



Original article

Assessing the pharmacy students' knowledge of common medical terms after a curricular change in Saudi Arabia



Yazed AlRuthia^{a,b,*}, Monira Alwhaibi^{a,c}, Haya Almalag^a, Hadeel Alkofide^a, Bander Balkhi^{a,b}, Amani Almejel^a, Fahad Alshammari^a, Fawaz Alharbi^d, Ibrahim Sales^a, Yousif Asiri^a

^a Department of Clinical Pharmacy, College of Pharmacy, King Saud University, Riyadh, Saudi Arabia

^b Pharmacoeconomics Research Unit, College of Pharmacy, King Saud University, Riyadh, Saudi Arabia

^c Medication Safety Research Chair, College of Pharmacy, King Saud University, Riyadh, Saudi Arabia

^d Al Ansaar Hospital, Almadinah, Saudi Arabia

ARTICLE INFO

Article history:

Received 23 February 2020

Accepted 3 May 2020

Available online 11 May 2020

Keywords:

Pharmaceutical education

Saudi Arabia

Health communication

ABSTRACT

Medical terminology is the vocabulary used to describe the human body and its conditions; fluency in this language is essential for health care professionals. We examined the level of basic medical terminology understanding among 347 pharmacy students in four different colleges of pharmacy in Saudi Arabia using a newly developed test of 30 multiple choice questions. Students in the relatively new colleges of pharmacy were more likely to have a higher score in the medical terminology test compared to their counterparts from the old college of pharmacy ($\beta = 1.23$, 95% CI = 0.16–2.30, P -value = 0.02). Female gender ($\beta = 1.72$, 95% CI = 0.57–2.88, P -value = 0.003), and advanced class level ($\beta = 0.84$, 95% CI = 0.36–1.32, P -value < 0.001) were also positively associated with high medical terminology test scores. The findings of this study reveal a deficiency in the pharmacy students' level of understanding of basic medical terms which may necessitate a reintroduction of the medical terminology course into the pharmacy curriculum.

© 2020 The Author(s). Published by Elsevier B.V. on behalf of King Saud University. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Medical terminology derives its origins from Latin and Greek roots with minor contribution from many other languages, such as Arabic, Chinese, Dutch, French, and Spanish (McGuire, 2009; The History of medical Terminology, 2019). Although Latin was initially considered the language of medicine after the Renaissance, its use has declined and is now considered a defunct language (Baethge, 2008). On an international level, not only is English the most commonly spoken language according to the number of people who speak it, but it is also the current undisputed language of medicine in terms of education and publishing (Galandi et al., 2006; Baethge, 2008; Lane, 2016; Lysanets and Bieliaieva, 2018).

On the contrary, the use of other languages for medical terminology can lead to discrepancies especially when taking into account regional dialects (Hur et al., 2018; Ko et al., 2018). While it is acknowledged how essential it is to have a good comprehension of medical terminology for health professions, learning medical terms is sometimes challenging and is similar in many instances to learning a second language for native English speakers (Banay, 1948; Feng et al., 2009; McGuire, 2009; Allibaih and Khan, 2015), and to learning a third language for those whose mother tongue is not English (Olson, 2012). An additional level of complexity is experienced by students who completed their secondary studies predominately in their local languages and then began learning English after beginning their higher studies followed by courses in medical terminology. Linguistics have determined that it may take up to seven years for those learning second languages to reach the level of academic proficiency of a native speaker (Paré, 1985; Cummins, 1994, 2000). Moreover, English instruction prior to admission in the health sciences in many occasions has been deemed insufficient for non-native English-speaking students' needs and may represent a barrier to their success compared to their native English-speaking counterparts (Niazi, 2012; Olson, 2012).

* Corresponding author at: Department of Clinical Pharmacy, College of Pharmacy, King Saud University, Riyadh, Saudi Arabia. P.O. Box 2454, Riyadh 11451, Saudi Arabia Phone: +966114677483 Fax: +966114677480

E-mail address: yazeed@ksu.edu.sa (Y. AlRuthia).

Peer review under responsibility of King Saud University.



Production and hosting by Elsevier

In the Kingdom of Saudi Arabia (KSA), the official language is Arabic, and English is not only considered the second language of the country, but is also the primary language of instruction in health care colleges (Telmesani et al., 2011). Similar to other countries in the region, students essentially choose one of two educational tracks for their primary and secondary education, a public or private school in which Arabic is the primary language of instruction, or a private “international” school in which English is the primary language of teaching and learning (Heming and Nandagopal, 2012). Those students in private “international” schools usually have the advantage of more exposure and essentially more opportunities to practice English language. This may be due to the fact that they have native English speakers as teachers, the medium of instruction is English language, native English peers in their classes, or peers who have travelled abroad to English speaking countries. Students who are enrolled in these private institutions are usually from wealthier families who have either studied abroad or can afford to travel with their children abroad.

Students enrolled in King Saud University have the option of taking one of two tracks, the health sciences track or the humanities track. All students in the health sciences track begin taking basic science courses in the preparatory college, such as physics and mathematics, in addition to basic medical terminology (Gyls and Wedding, 2017). This course serves as an essential bridge for prospective students prior to their admission to health care colleges. The College of Pharmacy at King Saud University is the first pharmacy college in KSA that was established back in 1959 and remained the only college until 2001 (Asiri, 2011). Today, there are more than 29 new colleges of pharmacy that were established after 2001 (Alhamoudi et al., 2018). These colleges along with King Saud University College of Pharmacy have relatively few native English speakers, and the vast majority of students struggle to learn or speak in English. Therefore, the Latin-based medical terms are taught as a third-language. Previously, the College of Pharmacy at King Saud University offered a refresher course in medical terminology for students which was subsequently removed from the curriculum back in 2009. This omission presented a challenge for students seeking to enhance their understanding of medical terminology which is essential to health sciences.

Recently, some faculty members at King Saud University College of Pharmacy have voiced their concern over the students' understanding of basic medical terms that should have been covered during their preparatory year. Those faculty were concerned about the students' level of understanding of commonly used medical terms in comparison to their peers in other new colleges of pharmacy in Saudi Arabia. Therefore, we aimed to examine King Saud University College of Pharmacy students' level of understanding of basic medical terms and compare it to other students in relatively new colleges of pharmacy in Saudi Arabia.

2. Methods

This was a cross-sectional study in which pharmacy students from King Saud University, AlMaarefa University, Princess Noura University, and Taibah University were recruited using a convenience sampling technique. In order to assess the pharmacy students' level of understanding of medical terms, a test of 30 multiple choice questions was developed by six faculty members from the department of clinical pharmacy. The questions were written based on the content of a textbook for medical terminology that is listed as a required textbook in the syllabus of the medical terminology course in the preparatory year for the health sciences track at King Saud University (Gyls and Wedding, 2017). The content and face validity were checked by four pharmacy faculty

members who are involved in teaching clinical courses. Pilot testing among a group of 15 students was conducted to examine the readability, difficulty, and discrimination of the test prior to administering it. The difficulty and discrimination of the test items were examined using item difficulty index and point biserial, respectively. The item analysis of the medical terminology test scores showed the test to be moderately easy with a mean value for the item difficulty of 0.81 and standard deviation of 0.26. Moreover, the test items' scores mean point biserial was 0.96 with a standard deviation of 0.32 suggesting that the test has a good discrimination index. Therefore, no major changes were required and only minor changes were made. The questions are shown in Appendix A.

2.1. Data collection

An online announcement was posted on King Saud University College of Pharmacy Education Unit's Twitter[®] account inviting the pharmacy students who completed the health sciences track preparatory year (e.g., first year) to participate in a research aimed at assessing their level of understanding of basic medical terms. The students who completed the preparatory year in the three other colleges of pharmacy have also been invited to participate. Upon signing the written consent form, which explained the purpose of the study and right of the participants to withdraw at any time without giving any reason, the consented students were asked to write down the year of the pharmacy program they are currently enrolled in as well as their gender and age before they start taking the test. The students were given 20 min to complete the test. The study took place between March 2018 and May 2019 and was approved by the institutional review board of King Saud University College of Medicine (Research Project No. E-18-2857).

2.2. Statistical analysis

The colleges of pharmacy were categorized into two groups (old and new). King Saud University was regarded as old since it is the first college of pharmacy in KSA (Asiri, 2011), and the other three colleges were considered new colleges since they were established after 2008. Student's *t*-test and one-way ANOVA were used to compare the mean test scores across sex, age groups, year in the program, and old versus new colleges as appropriate. Multiple linear regression was conducted to examine the impact of being in new versus old college of pharmacy on the overall test score controlling for age, sex, and year in the program. All statistical analyses were conducted using SAS[®] version 9.4 (SAS Institute Inc., Cary, NC, USA). Statistical significance was considered at $\alpha < 0.05$.

3. Results

A total of 347 students were recruited from four different pharmacy colleges as shown in Fig. 1. The majority of participants were females (63.1%), ≤ 25 years of age (96%), and enrolled in the Doctor

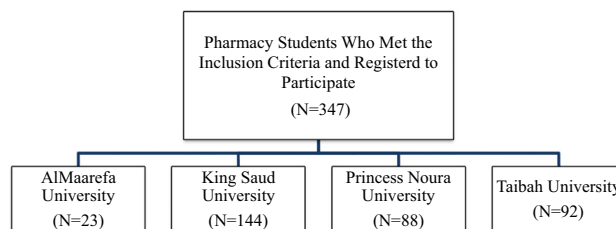


Fig. 1. Pharmacy students' recruitment scheme.

of Pharmacy (PharmD) program (66.28%). Only 8 (2.3%) students were in the first year of the pharmacy program and have just completed the health sciences track preparatory year, however, the majority of the participants were in their fourth class year or higher (56.4%). More than half of participants (58.5%) were from newly established colleges. The participants' baseline characteristics are shown in Table 1.

On evaluating medical terminology test scores, females had higher test scores than their male counterparts (24.4 ± 4.4 , $P < 0.0001$). Students in higher levels of the program had higher scores, and this was more apparent among students in the fifth year (25.2 ± 4.2 , $P < 0.0001$). Additionally, students in the newly established colleges of pharmacy had higher test scores compared to their counterparts in the old college (e.g., King Saud University College of Pharmacy) (24.2 ± 4.6 , $P = 0.004$). Although older students had higher scores than younger students, the differences were not significant. PharmD students had comparable test scores to their counterparts in the bachelor of pharmacy program. The medical terminology test scores across different variables are shown in Table 2.

The results of multiple linear regression analysis documented the presence of a positive relationship between the medical terminology test scores and the female gender ($\beta = 1.72$; 95% confidence interval, 0.578–2.881, $P = 0.003$), newly established colleges ($\beta = 1.23$; 95% confidence interval, 0.160–2.303, $P = 0.024$), and class year ($\beta = 0.836$; 95% confidence interval, 0.356–1.315, $P = 0.0007$) (Table 3).

4. Discussion

The current study represents, to the best of our knowledge, the first assessment of pharmacy students' knowledge of basic medical terminology in Saudi Arabia. Medical terminology is essential for health care professionals so that they can effectively communicate with each other (Brahler and Walker, 2008). Pharmacists need to utilize these terms as they provide direct patient care, describe medication-related mechanisms of action, recommend pharmacological treatments, and discuss monitoring and follow up parameters (Chisholm-Burns et al., 2010). The results of this study revealed that, accounting for age, gender, and class year, higher scores in the medical terminology test were positively associated with the female gender, the newly established schools of pharmacy, and students' class year. The age of the students was not associated with better test scores.

Table 1
Baseline characteristics of the participants.

Characteristic	N (%)
Sex	
Male	128(36.89)
Female	219(63.11)
Program	
Doctor of Pharmacy (Pharm.D)	230(66.28)
Bachelor of Pharmacy (B.Pharm)	117(33.72)
Program year	
First year	8(2.31)
Second year	66(19.02)
Third year	77(22.19)
Fourth year	99(28.53)
Fifth year	49(14.12)
Sixth year	48(13.83)
Age	
18–21 yrs.	159(45.82)
22–25 yrs.	174(50.14)
26–29 yrs.	11(3.17)
≥30 yrs.	3(0.86)
College of Pharmacy	
Old	144(41.50)
New	203(58.50)

Table 2
Medical terminology test scores across students' characteristics.

Characteristic	Test score (Mean \pm SD)	P-value
Sex		
Male	21.87 \pm 5.39	<0.0001*
Female	24.52 \pm 4.35	
Program		
Doctor of Pharmacy (Pharm.D)	23.35 \pm 4.92	0.424
Bachelor of Pharmacy (B.Pharm)	23.80 \pm 4.99	
Program year		
First year	20.75 \pm 4.68	<0.0001*
Second year	20.43 \pm 5.62	
Third year	23.84 \pm 4.35	
Fourth year	24.34 \pm 4.61	
Fifth year	25.16 \pm 4.15	
Sixth year	24.48 \pm 4.35	
Age		
18–21 yrs.	23.01 \pm 5.12	0.222
22–25 yrs.	24.01 \pm 4.69	
26–29 yrs.	22.81 \pm 5.67	
≥30 yrs.	26.00 \pm 4.35	
College of Pharmacy		
Old	22.65 \pm 5.27	0.004*
New	24.16 \pm 4.57	

* $P < 0.05$.

Table 3
Multiple linear regression for the association between the medical terminology scores and being a student in a new pharmacy college.

Variable	β estimate	P-value	95% Confidence interval	
New college	1.23	0.024*	0.160	2.303
Age	−0.88	0.092	−1.908	0.145
Class year	0.836	0.0007*	0.356	1.315
Sex	1.72	0.003*	0.578	2.881

* $P < 0.05$.

The results suggest that there is a need to reintroduce a medical terminology course in the first year of the pharmacy program since the test's questions were covering basic medical terms that all students should be familiar with prior to their admission in the pharmacy program. However, students' scores improved especially in the fourth and fifth years as opposed to the first two years of the pharmacy program, which suggests that the students became more familiar with the commonly used medical terms as they progress in their didactic studies. These years coincide with the beginning of pharmacotherapy courses and their associated pharmacy practice laboratories. It is possible that these courses provided audio reinforcement during the lectures and direct applications during their case discussions and laboratory sessions. Heming and Nandagopal reported a similar trend among medical students in Oman (Heming and Nandagopal, 2012). Like Saudi Arabia, Oman is an Arabic-speaking country where English is the official second language and the language of instruction for the health sciences. Students' comprehension of common medical terms improved as their class level advanced.

Students from the three newly or more recently established universities scored significantly higher in the medical terminology test compared to their counterparts from King Saud University, which is quite intriguing. Usually, medical terminology is a standard part of most health care colleges' curricula. In pharmacy schools, medical terminology courses are not commonly given at the professional program level. At this time, students are engaged with learning activities and skills focusing on the various medicinal products and how they work (Medina et al., 2013). The fact that an additional medical terminology course was previously incorporated into the curriculum at King Saud University College of Pharmacy, eventually removed, and subsequently the students performed poorer on the

assessment of basic medical terms raises a question as to whether reintroducing this course into the pharmacy curriculum should be considered. Reviewing the medical terms ensures better comprehension of didactic courses. Therefore, different approaches have been adopted in teaching or refreshing the students' memory with commonly used medical terms. Hsieh used Bingo, which is a team-based game to review medical terms during a medical terminology course for nursing students, and resulted in improved test scores and higher satisfaction among the students (Hsieh and Care, 2016). Allibaih and Khan incorporated a myriad of active teaching strategies during a medical terminology course and utilized peer assessment as well as audio and medical vignettes to assess students' performance prior to and after completing the study material. Students' scores significantly improved on both audio and medical vignette quizzes and their perceptions were overwhelmingly positive (Allibaih and Khan, 2015). Saxena and colleagues reinforced medical terminology and disease state related concepts with the use of crossword puzzles. The majority of students, 51%, reported that the crossword puzzles assisted them in understanding the medical terminology, and female students scored higher than their male counterparts (Saxena et al., 2009). Hays and Pearse also found that female medical students performed better overall on a general practice Objective Structured Clinical Examination (OSCE) for 5th year medical students (Hays et al., 1996).

Although medical terminology may be considered a third language, the literature indicates that deficiencies in the second language, i.e. English, may be the unstable foundation and the basis of students' linguistic challenges. Alqurashi surveyed a sample of Saudi medical fellowship students in Australia to determine their English language needs, skills, and concerns. He concluded that the English language curriculum in Saudi Arabia is inadequate and needs to be restructured in order to prepare students for future communication encounters, studying abroad in English speaking countries, graduate studies especially in the medical field, and the competitive labor market (Alqurashi and Studies, 2016). Additionally, Hays and Pearse reported that English as a Second Language (ESL) students who recently arrived in Australia or did not speak English at home were more likely to perform poorly on the general practice OSCE (Hays et al., 1996). Students in the fifth program year had a mean score of 25.16 out of 30 (83.9%). This is consistent with the findings of Heming and Nandagopal study, students who attended English-medium secondary schools in the fourth year of medical school, as opposed to the second and third years, answered all of the medical terminology-based questions (Heming and Nandagopal, 2012).

Possible solutions to ameliorate this deficiency include reintroducing the Medical Terminology course into the pharmacy curriculum, restructuring the medical terminology course in the preparatory year, or restructuring the English program in the preparatory year. Regardless of the association between English language deficiency and the comprehension of basic medical terminology, the English program revision has broader implications beyond medicine (Alqurashi and Studies, 2016). Students in Saudi Arabia lack two essential components of learning English language – opportunities for exposure and interactions with native English speakers, and an extensive duration of program-based learning (Heming and Nandagopal, 2012). With the current emphasis upon the Saudi nationalization scheme, or Saudization, the number of expatriate native English speakers has declined and is expected to continue to decline. The alternative opportunities of a permanent residency program or tourist visas may not be sufficient in order to stimulate the level of personal English-based interactions in order to assist in English as a second language (ESL) development.

As for what appears to be the obvious solution is directly related to the medical terminology courses, it depends on the perspective of the college of pharmacy. Overall, the university students

performed on a much lower standard than expected. This could be due to the fact that a large proportion of the students were former Arabic-medium secondary school graduates (Heming and Nandagopal, 2012). Therefore, the problem may be the result of the medical terminology course being poorly structured and not fulfilling the needs of ESL students (Alqurashi and Studies, 2016). If subsequent studies on other health care colleges yield similar results, the preparatory year medical terminology course must be restructured. The second option would be to reintroduce a medical terminology course into the curriculum. From the perspective of the older universities, this may be to their advantage as their students did not perform as well as the newer universities. The students from newer universities would also benefit from this alternative due to the additional exposure to these terms.

Although this is the first study to assess the pharmacy students' knowledge of basic medical terms in Saudi Arabia, several limitations have to be acknowledged. First, the participants represented a convenient sample and the results may not be generalized to the entire pharmacy student population. Further, the students were not asked to provide their grade point averages (GPA), and there might be a relationship between the students' scores and their GPAs. This study also did not request information regarding the medium of instruction in the students' secondary school education. Students who studied in English-medium secondary schools have shown to score higher on medical terminology exams than those from Arabic-medium secondary schools (Heming and Nandagopal, 2012). Finally, this study only focused on pharmacy students. In order to determine whether the deficiencies in the comprehension of basic medical terminology are related to weak medical terminology courses in the preparatory year or to the absence of an additional medical terminology course in the pharmacy curriculum, an additional study must be conducted to assess the comprehension of medical terminology among students from other health care colleges, such as medicine, dentistry, and nursing.

5. Conclusion

This study examined the comprehension of common medical terms among pharmacy students. Females, students from newer universities, and students in their advanced years of studies were factors associated with better comprehension of basic medical terms. Future studies should include other health care students from the various universities in the Kingdom. They should also take into consideration the medium of instruction in students' secondary education. Current recommendations include redeveloping existing English programs as early as the secondary educational years as well as enhancing medical terminology instruction either in the preparatory year or reintroducing medical terminology courses in the pharmacy curriculum.

Conflict of interest

The authors declared that there is no conflict of interest.

Acknowledgements

The authors would like to express their appreciation to Mr. Nasser Alwashli for his help in reviewing and editing the medical terminology test. Further, the authors would like to thank Omar Alenazi, Abdulaziz Alshehri, Turki Halabi, Abdullah Albogami, Faisal Alqniah, Wejdan Alsharif, Ghada Almuaiter, Hala Alrasheed, and Bushra Alghamdi for their support and help in data collection. The authors also acknowledge financial support from the Researchers Supporting Project number (RSP-2019/16), King Saud University, Riyadh, Saudi Arabia.

Appendix A

- 1. The term metastasis refers to:**
 - A. Spread of inflammation
 - B. Spread of cancer tumor
 - C. Spread of infection
 - D. Spread of red blood cells

- 2. Nerves run down the back from the**
 - A. Spinal column
 - B. Spinal cord
 - C. Cervical cord
 - D. Spinal canal

- 3. The prefix "Intra-" means which of the following?**
 - A. Between
 - B. Out
 - C. Within
 - D. Surrounding

- 4. Cholecystitis is an inflammation of the**
 - A. Colon
 - B. Tonsil
 - C. Eye
 - D. Gall bladder

- 5. Subcutaneous:**
 - A. Pertaining to under the scapula
 - B. Pertaining to across the abdomen
 - C. Pertaining to under the skin
 - D. Pertaining to behind the peritoneum

- 6. The term psychiatry is related to which of the following?**
 - A. Lung diseases
 - B. Diseases of children
 - C. Mental diseases
 - D. Nerve disease

- 7. The term cardiomegaly refers to:**
 - A. Death of heart cells
 - B. Decreased of ejection fraction
 - C. Enlargement of the heart
 - D. None of the above

- 8. The prefix "thoraco-" in thoracolumbar is related to the:**
 - A. Chest
 - B. Spinal cord
 - C. Shoulder
 - D. Neck

- 9. Cardioversion involves which of the following?**
 - A. Donor heart is transferred to a recipient
 - B. Surgery to detour around blockage in coronary arteries
 - C. Brief discharges of electricity to stop a cardiac arrhythmia
 - D. Removal of innermost lining of an artery

- 10. Cholelithiasis is an abnormal condition of the:**
 - A. Liver
 - B. Colon
 - C. Ileum
 - D. Gallstones

- 11. Radiotherapy refers to treatment by:**
- A. Antibody drugs
 - B. Herbs
 - C. Radiation
 - D. Anti-immune drugs
- 12. The abbreviation COPD refers to which of the following?**
- A. Chronic obstructive lung disease
 - B. Chronic obstructive pulmonary disease
 - C. Chronic obstructive pelvis disease
 - D. Common obstructive pulmonary disease
- 13. The prefix "neo-" means which of the following?**
- A. New
 - B. Before
 - C. Near
 - D. Within
- 14. The term jaundice means which of the following?**
- A. Yellow coloration of the skin
 - B. Liver inflammation
 - C. Kidney dysfunction
 - D. Abnormal condition of gallstones
- 15. Aneurysm means which of the following?**
- A. Local widening of an artery
 - B. Heart attack
 - C. Abnormal Heart beat
 - D. Chest pain
- 16. The medical term which describes an inflammation of the stomach is:**
- A. Hepatitis
 - B. Acidosis
 - C. Gastritis
 - D. Pyrosis
- 17. Excessive urination at night is known as which of the following terms?**
- A. Pyuria
 - B. Nocturia
 - C. Urolagnia
 - D. Enuresis
- 18. Adipose tissue is made of which of the following?**
- A. Lymph nodes
 - B. Muscles
 - C. Skin
 - D. Fat cells
- 19. Which of the following terms mean an enlargement of the liver?**
- A. Hepatitis
 - B. Hepatomegaly
 - C. Nephromegaly
 - D. Nephritis

20. Which of the following is the medical term for increased depth and rate of breathing?

- A. Hyperpnea
- B. Hypopnea
- C. Lung fibrosis
- D. Lung collapse

21. The medical term cephalic means:

- A. Pertaining to the skin
- B. Pertaining to the head
- C. Pertaining to the eyes
- D. Pertaining to the heart

22. The suffix "-itis" means which of the following?

- A. Inflammation
- B. Tumor
- C. Enlargement of
- D. Acidosis

23. The prefix "brady-" means which of the following?

- A. Slow
- B. Irregular
- C. Away from
- D. Fast

24. Red blood cells are known as:

- A. Lymphocyte
- B. Erythrocyte
- C. Leukocyte
- D. Eosinophil

25. The term venulitis refers to which of the following?

- A. Inflammation of small arteries
- B. Inflammation of small veins
- C. Inflammation of aorta
- D. Inflammation of pulmonary vein

26. Splenectomy is the excision of:

- A. Colon
- B. Stomach
- C. A gland
- D. Spleen

27. Which of the following is the medical term for hair loss?

- A. Impetigo
- B. Alopecia
- C. Eczema
- D. Folliculitis

28. Otalgia is a term related to which of the following?

- A. Pain of chest
- B. Pain of eye
- C. Pain of teeth
- D. Pain of ear

29. Hematology is a medical term related to:

- A. Eye disorders
- B. Mental disorders
- C. Blood disorders
- D. Skin disorders

30. Pathology is the study of the

- A. Eye
- B. Nature and causes of disease
- C. Progression of disease
- D. Chest organs

Answer key	
1. B	2. B
3. C	4. D
5. C	6. C
7. C	8. A
9. C	10. D
11. C	12. B
13. A	14. A
15. A	16. C
17. B	18. D
19. B	20. A
21. B	22. A
23. A	24. B
25. B	26. D
27. B	28. D
29. C	30. B

References

Alhamoudi, A., Alnattah, A., 2018. Pharmacy education in Saudi Arabia: the past, the present, and the future. *Curr. Pharm. Teach. Learn.* 10 (1), 54–60.

Allibai, M., Khan, L.M., 2015. Weaving together peer assessment, audios and medical vignettes in teaching medical terms. *Int. J. Med. Educ.* 6, 172.

Alqurashi, F., 2016. English for medical purposes for Saudi medical and health professionals. *Adv. Language Literary Stud.* 7 (6), 243–252.

Asiri, Y.A., 2011. Emerging frontiers of pharmacy education in Saudi Arabia: the metamorphosis in the last fifty years. *Saudi Pharm J.* 19 (1), 1–8.

Baethge, C., 2008. The languages of medicine. *Deutsches Arzteblatt Int.* 105 (3), 37–40.

Banay, G.L., 1948. An introduction to medical terminology I. Greek and Latin derivations. *Bull. Med. Libr. Assoc.* 36 (1), 1.

Brahler, C.J., Walker, D.J., 2008. Learning scientific and medical terminology with a mnemonic strategy using an illogical association technique. *Adv. Physiol. Educ.* 32 (3), 219–224.

Chisholm-Burns, M.A., Lee, J.K., Spivey, C.A., Slack, M., Herrier, R.N., Hall-Lipsy, E., Zivin, J.G., Abraham, I., Palmer, J., Martin, J.R., 2010. US pharmacists' effect as team members on patient care: systematic review and meta-analyses. *Med. Care*, 923–933.

Cummins, J., 2000. *Language, Power and Pedagogy: Bilingual Children in the Crossfire*, vol. 23. Multilingual Matters.

Cummins, J., 1994. The acquisition of English as a second language 13, pp. 36–62.

Feng, Y., Shi, J., Wang, W.J., 2009. When medicine was a foreign language. *J. Med. Educat.* 43 (11), 1110–1110.

Galandi, D., Schwarzer, G., Antes, G.J., 2006. The demise of the randomised controlled trial: bibliometric study of the German-language health care literature 1948 to 2004. *BMC Med. Res. Methodol.* 6 (1), 30.

Gyllys, B.A., Wedding, M.E., 2017. *Medical terminology systems: a body systems approach*. FA Davis.

Hays, R.B., Pearse, P., Cooper, C.W., Sanderson, L., 1996. Language background and communication skills of medical students. *Ethn. Health* 1 (4), 383–388.

Heming, T.A., Nandagopal, S., 2012. Comparative difficulties with non-scientific general vocabulary and scientific/medical terminology in English as a second language (ESL) medical students. *Sultan Qaboos Univ. Med. J.* 12 (4), 485.

Hsieh, C., 2016. Bingo! Team-Based Game in English Medical Terminology for Baccalaureate Nursing Students. *JIAoN* 2 (2), 46.

Hur, K., Park, D.-E., Oh, H.-K., Yang, H.H., Ko, D., Kim, M.-H., Kim, M.J., Kang, S.I., Kim, D.-W., Kang, S.-B.J., 2018. Discrepancies in general surgery medical terminology between South and North Korea. *Korean J. Med. Educ.* 30 (1), 51.

Ko, D., Oh, H.-K., Jo, J., Yang, H.H., Kim, M.-H., Kim, M.J., Kang, S.I., Kim, D.-W., Kang, S.-B., 2018. Discrepancy of medical terminology regarding colorectal surgery between South and North Korea. *Ann. Coloproctol.* 34 (5), 248.

Lane, J.J., Ddhwbcmnt-m-s-l-i-t-w, 2016. *The 10 most spoken languages in the world*.

Lysanets, Y.V., Bieliaieva, O.M., 2018. The use of Latin terminology in medical case reports: quantitative, structural, and thematic analysis. *J. Med. Case Rep.* 12 (1), 45.

McGuire, P., 2009. Teaching medical terminology. *J. Foreign Language Educat.* 16, 45–54.

Medina, M.S., Plaza, C.M., Stowe, C.D., Robinson, E.T., DeLander, G., Beck, D.E., Melchert, R.B., Supernaw, R.B., Roche, V.F., Gleason, B.L., 2013. Center for the Advancement of Pharmacy Education 2013 educational outcomes. *Am. J. Pharm. Educat.* 77 (8).

Niazi, M.M., 2012. *English for Medical Purposes: A Case of English for Specific Purposes*. National University Of Modern Languages, Islamabad.

Olson, M.A., 2012. English-as-a-Second Language (ESL) nursing student success: a critical review of the literature. *J. Cult. Divers.* 19 (1).

Paré, F., 1985. *Cummins, Jim. Bilingualism and Special Education: Issues in Assessment and Pedagogy*. Clevedon: Multilingual Matters, 1984. University of Toronto Press.

Saxena, A., Nesbitt, R., Pahwa, P., Mills, S., 2009. Crossword puzzles: active learning in undergraduate pathology and medical education. *Arch. Pathol. Lab. Med.* 133 (9), 1457–1462.

Telmesani, A., Zaini, R.G., Ghazi, H.O., 2011. Medical education in Saudi Arabia: a review of recent developments and future challenges. *East Mediterr. Health J.* 17 (08), 703–707. <https://doi.org/10.26719/2011.17.8.703>.

The History of Medical Terminology, 2019. New Zealand: Medical Academic; [accessed 2020 01/13]. <https://www.medicalacademic.co.za/news/the-history-of-medical-terminology/>.