sec 9 N=27
coronary	2 (8.00%)	1 (4.35%)	1 (3.70%)
pulmonary	2 (8.00%)	2 (8.70%)	1 (3.70%)
mechanism	5 (20.00%)	3 (13.04%)	2 (7.41%)
arthroplasty	3 (12.00%)	4 (17.39%)	0 (0.00%)
ven***tri***cular	15 (60.00%)	11 (47.83%)	12 (44.44%)
fibri***lla***tion	20 (80.00%)	19 (82.61%)	20 (74.07%)
epi***de***mics	13 (52.00%)	10 (43.48%)	12 (44.44%)
thera***peu***tic	17 (68.00%)	15 (65.22%)	14 (51.85%)
pneumo***tho***rax	23 (92.00%)	19 (82.61%)	19 (70.37%)
carci***no***ma	15 (60.00%)	14 (60.87%)	13 (48.15%)

Regarding the 4-syllable words, the data showed similar findings compared with the figures presented for the 3-syllable words. High-ability students could pronounce many 4-syllable words correctly, while mid-ability students and low-ability students made more errors in their pronunciation. Although students from the high-ability group still performed reasonably well on articulating the 4-syllable words, they also struggled to pronounce certain medical correctly. As illustration, for "***co**ronary*" only 8% of students in Section 1 could pronounce the term with a correct stress, while only 4.35% of the mid-ability group and 3.70% of the low-ability could pronounce the term correctly. The details of the students' performance show that 64% of Section 1 students put a stress on the third syllable of "***co**ronary*", 65.22% of students from Section 2, and 40.74% of students from Section 9 also placed a stress on the third syllable, More than half of the students from Section 9 (55.56%) put the stress on the second syllable of For "***pul**monary*", surprisingly, students from the mid-ability group outperformed those from the high-ability group as presented in Table 4, and only 3.70% of the low-ability group could pronounce the term correctly. The data shows that the students tended to put a primary stress

on the third syllable of the 4-syllable words as illustrated in the detailed students' performance in Appendix C.

Table 5

Students' performance in pronouncing more than 4-syllable medical terms

More than 4-syllable words	Sec 1 N=25	Sec 5 N=23	Sec 9 N=27
dexa***me***thasone	12 (48.00%)	7 (30.43%)	12 (44.44%)
neuroblas***to***ma	10 (40.00%)	6 (26.09)	5 (18.52%)
meningo***coc***cal	8 (32.00%)	7 (30.43%)	4 (14.81%)
cardio***vas***cular	2 (8.00%)	1 (4.35%)	4 (14.81.%)
antihyper***ten***sion	15 (60.00%)	8 (34.78%)	7 (25.93%)
thrombo***em***bolism	17 (68.00%)	12 (52.17%)	8 (29.63%)
gastroin***tes***tinal	15 (60.00%)	10 (43.48%)	9 (33.33%)
hepato***cel***lular	16 (64.00%)	13 (56.52%)	8 (29.63%)
osteoar***thri***tis	8 (32.00%)	4 (17.39%)	2 (7.41%)
epidemi***o***logy	20 (80.00%)	14 (60.87%)	13 (48.15%)

From Table 5 representing students' performance in pronouncing more than 4-syllable medical terms, it was obvious that students had difficulty placing the correct stress when pronouncing more than 4-syllable words even among the high-ability group of students. Nevertheless, the mid-ability and the low-ability groups of students made more errors on most terms. High-ability students (those in Section 1) could still pronounce many polysyllabic medical terms correctly. For example, 40% of the high-ability students could pronounce "*neuroblas**to**ma*" correctly, but only 26.09% and 18.52% of students from Section 5, and Section 9 could pronounce the word with the correct stress pattern. For other unfamiliar polysyllable terms, the data depict similar scenario in that 60% of high-ability students could pronounced "*gastroin**tes**tinal*" correctly, and 64% of them pronounced "*hepato**cel**lular*" correctly. The percentages of correctness suggest that pronouncing the medical terms containing more than 4-syllable is challenging even for the high-ability students. This implied that students from the mid-ability and low-ability groups would find it even more problematic, and the figures representing the percentage of correctness for Section 5 and Section 9 students' performance clearly illustrated this as presented in Table 5.

From the data illustrated in Tables 2, 3, 4 and 5, it was obvious that students could pronounce the majority of the 2 syllable-terms most correctly. However, most of them mispronounced

the medical terms which contain 4 or more syllable words. The longer the term, the more mistakes they made. In addition, students tended to mispronounce more of the less commonly used terms such as *hepato**cel**lular, dexa**me**thasone*, and *neuroblas**to**ma*.

Findings from the semi-structured interviews:

There were nine students who took part in the semi-structured interviews which lasted for 15-20 minutes. The results obtained are categorized into 3 main themes: A) students' awareness of the importance of word stress in English; B) students' adopted techniques when pronouncing unfamiliar medical terms; and C) students' views on how to improve their ability in pronouncing medical terms.

A. Students' awareness of the importance of the word stress in English.

The nine students who took part in the interviews were of mixed proficiency levels. S1, S2 and S3 are considered as the high ability or advanced learners, S4, S5 and S6 are classified as the mid-ability or intermediate learners, and S7, S8 and S9 are classified as low ability or lower intermediate learners. From the interviews, it was found that all participants were aware of the importance of word stress in English as illustrated in the following excerpts:

> *"In my opinion, word stress is very important when we communicate in English. If we pronounce the term incorrectly, it might lead to misunderstanding. I recalled once I talked to a foreigner who asked me for direction. I mispronounced some words, and the tourist could not understand what I was trying to say. So, I had to write the words down. When he saw the words, he simply nodded his head and smiled. That particular incidence really made me realize the importance of word stress. That was an example of using English in general, so I imagine it's even more essential for me to speak accurately as a doctor."* (S4)

> *"Word stress is important, but it's quite difficult for me to pick up the stress patterns. I tend to imitate my teachers or friends, but to be honest I don't understand the stress symbol in the dictionary. For me, I often pronounce some terms the way Thai people do in a Thai way. From my experience, my Thai pronunciation did cause some problems when I speak English with foreigners."* (S9)

> *"I would say word stress is very important. When I first went to a boarding school in the UK, most of my friends could not understand me because of my articulation. At the time, I felt a bit uneasy having to repeat what I intended to say a few times. Because of my good survival skills, I picked up the stress patterns quite quickly and that eased all the communication problems with friends and the locals. Well, it feels good to be able to speak and sound like the locals."* (S1)

From the above excerpts, it was clear that medical students are aware of the importance of using correct word stress when expressing themselves in English, and students' experiences evidently demonstrated how incorrect word stress may impede communication and negatively

affect their confidence. Students also realize it becomes essential for them to use correct pronunciation when communicating with other non-Thai speakers in all settings.

B) Students' adopted various techniques when pronouncing unfamiliar medical terms:

Although all of the participants had studied English since they were in Grade 1, none had formally studied words stress patterns. They said word stress was the topic which was often neglected in classes; consequently, they came up with their own strategies to pronounce any unfamiliar medical terms. This is illustrated in the following excerpts:

> *"For me, I use my understanding of the English vowels to help me figure out how I should pronounce each term. For example, for the word "hepatocellular", I saw "e", "a" and "o", so I read the term as "hep-pa-toh-cel-lu-lar". I must confess I use my feeling for the stress."* (S6)

> *"I have never learnt about word stress in my former schools. Most of the time, I listen to my teachers or native speakers say the words and I imitate them. For any unfamiliar terms, not only the medical terms, I just pronounce them the way I think it should be pronounced. If I really want to know the correct pronunciation, I just check it on my phone."* (S5)

> *"When I see any unfamiliar terms, I like to check for the correct pronunciation on my phone. I think it's important to articulate the words correctly to avoid misunderstanding or confusion when we communicate. It only takes less than 1 minute to check, but for the words shown on the screen, I can't look them up. Thus, I rely on my previous knowledge. For example, I know we need to place the primary stress on the word which appears before -ion, so I don't have any difficulty pronouncing fibrillation though I don't know this word."* (S2)

> *"I've never been abroad and have only studied English at a provincial school. Back then, most of my former Thai teachers focused on grammar, reading comprehension and vocabulary. When I studied speaking with native speaker teachers, the focus was on general conversational skills. I haven't studied any basic rules about pronunciation. In the past when I saw any new words, I only checked for meanings as I don't really need to use English in my real life. Now I have to speak more English in class, when I see any unknown words, I just guess how they should be pronounced. Quite often I mispronounced them, and I sometimes feel a little embarrassed. If you might recall, before I pronounced the terms on the screen, I did say I will pronounce the words the way I think they should be."* (Translated excerpt, S7)

Students' excerpts clearly depicted the Thai EFL learners' challenges in pronouncing unfamiliar medical terms. Owing to the fact that pronunciation is often neglected in most EFL classes in Thailand (Kanoksilapatham, 2014), students needed to rely on their own strategies i. e., using their background knowledge, applying what seems to work or making intelligent guess on how the words should be pronounced to help them articulate any new medical words. Depending

on individuals, S2 from the high ability group chooses to check the pronunciation of any unfamiliar words on her phone to ensure she can articulate them correctly while others such as S6 and S7 simply try to pronounce the terms. While S5 stated that he only checks for some words that he really wants to know the correct pronunciation. From the students' accounts, it can be implied that different group of learners adopt their distinctive techniques in helping them pronounce unfamiliar medical terms.

C) Students' views on how to improve their ability in pronouncing medical terms:

All nine participants were aware of the importance of the word stress patterns when pronouncing medical terms in their real life and professional life and thought the principles of medical term pronunciation should be integrated into the ESP courses.

> *"If possible, the teachers should teach basic pronunciation. I mean it should be integrated into the unit that covers medical terminology. It is not necessary to make a separate unit on pronunciation. Alternatively, it can be offered as an additional resource for students. Studying only pronunciation on its own might not be that appealing. Thus, an integration of basic pronunciation with the unit and just an add-on issue to help students will be enough."* (S3)

> *"Well, I think most students will welcome the idea of learning basic pronunciation as it will be useful for us to understand the basics. I mean I'm sort of a person who likes to have a framework or rules of something which I can apply. I don't know what others might think but I personally feel that studying basic pronunciation skills is definitely helpful for us."* (S6)

> *"When I see any unfamiliar medical terms, I often misplace the stress. I don't know where I should place the stress, so I just adopt the same strategies when I speak Thai. To be honest, I'm quite reluctant to pronounce many terms as I know my pronunciation was wrong. I think it will be good if pronunciation is included in the Foundation English for Medical Profession course. It will help weak students like me improve our speaking and this will increase our confidence too."* (Translated excerpt, S7)

From the students' perspectives, word stress should be integrated in the ESP courses to help them pronounce medical terms correctly. While high-ability students proposed the integration of word stress as an additional topic or as self-study online materials, low-ability students find explicit word stress instruction is more useful in that it can help them understand the basic principle of English pronunciation.

DISCUSSION AND IMPLICATIONS

Based on the research findings, the discussion and implications for the two research questions are as follows:

Regarding the first research question, identifying stress in English polysyllabic medical terms is problematic for first-year medical students, particularly among lower intermediate students. It is clear that the more syllables a medical term has, the more difficult it is for students to pronounce it correctly as illustrated in Tables 2, 3, 4 and 5. This corresponds with the findings obtained from previous studies conducted by Vairojanavong (1984) and Watanapokakul (2009), which found that students had difficulty with stress placement, and felt the more syllables a medical term had, the more difficult it was for them to pronounce the word with the correct stress.

From the quantitative data, it is evident that the majority of students from the three sections could pronounce the familiar terms such as *central, symptoms, patients, fatal, chronic*, and *disease* correctly as represented in Table 2. Nevertheless, for unfamiliar words such as hazard, only 81% of the students in Section 1, representing high-ability EFL learners, could still pronounce the term correctly. Mid-ability and low-ability students, on the other hand, misplaced the stress because of the influence of L1. In standard Thai, the syllable in the word-final position is the most prominent and has the strongest stress (Peyasantiwong, 1986). This explains why students in Sections 5 and 9 put the primary stress on the second syllable for any unfamiliar terms. The interview data were in line with the quantitative findings. For example, S6 asserted that "*For me, when I see any new words, I would put the stress on the last syllable. I think it sounds natural—like the word hazard. It should pronounce as 'ha-sard.*" This resonates with S8' voice stating that "*Well, I must confess that stressing the last syllable seems to be a practical thing to do when I have to say any unknown words. Just like when I speak Thai*."

The quantitative data also revealed that the high ability group or the advanced leaners (those in Section 1) tended to have the least difficulty pronouncing unfamiliar English polysyllabic medical terms. Students from Section 9, classified as the low-ability group or the lower intermediate EFL learners, on the other hand, faced greater difficulty when pronouncing unfamiliar medical terms even for the 2-syllable words, and their performance on pronouncing more than 4-syllable medical terms was unsatisfactory (the average percentage of accuracy was below 40% as presented in Table 5). This is in accordance with the findings in Jaiprasong & Pongpairoj (2017) which concluded that the learners with higher English proficiency had better English word stress production than the learners with lower English proficiency. This is because the EFL learners with higher proficiency seemed to apply more stress-assignment strategies towards English. To illustrate, S2 explicitly stated that "*…I rely on my previous knowledge. For example, I know we need to place the primary stress on the word which appears before -ion.*" Furthermore, the points raised by S1 (who pronounced all the 40 medical terms correctly) highlighted how paying great attention to the way native speakers articulate words in real contexts had helped him master speaking skills is supported by Jaiprasong and Pongpairoj (2017), who affirmed that the learners with higher English proficiency might have been better at differentiating the stressed syllable compared to others by recognizing the higher pitch of

the longer duration of the stressed syllable compared to other syllables in a word, while the group of L1 Thai learners with lower English proficiency tended to assign the stress in no particular pattern. According to Porzuczek (2014), proficiency is one of the important predictors of English word stress realization by speakers of English. Consequently, the better the learners' English proficiency was, the better the learners performed in English word stress.

In general, Thai students find it is challenging to pronounce medical terms correctly. This is because there are several key differences between English and Thai phonetic and phonological features. Luksaneeyanawin (2005) asserted that pronunciation problems among Thai EFL learners tend to arise from the difference between the respective L1 and L2 phonological systems, which can imply language interference. In line with this, McKenzie-Brown (2006) stated that English has many linguistic features which cause difficulty for Thai EFL learners. In order to help Thai EFL learners tackle the challenges, teachers should have an awareness of these differences and select appropriate pedagogical approaches for explicit phonological instruction.

Regarding the second research question, the majority of the medical students in this study had difficulty in pronouncing medical terms which contain four or more syllables due to the differences of the phonological systems between Thai and English. The typical errors in pronouncing English polysyllabic medical terms made by first-year students can be classified into 3 types based on phonological and other contributing factors causing such errors. These include interference errors, intralingual errors and developmental errors. In other words, these errors were caused by negative L1 transfer, a lack of knowledge of phonetic rules, differences in the phonetic inventory of English and Thai, and the interference of other words. Students' excerpts previously described in the findings section clearly illustrated those factors affecting their performance when pronouncing English polysyllabic medical terms. From the interview data, it can be concluded that negative L1 transfer as well as a lack of knowledge of phonetic rules are the two key factors which negatively affect medical students' performance on word stress.

The students' voices describing their past language learning experiences clearly depict the reality of English language teaching in Thailand. As Kanoksilapatham (2014) pointed out traditional methods of English language instruction are still dominant in Thailand; consequently, most students have not been formally taught basic pronunciation. Likitrattanaporn (2014) noted that English language accuracy in Thailand tends to focus on morphology and syntax rather than phonology. This in turn has had an adverse effect on students' ability to pronounce English words correctly.

The findings from this study suggest that there are several contributing factors affecting medical students' performance on English polysyllabic medical terms. These include language interference, a lack of knowledge of phonetic rules, the students' English proficiency, their exposure to English in real life, and their learning styles. To lessen the influence of negative L1 transfer, ESP teachers need to raise students' awareness of the phonological differences between English and Thai. Furthermore, it becomes ESP teachers' responsibilities to select appropriate pedagogical approaches and/or tools for pronunciation or phonological instruction either as part of the

core lesson or as online self-study resources. In order to help their students' improve their pronunciation and articulate English polysyllable medical terms correctly, ESP teachers might consider adopting some of the following practical techniques when teaching pronunciation in an ESP class.

1. During class duration, teachers should try to integrate the component of pronunciation to the core course content. For example, when new medical terms are present in the course book, teachers should draw students' attention to basic phonological rules and explicitly teach the correct pronunciation and word stress patterns of those terms. Students should be given sufficient time to practice, either by repeating after the teachers who serve as role models or engaging in language drills with their peers. If possible, teachers should provide substantial constructive feedback on students' performance. To help reinforce students' learning and create positive learning atmosphere, teachers should use game-based learning platform such as Kahoot, Wordwall or other games-based activities in class. Watanapokakul (2018) affirmed that Net Gen learners require learning options that are congruent with the fast-paced world in which they live; consequently, it is up to teachers to choose and find new, alternative instructional modes to meet the needs of their students and to optimize the teaching and learning experience.

2. Teachers should introduce students to several resources to help them improve their pronunciation. These include the use of reliable websites, YouTube clips and various online media. Schmidt (2001) asserted that insufficient numbers of samples and drills of correct English word stress could possibly mean that learners hardly acquire and apply them when it comes to real English word stress production. He concluded that more inputs lead to more acquisition. In order to motivate students to make use of these resources, teachers might consider giving them extra marks for completing any language tasks aiming to improve their pronunciation as part of the requirement of the ESP courses. Heikkinen (2014) affirmed that offering students extra marks for participating or completing a task is one effective strategy to motivate and engage students in their language learning.

3. Teachers should encourage their students to use various educational tools such as mobile app to help them learn basic pronunciation as well as practicing pronunciation. According to Li et al. (2008), the integration of mobile apps in language learning increases students' motivation and learning performance. The utilization of technology-based learning pronunciation such as mobile apps or software enables students to practice as long as they wish and self-paced themselves (Neri et al., 2002).

To conclude, since word stress is crucial for communicating in English, it should not be neglected or overlooked. In order to help EFL learners articulate English words correctly, particularly specific terminology in their disciplines of study, it is essential for EAP/ESP teachers to put greater emphasis on teaching word stress explicitly. Teaching pronunciation as a separate core content is not ideal for most ESP courses; thus, teachers should try to integrate pronunciation instruction in their teaching whenever suitable as well as providing online self-study resources

for their students. Specifically, a more focused approach to teaching pronunciation of medical terms is strongly encouraged as it will improve the Thai medical students' overall English-speaking ability which will lead to effective communication considered vital for their profession.

Recommendations for further research

Based on the findings of this study, the following areas should be further investigated:

First, this study should be replicated with different groups of participants from various health science disciplines such as students in the Faculty of Dentistry, the Faculty of Pharmaceutical Science, the Faculty of Allied Health Sciences and the Faculty of Nursing. This could provide clearer insights into the health sciences students' performance on identifying word stress patterns in English polysyllable medical terms. Furthermore, the results obtained from students in various disciplines should be conducted to gain additional perspectives. This in turn will be beneficial for future EAP/ESP course designs and course implementation.

Second, future study should examine medical students' performance on pronouncing English polysyllable words in context to represent the authentic use of medical terms in their profession and a larger set of medical terms should be used to gain better insights. In addition, future study might consider using students' proficiency test scores when classifying them into groups of advanced learners, intermediate learners, and elementary learners. Furthermore, the errors in the stress patterns of English polysyllabic medical terms found in other studies should be analyzed and compared with the findings obtained in the present study. This will help EAP/ESP teachers select the most suitable pedagogical approaches and tools to help their students articulate English polysyllable medical terms accurately, as well as enhancing their overall English proficiency particularly speaking skills.

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Appendix A

Word List

Directions: Please read each word out loud. Read only ONCE.

คำสั่ง กรุณาอ่านคำเหล่านี้เพียงครั้งเดียวเท่านั้น

1. Abortion	11. Fatal	21. Thrombosis	31. Patients
2. Physicians	12. Heparin	22. Depressive	32. Arthroplasty
3. Central	13. Abscess	23. Mechanism	33. Osteoarthritis
4. Prognostic	14. Vascular	24. Hazard	34. Fibrillation
5. Organs	15. Pulmonary	25. Malignant	35. Effect
6. Medical	16. Disease	26. Ventricular	36. Carcinoma
7. Gastrointestinal	17. Epidemiology	27. Therapeutic	37. Antihypertension
8. Pneumothorax	18. Dexamethasone	28. Symptoms	38. Chronic
9. Thromboembolism	19. Epidemics	29. Coronary	39. Hepatocellular
10. Neuroblastoma	20. Genetic	30. Cardiovascular	40. Meningococcal

Appendix B

Semi-structured interview questions

1. Are you aware of the importance of the word stress patterns in English? Please explain.

2. Have you ever learnt about the word stress patterns in English?

3. What technique(s) do you use when you have to pronounce an English polysyllabic medical term that you have never heard pronounced before?

4. Do you think such technique(s) can be applied to any English polysyllabic medical terms? Please explain.

5. How can you improve your ability to correctly put the primary stress on English polysyllabic medical terms?

6. What might be the best way to learn how to pronounce medical terms correctly?

Appendix C

Details of students' performance in pronouncing polysyllable medical terms

Table 6

Students' performance in pronouncing 2-syllable medical terms

	1st syllable				2nd syllable			
2-syllable words	Sec. 1 (N=25)	Sec. 5 (N=23)	Sec 9 (N=27)	Total	Sec 1 (N=25)	Sec 5 (N=23)	Sec 9 (N=27)	Total
*ce*ntral	24 (96.00%)	23 (100.00%)	24 (88.89%)	71 (94.67%)	1 (4.00%)	0	3 (11.11%)	4 (5.33%)
*symp*toms	25 (100.00%)	22 (95.65%)	22 (81.48%)	69 (92%)	0	1 (4.35%)	5 (18.52%)	6 (8.00%)
*pa*tients	23 (92.00%)	22 (95.65%)	22 (81.48%)	67 (89.33%)	2 (8.00%)	1 (4.35%)	5 (18.52%)	8 (10.67%)
*haz*ard	21 (84.00%)	13 (56.52%)	17 (62.96%)	51 (68%)	4 (16.00%)	10 (43.48%)	10 (37.04%)	24 (32%)
*abs*cess	8 (32.00%)	4 (17.39%)	6 (22.22%)	18 (24%)	17 (68.00%)	19 (82.61%)	21 (77.78%)	57 (76%)
*or*gan	14 (56.00%)	13 (56.52%)	16 (59.26%)	43 (57.33%)	11 (44.00%)	10 (43.48%)	11 (40.74%)	32 (42.67%)
*fa*tal	22 (88.00%)	21 (91.30%)	24 (88.89%	67 (89.33%)	3 (12.00%)	2 (8.70%)	3 (11.11%)	8 (10.67%)
*chro*nic	25 (100.00%)	21 (91.30%)	26 (96.30%)	72 (96%)	0	2 (8.70%)	1 (3.70%)	3 (4%)
di*sease*	3 (12.00%)	4 (17.39%)	1 (3.70%)	8 (10.67%)	22 (88.00%)	19 (82.61%)	26 (96.30%)	67 (89.33%)
ef*fect*	7 (28.00%)	4 (17.39%)	9 (33.33%)	20 (26.67%)	18 (72.00%)	19 (82.61%)	18 (66.67%)	55 (73.33%)

Table 7

Students' performance in pronouncing 3-syllable medical terms

	1st syllable				2nd syllable				3rd syllable			
3-syllable words	Sec. 1 (N=25)	Sec. 5 (N=23)	Sec 9 (N=27)	Total	Sec. 1 (N=25)	Sec. 5 (N=23)	Sec 9 (N=27)	Total	Sec. 1 (N=25)	Sec. 5 (N=23)	Sec 9 (N=27)	Total
*me*dical	25 (100.00%)	23 (100.00%)	24 (88.89%)	72 (96.00%)	0 (0.00%)	0 (0.00%)	3 (11.11%)	3 (4.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
phy*si*cian	7 (28.00%)	16 (69.57%)	16 (59.26%)	39 (52.00%)	18 (72.00%)	7 (30.43%)	3 (11.11)	28 (37.33%)	0 (0.00%)	0 (0.00%)	8 (29.63%)	8 (10.67%)
throm*bo*sis	6 (24.00%)	7 (30.43%)	19 (70.37%)	32 (42.67%)	19 (76.00%)	15 (65.22%)	5 (18.52)	39 (52.00%)	0 (0.00%)	1 (4.35%)	3 (11.11%)	4 (5.33%)
a*bor*tion	0 (0.00%)	0 (0.00%)	1 (3.70%)	1 (1.33%)	25 (100.00%)	23 (100.00%)	26 (96.30)	74 (98.67%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
de*pre*ssive	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	25 (100.00%)	23 (100.00%)	27 (100.00)	75 (100.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
*vas*cular	22 (88.00%)	18 (78.26%)	20 (74.07%)	60 (80.00%)	3 (12.00%)	3 (13.04%)	3 (11.11%)	9 (12.00%)	0 (0.00%)	2 (8.70%)	4 (14.81%)	6 (8.00%)
ma*lig*nant	21 (84.00%)	19 (82.61%)	24 (88.89%)	64 (85.33%)	4 (16.00%)	4 (17.39%)	3 (11.11%)	11 (14.67%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
*he*parin	22 (88.00%)	14 (60.87%)	12 (44.44%)	48 (64.00%)	3 (12.00%)	2 (8.70%)	4 (14.81%)	9 (12.00%)	2 (8.00%)	7 (30.43%)	9 (33.33%)	18 (24.00%)
*pro*gnostic	10 (40.00%)	7 (30.43%)	10 (37.04%)	27 (36.00%)	9 (36.00%)	16 (69.57%)	17 (62.96%)	42 (56.00%)	6 (24.00%)	0 (0.00%)	0 (0.00%)	6 (8.00%)
ge*ne*tic	12 (48.00%)	7 (30.43%)	5 (18.52%)	24 (32.00%)	7 (28.00%)	16 (69.57%)	22 (81.48%)	45 (60.00%)	6 (24.00%)	0 (0.00%)	0 (0.00%)	6 (8.00%)

Table 8

Students' performance in pronouncing 4-syllable medical terms

	1st syllable				2nd syllable				3rd syllable			
4-syllable words	Sec. 1 (N=25)	Sec. 5 (N=23)	Sec 9 (N=27)	Total	Sec. 1 (N=25)	Sec. 5 (N=23)	Sec 9 (N=27)	Total	Sec. 1 (N=25)	Sec. 5 (N=23)	Sec 9 (N=27)	Total
coronary	2 (8.00%)	1 (4.35%)	1 (3.70%)	4 (5.33%)	7 (28.00%)	7 (30.43%)	15 (55.56%)	29 (38.67%)	16 (64.00%)	15 (65.22%)	11 (40.74%)	42 (56.00%)
pulmonary	2 (8.00%)	2 (8.70%)	1 (3.70%)	5 (6.67%)	6 (24.00%)	6 (26.09%)	9 (33.33%)	21 (28.00%)	17 (68.00%)	15 (65.22%)	17 (62.96%)	49 (65.33%)
mechanism	5 (20.00%)	3 (13.04%)	2 (7.41%)	10 (13.33%)	3 (12.00%)	4 (17.39%)	5 (18.52%)	12 (16.00%)	17 (68.00%)	15 (65.22%)	19 (70.37%)	51 (68.00%)
arthroplasty	3 (12.00%)	4 (17.39%)	0 (0.00%)	7 (9.33%)	5 (20.00%)	5 (21.74%)	6 (22.22%)	16 (21.33%)	17 (68.00%)	14 (60.87%)	20 (74.07%)	51 (68.00%)
ven***tri***cular	7 (28.00%)	9 (39.13%)	14 (51.85%)	30 (40.00%)	15 (60.00%)	11 (47.83%)	12 (44.44%)	38 (50.67%)	3 (12.00%)	3 (13.04%)	1 (3.70%)	7 (9.33%)
fibri***lla***tion	5 (20.00%)	3 (13.04%)	4 (14.81%)	12 (16.00%)	0 (0.00%)	1 (4.35%)	3 (11.11%)	4 (5.33%)	20 (80.00%)	19 (82.61%)	20 (74.07%)	59 (78.67%)
epi***de***mics	2 (8.00%)	3 (13.04%)	3 (11.11%)	8 (10.67%)	10 (40.00%)	10 (43.48%)	12 (44.44%)	32 (42.67%)	13 (52.00%)	10 (43.48%)	12 (44.44%)	35 (46.67%)
thera***peu***tic	2 (8.00%)	6 (26.09%)	6 (22.22%)	14 (18.67%)	6 (24.00%)	2 (8.70%)	6 (22.22%)	14 (18.67%)	17 (68.00%)	15 (65.22%)	14 (51.85%)	46 (61.33%)
pneumo***tho***rax	0 (0.00%)	3 (13.04%)	3 (11.11%)	6 (8.00%)	2 (8.00%)	1 (4.35%)	5 (18.52%)	8 (10.67%)	23 (92.00%)	19 (82.61%)	19 (70.37%)	61 (81.33%)
carci***no***ma	4 (16.00%)	5 (21.74%)	6 (22.22%)	15 (20.00%)	6 (24.00%)	4 (17.39%)	7 (25.93%)	17 (22.67%)	15 (60.00%)	14 (60.87%)	13 (48.15%)	42 (56.00%)

	4th syllable			
4-syllable words	Sec. 1 (N=25)	Sec. 5 (N=23)	Sec 9 (N=27)	Total
coronary	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
pulmonary	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
mechanism	0 (0.00%)	1 (4.35%)	1 (3.72%)	2 (2.67%)
arthroplasty	0 (0.00%)	0 (0.00%)	1 (3.70%)	1 (1.33)
ven***tri***cular	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
fibri***lla***tion	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
epi***de***mics	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
thera***peu***tic	0 (0.00%)	0 (0.00%)	1 (3.70%)	1 (1.33%)
pneumo***tho***rax	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
carci***no***ma	0 (0.00%)	0 (0.00%)	1 (3.70%)	1 (1.33%)

Table 9

Students' performance in pronouncing more than 4-syllable medical terms

	1st syllable				2nd syllable				3rd syllable			
More than 4-syllable words	**Sec. 1 (N=25)**	**Sec. 5 (N=23)**	**Sec 9 (N=27)**	**Total**	**Sec. 1 (N=25)**	**Sec. 5 (N=23)**	**Sec 9 (N=27)**	**Total**	**Sec. 1 (N=25)**	**Sec. 5 (N=23)**	**Sec 9 (N=27)**	**Total**
dexa***me***thasone	3 (12.00%)	4 (17.39%)	5 (18.52%)	12 (16.00%)	5 (20.00%)	4 (17.39%)	2 (7.41%)	11 (14.67%)	12 (48.00%)	7 (30.43%)	12 (44.44%)	31 (41.33%)
neuroblas***to***ma	1 (4.00%)	3 (13.04%)	2 (7.41%)	6 (8.00%)	4 (16.00%)	4 (17.39%)	7 (25.93%)	15 (20.00%)	10 (40.00%)	9 (39.13%)	12 (44.44%)	31 (41.33%)
meningo***co***ccal	2 (8.00%)	4 (17.39%)	4 (14.81%)	10 (13.33%)	2 (8.00%)	1 (4.35%)	3 (11.11%)	6 (8.00%)	12 (48.00%)	10 (43.48%)	14 (51.85%)	36 (48.00%)
cardio***va***scular	2 (8.00%)	5 (21.74%)	9 (33.33%)	16 (21.33%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	21 (84.00%)	17 (73.91%)	14 (51.85%)	52 (69.33%)
antihyper***ten***sion	0 (0.00%)	2 (8.70%)	3 (11.11%)	5 (6.67%)	3 (12.00%)	4 (17.39%)	6 (22.22%)	13 (17.33%)	0 (0.00%)	1 (4.35%)	3 (11.11%)	4 (5.33%)
thrombo***em***bolism	1 (4.00%)	1 (4.35%)	2 (7.41%)	4 (5.33%)	1 (4.00%)	1 (4.35%)	0 (0.00%)	2 (2.67%)	17 (68.00%)	12 (52.17]%)	8 (29.63%)	37 (49.33%)
gastroin***te***stinal	6 (24.00%)	5 (21.74%)	11 (40.74%)	22 (29.33%)	4 (16.00%)	6 (26.09%)	6 (22.22%)	16 (21.33%)	0 (0.00%)	2 (8.70%)	0 (0.00%)	2 (2.67%)
hepato***ce***llular	7 (28.00%)	7 (30.43%)	10 (37.04%)	24 (32.00%)	0 (0.00%)	1 (4.35%)	5 (18.52%)	6 (8.00%)	2 (8.00%)	2 (8.70%)	3 (11.11%)	7 (9.33%)
osteoar***thri***tis	10 (40.00%)	10 (43.48%)	13 (48.15%)	33 (44.00%)	1 (4.00%)	1 (4.35%)	2 (7.41%)	4 (5.33%)	0 (0.00%)	1 (4.35%)	1 (3.70%)	2 (2.67%)
epidemi***o***logy	0 (0.00%)	0 (0.00%)	1 (3.70%)	1 (1.33%)	3 (12.00%)	4 (17.39%)	5 (18.52%)	12 (16.00%)	0 (0.00%)	1 (4.35%)	3 (11.11%)	4 (5.33%)

	4th syllable				5th syllable				6th syllable				7th syllable			
More than 4-syllable words	**Sec. 1 (N=25)**	**Sec. 5 (N=23)**	**Sec 9 (N=27)**	**Total**	**Sec. 1 (N=25)**	**Sec. 5 (N=23)**	**Sec 9 (N=27)**	**Total**	**Sec. 1 (N=25)**	**Sec. 5 (N=23)**	**Sec 9 (N=27)**	**Total**	**Sec. 1 (N=25)**	**Sec. 5 (N=23)**	**Sec 9 (N=27)**	**Total**
dexa***me***thasone	3 (12.00%)	4 (17.39%)	5 (18.52%)	12 (16.00%)	2 (8.00%)	4 (17.39%)	3 (11.11%)	9 (12.00)%	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
neuroblas***to***ma	10 (40.00%)	6 (26.09%)	5 (18.52%)	21 (28.00%)	0 (0.00%)	1 (4.35%)	1 (3.70%)	2 (2.67%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
meningo***co***ccal	8 (32.00%)	7 (30.43%)	4 (14.81%)	19 (25.33%)	1 (4.00%)	1 (4.35%)	2 (7.41%)	4 (5.33%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
cardio***va***scular	2 (8.00%)	1 (4.35%)	4 (14.81%)	7 (9.33%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
antihyper***ten***sion	6 (24.00%)	8 (34.78%)	9 (33.33%)	23 (30.67%)	15 (60.00%)	8 (34.78%)	7 (25.93%)	30 (40.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
thrombo***em***bolism	6 (24.00%)	8 (34.78%)	13 (48.15%)	27 (36.00%)	0 (0.00%)	1 (4.35%)	3 (11.11%)	4 (5.33%)	0 (0.00%)	0 (0.00%)	1 (3.70%)	1 (1.33%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
gastroin***te***stinal	15 (60.00%)	10 (43.48%)	9 (33.33%)	34 (45.33%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (3.70%)	1 (1.33%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
hepato***ce***llular	16 (64.00%)	13 (56.52%)	8 (29.63%)	37 (49.33%)	0 (0.00%)	0 (0.00%)	1 (3.70%)	1 (1.33%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
osteoar***thri***tis	6 (24.00%)	6 (26.09%)	8 (29.63%)	20 (26.67%)	8 (32.00%)	4 (17.39%)	2 (7.41%)	14 (18.67%)	0 (0.00%)	1 (4.35%)	1 (3.70%)	2 (2.67%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
epidemi***o***logy	0 (0.00%)	0 (0.00%)	1 (3.70%)	1 (1.33%)	20 (80.00%)	14 (60.87%)	13 (48.15%)	47 (62.67%)	2 (8.00%)	4 (17.39%)	3 (11.11%)	9 (12.00%)	0 (0.00%)	0 (0.00%)	1 (3.70%)	1 (1.33%)