USING CORPUS DATA TO TEACH COLLOCATIONS IN MEDICAL ENGLISH

Neslihan Önder Özdemir, School of Foreign Languages, Uludağ University, Bursa, Turkey

Abstract

Corpus linguistics provides English teachers with an opportunity to analyse large amounts of language data to facilitate language learning and allows teachers to produce authentic in-house materials. Textbooks started to integrate corpus data (see Carter & McCarthy, 1997). However, surprisingly, corpus-based activities and materials have not completely reached the classroom. Following Johns (1991), this preliminary study aims to assess the relevance of corpus data in a mainstream ESP classroom, specifically, in teaching medical English using a data-driven learning approach. A longitudinal critical needs analysis on 323 Turkish medical students revealed that students perceive learning meanings of English words with collocations as a highly important need. The present study seeks to satisfy the perceived needs of medical students who are learning medical English. Considering students' content knowledge, medical specialists were consulted to choose a relevant medical journal. A self-compiled specialised corpus was built from research articles in the *Journal of Medical Case Reports*. The corpus comprised 31,731 words. The corpus data were used to teach students collocations and to produce in-house ESP materials, such as concordance lines, that foster autonomous learning and active participation in first-year medical students. Pedagogical applications of corpus work are discussed.

Keywords: corpus, DDL, medical English, autonomy, ESP

Introduction

English language teaching has several branches, including English for Specific Purposes (ESP) and general English. ESP provides contexts to meet specific student needs emphasising disciplinary knowledge in the teaching of English (Hyland, 2006). ESP is committed to tailoring instruction for specific purposes, and it is associated with university-level learning (Hyland & Hamp-Lyons, 2002). ESP is relevant to student needs, interests and purposes; therefore, ESP courses tend to be more motivational (Basturkmen, 2010; Hutchinson & Waters, 1987; Strevens, 1988). Increased ESP teaching at universities has paved the way for needs analyses and corpus linguistics in English language teaching (Flowerdew, 1993; Skehan, 1981), which will be discussed briefly below.

Needs analysis

Needs analysis is a perquisite for an effective course design and material development (see Basturkmen, 2010; Dudley-Evans & St. John, 1998; Long, 2005). Instead of the necessities of an external syllabus, student needs have been emphasised in ESP courses; therefore, ESP courses should be developed based on needs analyses (Robinson, 1980). Given the pivotal role of student needs, this study has benefitted from the outcomes of a longitudinal critical needs analysis. This analysis showed that students should be encouraged to discuss their opinions, suggestions, and needs as a reflective practice (Benesch, 2001) to help

diagnose and meet their needs; students should also have a voice in the production process for in-house course materials.

Corpus linguistics

A corpus is more than a selection of documents and is not a random collection of text but **"**a collection of (1) *machine-readable* (2) *authentic* texts (including transcripts of spoken data) which is (3) *sampled* to be (4) *representative* of a particular language or language variety" (McEnery, Xiao, & Tono, 2006, p. 5). Previous research in corpus linguistics suggests that when we compare corpus-based and intuition-based approaches, a corpus-based approach provides stronger and more reliable empirical evidence through systematic access. Because specificity is one of ESP's main characteristics, a discipline-specific corpus can provide rich and authentic language for each discipline (i.e., a corpus of medical research articles). For example, a corpus is key in determining the linguistic features of different disciplines, including medicine (Adolphs, Brown, Carter, Crawford & Sahota, 2004; Dahl, 2004; Ferguson, 2001; Wang, Liang, & Ge, 2008). A specialised corpus was built in the present study. A specialised corpus refers to a collection of texts, namely medical research articles, tailored to ESP practitioners' and Turkish medical students' needs.

ESP corpora have attached greater importance to data-driven learning (DDL), through which language teachers provide contexts to scaffold learners in language discovery (but see Boulton, 2010; Widdowson, 1998). In this approach, teachers monitor classrooms, asking questions to oversee the learning process, and provide feedback (Johns, 1986). Each discipline has specific collocation patterns that are challenging to teach using traditional methods, dictionaries and course books. Concordance is grouping the uses of a particular word (e.g., diagnosis) to see how the words are used on the computer screen. Concordancing in particular is effective to highlight repetition of patterns in texts in the target disciplines. However, little research has been conducted using needs analysis on computer corpora use as a pedagogical practice in classrooms where English is considered a foreign language. Given this largely unexplored area, this study integrates needs analysis and DDL to meet Turkish medical students' learning needs and encourage their autonomy, focusing on how to teach collocations with active medical student participation. As an ESP practitioner, I was an intermediary advisor, rather than an authoritative presence, between students and subject teachers to support teaching and clarify complex topics. This role can be assessed as a reflection of DDL in mainstream ESP classrooms.

Methods and procedure

As Braun (2005) rightly observes choosing of corpora texts is important because materials should be relevant to student needs; thereby motivating their learning. The needs analysis in the context of using corpus data still remains to be addressed. In addition to filling this niche in the ESP literature, this empirical research aims is satisfy the needs of medical students who are learning English medical terminology. These needs were identified through a recent longitudinal critical needs analysis conducted with 323 Turkish medical students in the Faculty of Medicine at Uludag University in Turkey (see Onder, in press, for comprehensive results on needs analysis). About learning the meaning of English words with their collocations in medicine, the needs analysis reveals that 41.2% of the students perceive

learning English words with their collocations as very important and 38.1% of the students rated as important. Very few students (0.9%) consider collocations as completely unimportant and unimportant (2.5%) as shown in Table 1.

Table 1. *Responses about learning meanings of English words with collocations*

	Response										Total
	Completely Unimportant		Unimportant		Partially important		Important		Very Important		
	n	%	n	%	n	%	n	%	n	%	
Meanings of English words with collocations	3	0.9	8	2.5	56	17.3	123	38.1	133	41.2	323

Given perceived medical student needs, a smaller specialised corpus was built, which can be considered a pedagogic corpus was built (Hunston, 2002), to offer more advantages than a general corpus (see Atkins, Clear & Ostler, 1992; Flowerdew, 2004; Gavioli, 2005; O' Keeffe, McCarthy & Carter, 2007). Each content word's frequency was examined and counted with computer analyses by using Laurence Anthony's AntConc (2008). First, students were given classroom access to the specialised corpus of medical research articles. Using this corpus, students could investigate collocations of the discipline-specific target words with concordance lines. Then, students were asked to conduct a self-initiated project to find out collocations with an assumption that they could have more control for their own needs and raise awareness how to meet their needs on their own.

Results and discussion

The study exploited corpus data to satisfy medical student needs. As an ESP practitioner, I also observed some important classroom discussions about the challenges students experienced. Students generally reported that they could not find medical vocabulary with detailed explanations in their general English dictionaries, which provided insufficient information about the specialised target words and collocations required. Harwood (2005) rightly criticises "[course] materials remain unchanged, dispensing intuitive judgments, which fail learners and teachers" (p.156). Indeed, finding reliable materials is also a problem for ESP teachers, like me. Accordingly, this problem was addressed by building a self-compiled corpus. I would like to underscore three central issues with regard to pedagogically relevant corpora. First, while using corpus data, students were interested and actively participated, a possible effect of concordance line usage. During classroom application, student feedback revealed that the specialised corpus regularities were easy to learn and retain with the use of multiple concordances. Second, with student cooperation, data were used for various tasks (i.e., making learners discover the collocations themselves, discussing fixed phrase meanings from the concordance lines and translating them into Turkish). Students were

asked which collocation might be most frequently used and in which settings they might need to use it (see Appendix A for the collocation diagrams). Strikingly, students took the role of researchers and chose their own description of collocations. Third, the critical significance of ESP practitioners' lack of subject knowledge is worthwhile and tended to be taken for granted. As Wu and Badger (2009) rightly describe ESP practitioners are "reluctant dwellers in a strange and uncharted land" (p. 20) while teaching English for specific purposes because of the limited content knowledge. Notably, compared to dictionaries and available ESP course books, concordance lines can provide richer data that will motivate students, facilitate ESP practitioners' roles and potentially compensate for the paucity of practitioners' content knowledge.

Concordance lines produced in the classroom could be an initial step to ameliorate problems associated with paucity of materials and ESP teachers' content knowledge. The concordance lines showed that the word treatment had 88, blood 76, diagnosis 59, abdominal 41 and lymphoma 40 occurrences (see Appendix B). Some concordance lines from the corpus were presented below. The underlined parts below were students' perceptions of collocations. Researchers who prepare dictionary entries and textbook writers may benefit from these concordance lines. When we opened the dictionary in the classroom, the findings were incredible according to students' perception. The following concordance lines can be compared with entries in available dictionaries.

Some concordance lines about collocations of 'treatment'.

1. Genetic hallmark that predicts **a good response to treatment** with epidermal growth factor receptor tyrosine ki
2. seven years. She had been **receiving locoregional treatment** in addition to systemic treatment. She maintained
3. ng locoregional treatment in addition to **systemic treatment**. She maintained a good performance status until s
4. Tumor response was subsequently observed and **the treatment was continued**. However, a routine brain magnetic
5. severed flexor pollicis longus tendon. **Definitive treatment was performed** by marginal resection of the lipoma
6. te cerebral perfusion while **continuing nimodipine treatment** for rcvs. Our patient tolerated this well without
7. g vasoconstriction [2]. The other aspect of **rcvs treatment** is identification and discontinuation of the pote
8. been decreased dramatically due to **conservative treatment** of peptic ulcers with h2 receptor antagonists,
9. bidities [9]. Discussion **a cognitive behavioral treatment** was proposed (habit reversal therapy [10]), bu
10. mmonly seen in parents **refusing rehabilitative treatment** [17]. Conclusions to the best of our knowledge,
11. ge. Our patient was scheduled for **prompt surgical treatment**, but before that occurred she presented with left

12. y cystic mass appearing before or during **hormonal treatment**. Thorough ultrasound screening is mandatory in ev
13. intensity, and intermittent ambulant **medical treatment was administered**. When her symptoms increase
14. secondary addison disease. She **underwent standard treatment** with rifampicin, ethambutol, isoniazid, and pyraz
15. ackbone x-ray, which was negative. She was **put on treatment** with anti-tuberculosis agents: rifampicin (rfp),
16. uration, complications, and so on). **The length of treatment** for periprosthetic tuberculosis infection is deba
17. debatable and not standardized. The **medical drug treatment** in our patient included four drugs for two months
18. of mature adipocytes and hematopoietic elements. **Treatment modalities** include watchful waiting and resection
19. those without a history of diabetes. **Introduction treatment** with a biologic agent is useful for controlling i
20. to improve in patients with **prolonged infliximab treatment** [8]. İn this paper, we present nine patients who
21. ctivity was not adequately controlled, **additional treatment** with tnf inhibitor infliximab at 3 mg/kg intraven
22. glucose, of 68 mg/dl, 10 months after **initiating treatment**. So, overall, she developed two episodes of low b
23. in obese mice [6]. One report showed that **chronic treatment** with infliximab for either ra or psoriatic arthri
24. of normal parenchyma [4,5,15]. Therefore, **primary treatment** should be targeted towards addressing hydrocephal
25. sing hydrocephalus, if the dvas are symptomatic. **Treatment options** in these cases include close observation

The activity was discussed with the students. Students expressed that they could draw conclusions about medical collocations, frequent collocations and preposition use that they could not find in the dictionary. In this student-centred classroom activity, students also attempted to find and underline target vocabulary collocations in the medical research articles. To focus on academic medical vocabulary use and comprehension, students read updated medical texts in scientific journals, but they also stayed informed about campus activities, including an activity to prepare a written report for campus medical posters. More than 500 medical students attended Uludağ University R&D Information Days II in 2012, and their written reports on academic posters in English were assessed as a part of final examination. The reports can be a good reflection of using both the academic vocabulary (the use of words such as ‘efficacy’ and ‘in remission’) as well as collocations (such as ‘administer treatment’, ‘undergo surgery’ and ‘a tentative diagnosis’) that we studied during the year with corpora data. Moreover, while we were benefitting from medical websites as corpora in the classroom, such as ScienceDaily, we examined the sentences for different contexts for the target collocations as follows:

- This article clarifies the research conducted to identify the relationship between pharmacological *treatments administered* to the patient and the role of the mind in the overall patient health.

- Scientists harness immune system to prevent *lymphoma relapse*.

It is worth mentioning that the specialised corpus offered to students was manageable and presented adequate examples of medical English. It was also advantageous that this corpus was created from authentic medical texts. As Willis (1998) puts it "[t]here is little point in learners studying language that is unnatural or untypical of the language they will meet in real life" (p. 46). To alleviate the effects of the availability problem with ESP materials, the concordance lines above suggest that the target content words 'treatment', 'blood', 'diagnosis', 'abdominal' and 'lymphoma' could be used with various collocations. This kind of analysis allows students and ESP practitioners to discuss and answer a common question through collaborative analysis, which highlights the recurrent specialised language features in medicine. Thus, pedagogic corpus data should be expanded and used as a methodology in the classroom. The material in Appendix B was a collaborative work in the mainstream ESP classroom. When students were scanning concordance lines, medical student volunteered to draw the tables, as a basis to discover and internalise the regularities not only for the course examination but also for their future profession. Students were truly their educational researchers in this consciousness-raising activity.

Conclusions and pedagogical implications

This study employed a corpus-based approach with a focus on the use of DDL in teaching medical English. In this study, language learners helped each other to learn English. The findings suggest that given the benefits of using corpus data, there is an urgent need to foster pedagogic corpus use in the classroom. Moreover, because ESP practitioners tend to have general English knowledge, they need to be familiar with specialised vocabulary and specialised knowledge to teach ESP, which makes teaching more challenging. This study attempted to remedy the problems in an ESP classroom in Turkey, a periphery country; medical students were presented with the tool AntConc and briefed on how to explore the self-compiled corpus and exploit in-house materials. The findings clearly showed that concordance lines allowed us to observe potential medical collocations. Accordingly, concordances can be used as supplementary to ESP teaching materials, to influence curriculum development, and to design syllabus and materials for pedagogical purposes. The most frequent content words can be embedded in the course materials. We can tackle numerous texts very quickly, and as a part of inductive learning, students can run concordances when there is hesitation about specialised word usage. Indeed, the corpus data could be valuable for dictionaries as well to explain each medical word with a number of sentences and collocations in a rich context. The study also provided valuable insights into cooperation between my students and me as an ESP practitioner. The findings are promising thanks to the authenticity and specificity of the materials produced. Future research could be conducted to prepare testing materials from concordances.

Biodata

Neslihan Onder is an English instructor and coordinating medical English courses at Uludağ University in Turkey. She had her postgraduate study in English for Specific Purposes at the University of Essex, UK. Her main research interests include English for specific/academic purposes, English as a lingua franca, academic writing, corpus linguistics, learning styles, need analysis and critical pedagogy.

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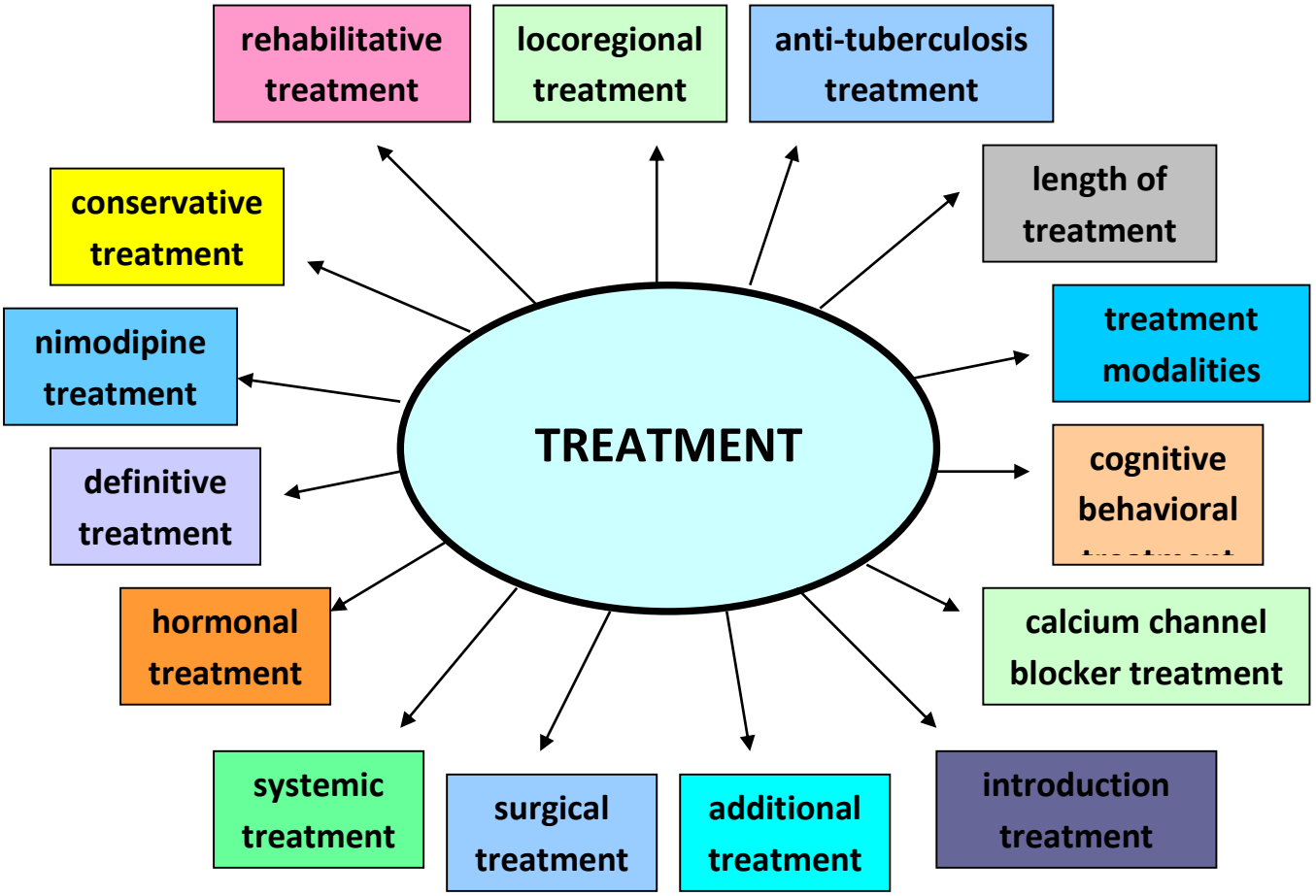
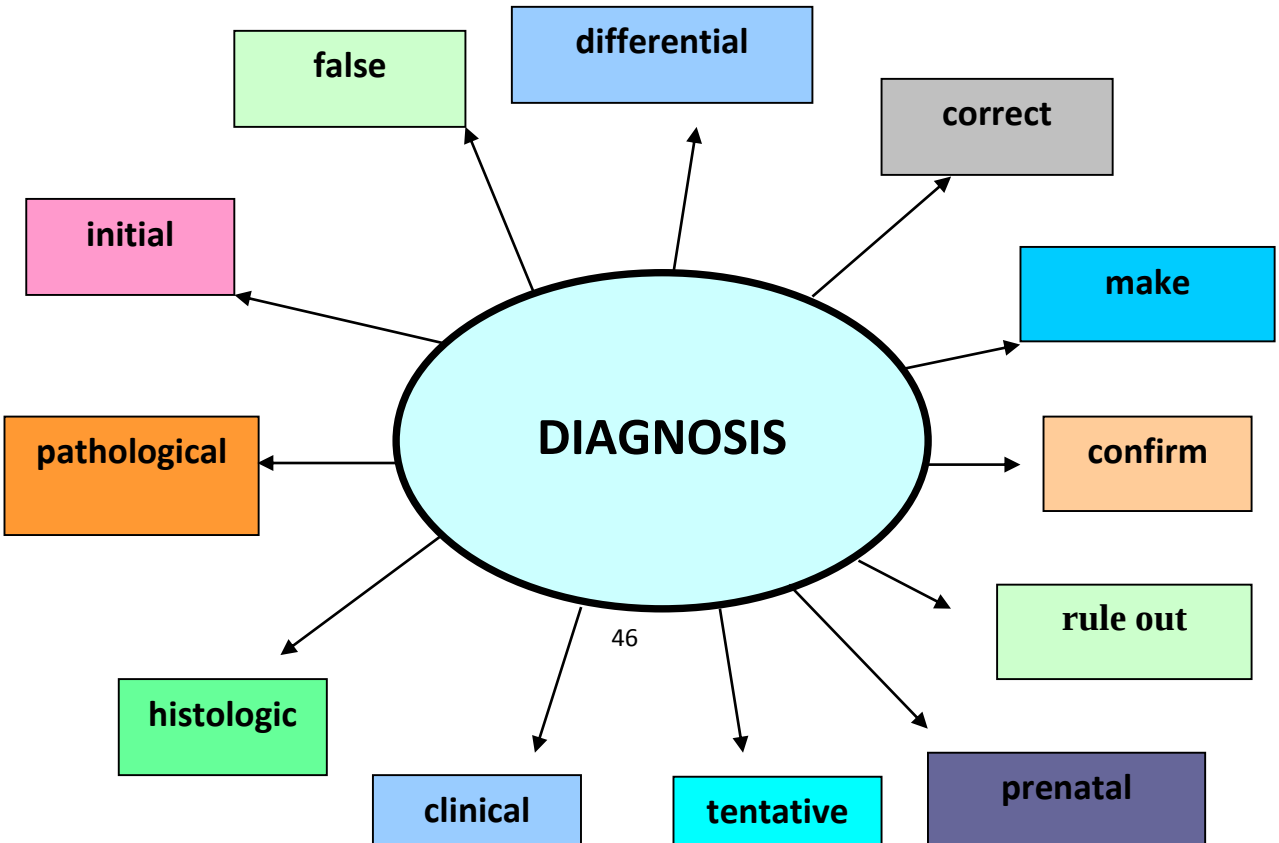
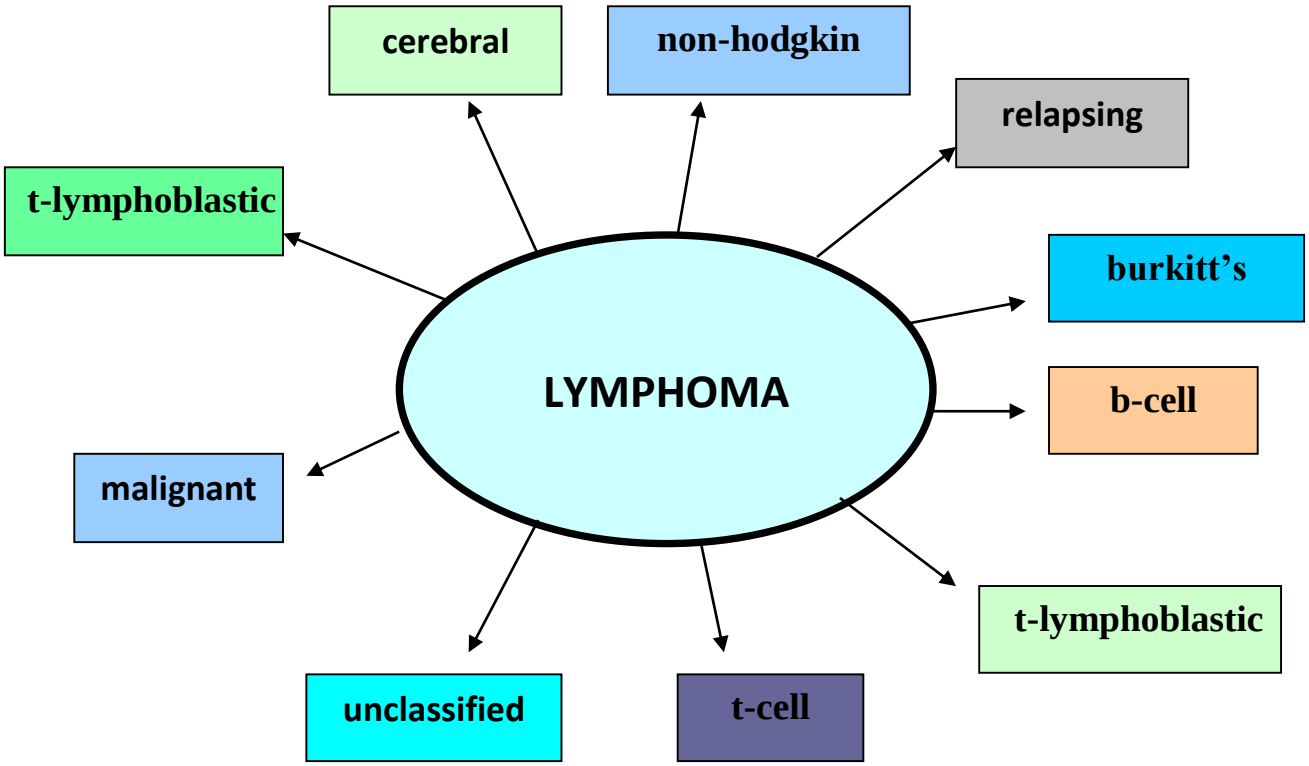
Appendix A Collocation diagrams






cerebral
non-hodgkin
relapsing
t-lymphoblastic
burkitt's
LYMPHOMA
b-cell
malignant
t-lymphoblastic
unclassified
t-cell

Appendix B Sample concordance lines for medical words with collocations

Some concordance lines about collocations of 'blood'.

1. lity bound. Thus, all four tumor clones were from **blood relatives** with an identical genetic ancestor. İn
2. eEveloped skin lesions. Swabs from the lesions and **blood cultures** were positive for methicillin-resistant
3. /dl, ldh of 1085u/l, total bilirubin of 1.6mg/dl, **blood urea nitrogen** of 34mg/dl, creatinine of 1.1mg/dl,
4. on of her hospitalization given her normal to **low blood pressures**. Her fasting lipid panel revealed chole
5. s being treated with prednisone, revealed 0 **white blood cells (wbc),** 48 red blood cells (rbc), cerebrospi
6. isone, revealed 0 white blood cells (wbc), 48 **red blood cells (rbc)**, cerebrospinal fluid (csf) protein 27
7. after beginning nimodipine for rcvs, her **systolic blood pressures** ranged from the high 80s to low 100s (m
8. mmhg. Therefore, she was advised to **measure** her **blood pressure** at home and take nimodipine only if syst
9. al and there was no local heat on his instep. **Blood tests** did not indicate infection or inflamma
10. The operation duration was 260 minutes and the **blood loss** was 50 g. Pathology results revealed no evid
11. is present, there is **increased blood flow into** the azygos and hemia- zygos veins.
12. opsoas abscess, which was confirmed by **peripheral blood mononuclear cells** marked with 99 mtc. Her clinica
13. ases. Development of **low blood glucose readings** in nine non-diabetic patients tr
14. Disease such as coronary artery disease and **high blood pressure**. However, most of our patients who devel
15. ate exclusion of all other possible causes of **low blood glucose readings.** Lastly, the threshold for low b
16. glucose readings. Lastly, the threshold for **low blood glucose levels** used here (< 70 mg/dl) is consider
17. umentation of whipple triad for hypoglycemia (low **blood glucose concentration** measured with a precise met
18. cemia, and symptom alleviation upon **correction of blood glucose**) [16]. Thus, it may be undermining the cl
19. ch low levels of glucose. However, a **threshold of blood glucose level** of less than 70 mg/dl is often used
20. e a proposed mechanism for the **development of low blood glucose readings** observed in our cases. Hotamisli
21. N-diabetic patients who developed **episodes of low blood glucose readings** after treatment with tn

22. derpublicized. Accordingly, closer **monitoring of blood glucose levels** should be rendered. Further random
23. ter isolation of immune cells from her **peripheral blood**, as described elsewhere [4], the immune cells wer
24. be answered. Activated immune cells can pass the **blood brain barrier**. İf the assumption that the improve
25. from the ventricular catheter corroborating **old blood** that was identified on the preoperative mri

Some concordance lines about collocations of 'abdominal'.

1. manding for patients with a history of major **abdominal surgery**. However, we think that laparos
2. but before that occurred she presented with left **abdominal tenderness** with suspected adnexal torsion to the
3. el of pain was experienced with increased **intra-abdominal pressure** (when, for example, coughing, sneezi
4. a gestation of 28 weeks and four days, **developed abdominal distention**. Case nine, a female baby, born with a
5. eight was 860 grams (p25-50). He developed **severe abdominal distention** on the second day of life and received
6. ic lobe herniation through an incisional **anterior abdominal wall hernia** and right adrenal myelolipoma: a case
7. tion: herniation of the liver through **an anterior abdominal wall** hernia defect is rare. To the best of our kn
8. with a one-week history of **right upper quadrant abdominal pain**, nausea, vomiting, and jaundice to our depar
9. excessive weight. She presented with jaundice, **abdominal distension** with a midline surgical scar, right up
10. upper quadrant tenderness, and a large **midline abdominal wall defect** with dullness upon percussion and pro
11. adrenal myelolipoma mass effect, and the previous **abdominal surgery** are likely to have contributed to incisio
12. Tomy 20 years earlier is reported here. A **midline abdominal wall hernia** with a protrusion of the left hepatic
13. car, right upper quadrant tenderness, and a large **abdominal wall defect** suggestive of a post-incisional herni
14. He presented with confusion and **progressive upper abdominal pain** and swelling for the previous three months.
15. had a six-month evolution of **right upper quadrant abdominal pain**, nausea, and dyspnea. A physical examination
16. through the rectus muscle presented as **persistent abdominal pain**. Adrenal myelolipomas are uncommon, benign,

17. but can attain very large sizes. Back, flank, or **abdominal vague pain** with or without a palpable mass and he
18. ence of strangulation. The decision to perform **an abdominal wall reconstruction** should be made on an individu
19. orted here, the one-week **clinical presentation of abdominal pain and jaundice**, the previous cholecystectomy,
20. likely to have contributed to **an increased intra-abdominal pressure**, which was exerted over a previously ope
21. ure, which was exerted over **a previously operated abdominal wall**, with subsequent incisional hernia formation
22. liver herniation through **an incisional anterior abdominal wall hernia** in this report represents, to the bes
23. weeks was unremarkable. At 37 weeks, **the maternal abdominal girth** exceeded the expected range, and a second u
24. ented with a head and neck mass (three cases), **an abdominal mass** (three cases), lymphadenopathy (two cases),
25. ing a physical examination, she was noted to **have abdominal distention** and tenderness. The results of her lab

Some concordance lines about collocations of 'diagnosis'.

1. rmance status until seven years after the **initial diagnosis**, although she had local and distant recurrences.
2. which may appear in almost any human organ. Their **diagnosis rate** in the hand region is not known. Case presen
3. Ally led the first treating physicians to **a false diagnosis** of a regular carpal tunnel syndrome with two unsu
4. particularly if located deeply. The **differential diagnosis** between lipomas and well-differentiated liposarc
5. of 134 cases revealed that mri **gave the correct diagnosis** in 94% of cases [1]. The tumors lie in close appr
6. Presentation shows not only that **a sound original diagnosis** might have prevented three further re-operations
7. is now the gold standard **technique for the diagnosis** of pnh [4]. The normal values of cd55 and cd59 ar
8. rebral arteries (figures 2a and 2b). We **made the diagnosis** of rcvs and began treatment with nimodipine 30mg
9. tion of cerebral vasoconstriction, **confirming the diagnosis** of rcvs (figures 2c and 2d). Discussion this cas
10. or endoscopy are essential for the **correct diagnosis** of gjc fistula [6]. Thoeny et al. Reported
11. and colonoscopy have been **recommended for the diagnosis** of gjc fistula to exclude other gastrointestinal

12. Colonoscopy is insufficient to the **rule out a diagnosis** of gjc fistula. İn our patient' s case, endoscopy
13. is often diagnosed incidentally with **prenatal diagnosis** or following medical testing for infertility.
14. or following medical testing for infertility. **Diagnosis is confirmed** by karyotype analysis and the mos
15. of a substance or of a general illness [7]. **Diagnosis is usually delayed** more than five years from
16. was obtained. Three years after the **initial diagnosis**, she had no clinical symptoms. Discussion this
17. woman who was treated under **a tentative diagnosis** of a multisegmental lumbar disc protrusion for
18. acterium tuberculosis is uncommon. **A differential diagnosis** of tuberculosis should be considered when dealing
19. nce of anti-cortex antibodies suggested **exclusion diagnosis** of addison disease secondary to mtb infection. Th
20. importance in determining the **correct clinical diagnosis**. The presence of skin and mucosal pigmentation li
21. tuberculosis infection. The gold standard in the **diagnosis of tuberculosis** remains a positive mtb cultural t
22. tion biopsy should be considered [13]. **Histologic diagnosis** of myelolipoma is based on the presence of mature
23. y-old, african-american baby girl with a **prenatal diagnosis** of hydrocephalus. She presented with a full fonta
24. of cases were young with a median age **at lymphoma diagnosis** of 9.4 years (range 1.1 to 77 years). Two-thirds
25. psy was performed to make a **definite pathological diagnosis** which revealed diffuse, mixed small and large lym

Some concordance lines about collocations of 'lymphoma'.

1. pheral embolism. Now, she presented with **cerebral lymphoma**, received glucocorticoids, and subsequently devel
2. e further course was complicated by a **non-hodgkin lymphoma** and probably by chemotherapy- induced evans syndr
3. of a cerebrospinal fluid examination, **relapsing lymphoma** was suspected on the basis of cerebral magnetic r
4. in this population. Diffuse large b cell **lymphoma presenting** as horner's syndrome in a patient diag
5. lymphoid neoplasms. Only one case of **burkitt's lymphoma** presenting with toothache, paresthesia, and horne
6. ribed and no case reports of diffuse **large b-cell lymphoma** as the etiology of horner's syndrome currently ex

7. opsy provided a diagnosis of diffuse **large b-cell lymphoma**. Interestingly, the patient was also definitely d
8. from the literature. All cases were **non-hodgkin lymphoma** and the major subtype was t-cell. Only nine cases
9. subtype was t-cell. Only nine cases were **b-cell lymphoma**. The majority of cases were young with a median a
10. majority of cases were young with a median age **at lymphoma diagnosis** of 9.4 years (range 1.1 to 77 years). T
11. for the first time a case of diffuse **large b-cell lymphoma** that occurred in a neurofibromatosis type 1 patie
12. xact molecular mechanism for diffuse **large b-cell lymphoma development** in neurofibromatosis type 1 cases rem
13. umor, thyroid carcinoma, neuroblastoma, **burkitt's lymphoma**, and hodgkin's disease have all been described as
14. cies. All cases were diagnosed with **non-hodgkin's lymphoma** (nhl). The majority of cases were young with a me
15. ears (range 1.1 to 77 years; median 9.4 years) at **lymphoma diagnosis** and two-thirds of the cases were boys a
16. nd two-thirds of the cases were boys and men. **The lymphoma subtype** was predominantly t-cell (13 of 25 cases)
17. cell (13 of 25 cases), especially **t-lymphoblastic lymphoma** (five cases) and cutaneous t cell lymphoma (two c
18. lastic lymphoma (five cases) and **cutaneous t cell lymphoma** (two cases). Nine cases had b-cell lymphoma and f
19. cell lymphoma (two cases). Nine cases had **b-cell lymphoma** and five cases had unclassified lymphoma. Six cas
20. d b-cell lymphoma and five cases had **unclassified lymphoma**. Six cases presented with a mediastinal mass and
21. e, there was only one described case of **burkitt's lymphoma** presenting with toothache, paresthesia and horner
22. es. The direct association between nf1 and **t-cell lymphoma** in most previously reported cases or between nf1
23. have been reported in nf1 cases with **malignant lymphoma** (as shown in table 1), early-onset cns tumors, an
24. required for the initiation and **propagation of lymphoma** in nf1 cases should be determined to answer why a
25. and how only a very few nf1 cases are at **risk of lymphoma development** in their lifetimes. Connection tubing