Inaccuracy of Machine Translation in Translating Medical Terms from English to Arabic

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ABSTRACT

Medical terminology has distinct qualities that cause significant challenges for translators while translating medical texts. Despite the creation of numerous medical dictionaries and the development of machine translation, many medical terms are still not included in these dictionaries, and machine translation cannot provide adequate translation. The main objective of the current study is to prove that machine translation does not provide accurate translation of medical terms. The medical terms used in this study contain single words, compounds and abbreviations. All terms used are classified into three categories: 15 related to COVID-19, 15 medical terms and 15 medical abbreviations. To translate these medical terms three free online applications have been selected: Google, Bing and Yandex. A comparison has been carried out to evaluate the quality of machine translation outputs by comparing the numbers and percentages of the correct responses occurring in English to Arabic translation outputs of the three machine translations using descriptive statistics. Furthermore, the findings were graphically represented. The results of the study clearly demonstrated the deficiencies of three online translators in translating different terms related to medicine.

KEYWORDS medical terms, machine translation, comparison, deficiencies

الملخص

تسبب ترجمة المستندات الطبية صعوبات وعقبات كبيرة للمترجمين، ويرجع ذلك إلى طبيعة المصطلحات الطبية التي لها صفات تميزها عن بقية المصطلحات الأخرى، فعلى الرغم من وجود العديد من القواميس الطبية وتطور الترجمة الآلية إلا أن الكثير من المصطلحات الطبية لا تزال غير مدرجة في هذه القواميس، وبالتالي لا يمكن للترجمة الآلية أن توفر ترجمة صحيحة، وحيث أن الهدف الرئيسي من هذه الدراسة هو إثبات أن الترجمة الآلية لا توفر ترجمة دقيقة للمصطلحات الطبية، فقد تم اختيار المصطلحات وتصنيفها إلى ثلاث فئات: **15** مصطلحًا يتعلق بكوفيد-**19**، و**15** مصطلحًا طبيًا، و**15** اختصارًا طبيًا، كما تم اختيار ثلاثة تطبيقات مجانية عبر الإنترنت لترجمة هذه المصطلحات ، وهذه التطبيقات هي: **Google وBing وYandex**، وتم إجراء مقارنة لتقييم جودة مخرجات الترجمة الآلية من خلال مقارنة الأعداد ونسب الترجمة الصحيحة لكل موقع في مخرجات الترجمة من الإنجليزية إلى

العربية للترجمات الآلية الثلاث باستخدام الإحصاء الوصفي، كما تم تمثيل النتائج بيانياً، وأظهرت نتائج الدراسة بوضوح أوجه القصور لدى التطبيقات الثلاثة عبر الإنترنت في ترجمة المصطلحات المختلفة المتعلقة بالطب.

Introduction

Translation is the process of conveying the meaning of a text created in the source language through a text produced in the target language. However, it is not a mere transformation of words from one language to another; it is also concerned with cultural aspects. In addition to being a complicated process, translation is a multifaceted endeavour that demands expertise, knowledge, and immense effort. It takes more information, experience, and practice to be able to communicate ideas and thoughts in writing or oral form from one language to another. In this respect, Newmark (1981, p. 7) indicates that translation is "a craft that attempts to replace a written message and/or statement in one language by the same message or statement in another language", (ibid) regards translation as an art that requires understanding the message and evaluating the language used to convey that message. As an art, translation involves innovative, intuitive, and inspired levels in order to translate the SL to the TL, and a translator acts as a mediator between the two languages and cultures. Furthermore, communication between languages and cultures has grown considerably via translation. Modern technology would never have been transmitted among countries without translation. Any area of language, such as the legal, theological, and literary spheres can benefit from translation. Medical specialties are included in the field of translation, which is one of these fields. Because it calls for precision, in-depth knowledge, and a comprehension of the terminologies, expressing medical concepts and material is typically challenging and serious.

The fact that the terms used in medicine has its own unique characteristics might cause problems. In the translation of any form of medical literature, terms are the main notion. While the more experienced professional translators found them to be rather simple, the translation of medical terminology caused serious difficulties and obstacles for novice translators. Thus, to work as a translator in the field

of medicine, training in the translation of medical terms is essentially required. However, according to Argeg (2015) literal translation, the frequent use of transliteration, insufficient training and experience in medical translation, and a lack of current English-Arabic medical dictionaries are some of the factors that have contributed to the problems in medical translation. In addition, novice translators utilize CAT or MT software to assist them in translating medical terminology. Perhaps the most significant challenge in medical translation is how to convey information from the source language text (SLT) into the target language text (TLT) with the highest level of accuracy while maintaining the original meaning.

Objective of the Study

The main objective of this study is to demonstrate that machine translation does not accurately translate medical terminology from English to Arabic. Moreover, to ascertain which of the three online translators—Yandex, Bing, and Google—produces the lowest number of translation errors and which is the most accurate.

Medical Translation

One of the earliest forms of translation is medical and religious. Fischback (1986, p. 4) maintains that "translating medicine is regarded as the most universal and oldest field of scientific translation because of the homogenous ubiquity of the human body". Without medical translation, doctors would not have been able to know and study diseases or treat them. As it pertains to people's lives and health, medical translation is a particularly delicate topic. As a result, the translator of medical texts needs to work carefully and proficiently in order to comprehend the source text and then choose the proper lexical equivalent in the target language. The fact that medical translation cannot accept the incidence of an error, even a minor one, is one of its risks. A patient's death or a health problem could result from medical translation. Thus, a medical translator requires sufficient knowledge of medical terms as well as medical information.

The widespread use of English in science in general and in medicine in particular severely restricts the use of other languages, Krulj et al state

(2011, p.170)"It is well known that English is the leading language of medical sciences". Indeed, English communication has been crucial throughout the history of medicine, for instance, the majority of Arab countries use English in higher education although Arabic is the official language in all Arab countries, English is still used as the language of teaching in most Arab medical universities such as Arab Medical University in Libya. Most medical professionals in the Arab world, including Arabs themselves, write medical documents or reports in English, even while issuing prescriptions. According to Khashm (2006) Arab physicians in many Arabic countries, including Libya, Egypt, Iraq, and all the Arab Gulf states, write reports and prescribe medications in English because they received their education in the English language. Therefore, there is a high demand for the study of scientific and technical translation from English into Arabic and vice versa. In order to address the issues with accessing scientific and technological information, such a requirement is included in the national strategies of Arab academies. Technical and scientific progress, the expansion of scientific, technical, commercial, cultural, and other relations, and the desire of nations and governments to develop cooperation and coordinate their efforts in promoting civilization are the causes of the rising demand for technical and scientific translation. A very significant category of translation is medical translation, which is a subset of scientific and technical translation, Montalt (2011) emphasises that medical translation is one of the most active types of professional translation. However, the sensitive issue of medical translation necessitates a high level of accuracy and consistency when translating the source text into the target language (TL). Generally speaking, translating medical terminology presents several difficulties. Even though some medical terms are easily translated, others are incredibly challenging. The intricate nature of several medical words makes their translation into Arabic more challenging, for example gastroesophageal. In addition to the medical abbreviations that cannot be found in bilingual dictionaries and computer translation tools. Sometimes there is a lack of consistency in the translation of medical terms within the same language. Consistency refers to the use of several translations for the same SL term within a text or among pertinent texts. According to Rogers (2008), terminological inconsistency can be understood as the employment of various forms for

the same referent, such as synonyms, orthographic variants, geographical variants, and hyponyms in the same text or group of related texts. Arabic is a good example because there are significant term variations from region to region, and the absence of standardisation causes a significant portion of a translated text to be lost in translation. For instance, in the Maghreb countries, which are influenced by the French language, they use السيدا as an equivalent for AIDS, whereas in eastern Arab countries, which are influenced by English, they use ايدز.

Medical Terminology

Like any other discipline, medical discipline has its terminology. Medical terminology is a system of words that are used to describe specific medical aspects and diseases. It is based on standard root words, prefixes, and suffixes. In this case, Davies (1985, p. 13) defines medical terminology as "the study of words used to communicate facts and ideas particular to medicine; it is chiefly concerned with the present use and meaning of such words." Medical terms refer to words, compounds, abbreviations and acronyms that are related to medicine. In terms of origin, most medical words have been taken from Latin or Greek such as (*uterus*) womb. The translation of medical words is a crucial step in the process of translating medical content. In this context, Montalt and Gonzalez (2007) argue that identifying and resolving terminological issues takes up more than half of the time spent throughout the translation process. The medical translator must also be fully aware of what medical language contains. As an illustration, the word *Abortion*, this term literally means (the process of expelling the fetus from the uterus), and a novice translator may interpret it as follows: It is (a birth process), but the professional translator knows that this word means (abortion). One of the dangers of medical translation is that it cannot tolerate the occurrence of an error, even a small one. However, Newmark (1988) distinguishes two categories of medical terms: common medical terms (lay terms) and professional terms. The latter comprises words that are used in the medical field, doctors usually use scientific medical terms, for instance, *spectacles* instead of the word *glasses*. On the other hand, the lay terms are the common names used by laypeople, such as fever, womb, etc. Medical terms usually cause the main problems for the

translator of medical texts because of their difficulty and structure; in the process of word-building, very long words can be broken down into their component parts and thus their meanings can be understood, for instance, the term nephritis (inflammation of the kidney) consists of two words: neph +ritis. The next section will discuss the structure of medical terms in detail.

Structure of Medical Terms

A great deal of words used in medicine are constructed of one or more morphemes. Many of these words include roots, prefixes, suffixes, and linking or combining vowels, having Greek or Latin roots, for example, the term "*pericarditis*" is used to describe inflammation in the outer layer of the heart. It can be broken down into three component parts: peri-card-itis, and each part of the word tells us something about the condition. The prefix "peri" means "surrounding," the root word "card" means "heart," and finally the suffix "itis" means inflammation. Any medical term may contain one, both, or all of these categories. These categories will be discussed in detail below.

Word Root

The root is considered to be the core part of a word and it contains the primary meaning, Hutton (2006, p.2) states that "roots are the basic medical words." Many words are derived from early Greek and Latin words such as diabetes mellitus. On the other hand, some words have their origins in Arabic. Arabic has made significant contributions to the field of medicine, and numerous medical terms have their roots in the Arabic language. Here are some medical words that originated from Arabic: Alcohol (Al-Kuhl): The term "alcohol" derives from the Arabic word "al-Kuhl," originally referring to a fine powder used as an antimony-based eyeliner. Later, it came to denote distilled substances. Another illustration is the term Syrup: The word "syrup" is derived from the Arabic term "sharāb," which means a drink. In medicine, it refers to a concentrated liquid medication sweetened with sugar or a sugar substitute.

However, as it has been stated most medical terms are made of a root and one or more affixes, for example by combining the root *cardi-* (heart) and the suffix *-ac* (pertaining to), we produce the term *cardiac* to refer to the notion of *pertaining to the heart.*

Prefixes

A prefix is part of a word, it is found at the beginning of a word, as in *asphyxia.* Prefixes usually are added to words to change or modify the meaning of the word root, for example, the prefix "a" is employed in the health sciences indicating "not, without, or less" as in *alexia* (not read), *aphagia* (not eat). The "a-" usually becomes "an-" before a vowel as in *anemia* (without blood), and *anoxia* (no oxygen). The prefix "a-" comes from the Greek meaning "not". It is very useful to understand the prefixes used with medical terms to assist in tackling the problems of medical translation.

Suffixes

Suffixes are word parts that are located at the end of words. Suffixes can change the meaning of medical terms. The suffix appears at the end of a term and may indicate a specialty, test, procedure, function, disorder, or status. Otherwise, the suffix may simply define whether the word is a noun, verb, or adjective. For instance, the suffix graphy means the process of recording, radiographic imaging as in electrocardiography. Another example is the suffix iatry which means specialty, as in psychiatry.

Combining Vowels

Many terms are produced by combining more than one root (compound terms) or by adding a suffix to the root using a combining vowel (mainly, -o- or, less frequently, -i-) for easier pronunciation. Where medical terms consist of more than one root, the combining vowel is inserted between roots. For instance, the word *Cariopulmonary* (pertaining to the heart and lungs), where the root is cardi, the linking vowel is o and *pulmon* is the root and *ary* is the suffix.

Derivation of Arabic Medical Terms

Derivation means how Arabic lexicographers and terminologists produce an Arabic equivalent for a foreign word. Indeed, derivation is very common in Arabic lexicography and terminology. Stetkevych (1970, p. 7) states "Arabic has been called the language of ishtiqāq (derivation), and this ability to grow from its own essence has given the language its rare homogeneousness". In other words, it is the production of new terms with new lexical meanings from existing and old Arabic roots following a lexical pattern, for instance many words can be derived from the word مرض(illness), such words as patient مريض/مريضة, male nurse ممرض, female nurse ممرضة, nursing التمريض.

Derivation is a popular strategy employed by Arab lexicographers to deal with the issues posed by neologisms, although it is ineffective in cases when the new foreign term has no existing or ancient Arabic roots. For instance, certain Arabic medical phrases are created by describing the nature of the product such as the word *asphyxia* which means الاختناق بسب نقص الأكسجين. On the other hand, some Arabic medical terms have been derived by a word-for-word translation of foreign medical terms such as *yellow fever* which is translated literally into Arabic as الحمى الصفراء. Some Arabic medical terms are coined by describing symptoms and signs, for example *Hepatitis* which is rendered into Arabic asالتهاب الوبائي الكبد. Furthermore, terminology named after discoverers, inventors, or locations are frequently preserved and they are called Eponymous such as Down's syndrome can be rendered into Arabic asمتلازمة داون.

Problems of Translating Medical Terms

One of the most serious challenges in the translation of medical texts are the glossaries that are related to medicine, and the more frequently they appear in the source text, the more difficult it is to translate those words into the target language. In such cases, translators frequently employ bilingual medical dictionaries, however, these are frequently out-of-date in the target language, which could have an impact on the translation. A translator will therefore consider the idea of equivalency, which is one of the key components of translation studies. Failure to produce an accurate

equivalent translation by a translator can lead to a mistranslation that, while generally deceptive, can be fatal in the realm of medicine. Below is a discussion of these problems.

The Problem of Nonequivalence

Finding Arabic equivalence for English words can be a challenge for translators. In this respect, Baker (2011, p. 23) claims that "non-equivalence at word level means that the target language has no direct equivalents for a word which occurs in the source text." For instance, the medical term *acanthosis* which is translated by (Gaballah, 2012) as كما في مرض الصدفية تغلظ الطبقة الشوكية لبشرة الجلد،in this case the translator employed paraphrasing since the term has no precise equivalence in Arabic. Although Arabic is called the language of derivation and is rich in terminology, many English medical terms, especially the modern ones have no equivalents in Arabic. This is due to the vast development in the field of medicine.

Lack of Standardisation

Some medical terms have more than one equivalent in Arabic and this is due to the lack of standardization. This leads to inconsistency in medical translation. In other words, one English medical term has different Arabic equivalents such as the term AIDS الإيدزin some Arabic words like Lebanon, it is rendered as السيدا. This is due to the fact that the Arabic world is divided into two main parts; one occupied by Britain and the other by France; therefore, the impact of these languages still exists in the Arabic language.

The Problem of Transliteration

Some of the medical terms are new to the Arab environment and culture making it difficult if not possible to find equivalents, for example *Covid 19* is transliterated into Arabic as كوفيد 19. However, transliteration causes a lot of trouble for translators and the target audience because some of the translators opted for keeping the original term such as *AIDS and*

Covid كوفيد، الإيدز, while others. translate the term semantically مرض نقص المناعة المكتسبة. According to Megrab (2011, p. 492) "transliteration is the process of rendering the letters of one alphabet in the letters of another with different alphabetical system", (ibid) aims that novice translators tend to overuse transliteration when they fail to find the appropriate equivalents. Moreover, the effect of mass media on novice translators paves the way for the overuse of transliteration.

The Problem of Neologisms

Neologisms are lexical units that are newly coined. Indeed, neologisms cause problems to translators to find the appropriate equivalent in Arabic owing to the continuous development in the field of medicine. Montalt and Gonzalez (2007) claim that medical translators face two main problems. First is the comprehension of the meaning of the medical term and then finding the appropriate and accurate equivalent in the target language. If the translator cannot find any equivalent after making sure that the source language term has no acceptable and concise Arabic equivalent; therefore, giving a definition or transliteration will be the last solution.

The Problem of Polysemy

Polysemy is a word with different meanings, for instance the term *Haemophilia,* has different equivalents in Arabic: نزف الدم which is the translation of the medical term. On the other hand, the term is transliterated as الهيوفيليا, or it is rendered into Arabic as الناعور،النزف. Another illustration is the Arabic medical term مرض تضخم الغدة الدرقية, it has different equivalents in English: Grave's disease, Basedow's disease and Exophthalmic goiter. These different terms for the same disease are attributed to different names; doctor Grave, doctor Basedow, and the last one refers to the symptoms of the disease itself. Polysemy is problematic for translators since they face the challenge of selecting the equivalent from different words for the same term as in the examples mentioned above.

The Problem of Abbreviations and Acronyms

Medical texts such as medical reports are rich in abbreviations and acronyms. In fact, abbreviations and acronyms are considered to be one of the most significant problems in the field of medical translation because one abbreviation or acronym can have hundreds of full words, for instance the medical abbreviation *CF* in Medilexicon Dictionary has 104 equivalents. In this respect, the translator relies on the context to render the precise meaning of the abbreviation or the acronym.

Machine Translation

All facets of our lives, including medicine and translation work, are affected by developments in technology. The vast progress of modern medicine has raised the demand for translations and placed pressure on translators to adopt and use new technology in their translation works. Throughout the world, computers and the internet have changed translation activities. Modern translation technologies include specialized equipment and software that may be adjusted to the requirements of the translators. These tools include some electronic resources, terminology management tools, term bases, cloud-based databases, translation memory, and server-based translation systems. In fact, machine translation assists translators in their translation activities and helps them work faster so it increases their productivity. However, human translation is considered to have better quality and it maintains consistency. Attempts to completely replace human translation with machine translation, according to Jebbar (2014) it would undoubtedly fail for the obvious reason that there is currently no machine translation technology that is capable of interpretation. For example, machine translation cannot comprehend the linguistic and cultural equivalences between English and Arabic translations. As an illustration, machine translation translates the Arabic phrase " أثلج صدري " as "it froze my heart" in its literal sense. Apparently, the favourable attitude towards snow in a hot environment like the Arab world is reflected in the Arabic metaphor, which suggests a case of relief and contentment. The English translation, on the other hand, alludes to a feeling of disappointment and despair because "freezing" is the norm for terrible weather in the West. While "it warmed

my heart "أدفأ صدري would be the human translation that would best fit the target culture. It can be said that machine translation is not perfect and frequently translates text with errors. Thus, human postediting reduces the deficiencies produced by machine translation. Text translation is a challenging task for general-purpose automatic translation systems like Microsoft (Bing) Translator, Google Translate, IBM Language Translator, and many more. This problem arises when the text is related to a specific field such as medicine. Garsa (2015) claims that machine translation showed several deficiencies which limited their use for this purpose. Although aware of their shortcomings, Arabic speakers frequently utilize MT systems to translate documents from English into Arabic or vice versa. This could be due to a desire to save time, money, or both.

Despite the creation of numerous English-Arabic medical dictionaries and the development of CAT (computer-assisted translation) tools like translation memories, term bases, and terminology management systems, many medical terms are still not included in these dictionaries, and these tools may not always be useful. This is because the terms are either new or missing direct Arabic equivalents. Additionally, English-Arabic dictionaries and other translation tools typically do not contain some abbreviations. In this case, the translator will attempt to offer some solutions to the non-equivalence and new words issue.

Methodology

This study is concerned with using machine translation tools in translating medical terms from English into Arabic, and the assessment of the output translation. To achieve the goals of the study, a qualitative-quantitative approach was adopted entailing a descriptive and evaluative analysis. The data are medical terms that have been collected from various medical reports. These medical reports are produced by specialists and translated into Arabic by official Arabic translators in Benghazi, Libya. The medical terms used in this research contain single words, compounds and abbreviations. The medical terms were chosen to be inclusive of some medical terminology, with the exception of pharmacy-related terms (most of which are formulas, trade names, and

drug names that cannot be translated into Arabic). All terms used are related to medicine and they are classified into three categories: 15 terms related to COVID-19, 15 medical terms and 15 medical abbreviations. The terms of COVID-19 were selected because of the disease's worldwide impact and widespread effects. To assess the machine translator's performance, a number of medical words were also chosen at random. Medical abbreviations were selected to assess the machine translator's level of proficiency because they present challenges and difficulties for translators. In addition, medical reports are full of abbreviations. To prevent them from being confused with abbreviations used in another field, they were inserted into sentences.

To ensure the high quality and accuracy of the Arabic translations for the chosen medical terms, they were double-checked using English-Arabic medical dictionaries, namely Dictionary of COVID-19 Terms (2020) and Concise Medical Dictionary (2012).

In addition, three online applications have been selected to translate the medical terms. It appeared reasonable to select the most commonly and frequently used applications by Arabic native speakers. The three applications are Google Translate as the first option since it is the most commonly used system, the second application is Microsoft Bing and the last one is Yandex. The reasons behind using these three applications are they are free and available online. The output translation of every application is compared to the accurate translation of the dictionaries mentioned above. Three tables were created from the data: the first table includes COVID-19 terms, the second contains medical terms, and the third includes medical abbreviations. After analyzing each table independently, descriptive statistics were used to list the relationships between the three tables. Then, a comparison between the three applications was made to demonstrate which of these applications is capable of providing acceptable translation. A comparison has been carried out to evaluate the quality of machine translation outputs by comparing the numbers and percentages of the correct translation outputs occurring in English to Arabic translation outputs using the three machine translations: Google, Bing and Yandex, and the results were represented graphically.

Analysis of Machine Translation Outputs and Results

The purpose of this study is to prove that medical terminology cannot be accurately translated from English to Arabic via machine translation, to determine which of the three online translators—Google, Bing, and Yandex—is the most accurate, and to find out which one produces the lowest number of translation errors.

The tables below reveal the translation outputs of the three websites followed by the analysis and the graphics.

Table 1: 15 terms related to COVID-19

NO.	Terms	Google	Bing	Yandex	Dictionary of COVID 19
1	Cluster	تجمع	كتلة	مجموعة	عنقود
2	Mass vaccination campaign	حملة تطعيم واسعة النطاق	حملة التطعيم الجماعية	حملة التطعيم الشامل	حملة تلقيح جماعي
3	Super-spreader	الموزعة الفائقة	سوبر الموزعة	سوبر الموزعة	ناشر العدوى الفائق
4	Droplet transmission	انتقال القطرات	انتقال العدوى	انتقال القطيرات	انتقال الرذاذ
5	Fomite	أداة العدوى	الفوميت	فوميت	أداة العدوى
6	Health screening	الفحص الصحي	الفحص الصحي	الفحص الصحي	الفحص الصحي
7	Herd immunity	مناعة القطيع	مناعة القطيع	مناعة القطيع	المناعة الجماعية
8	Hygiene measure	مقياس النظافة	تدبير النظافة	قياس النظافة	التدبير الصحي
9	Index case	حالة الفهرس	حالة الفهرس	حالة الفهرس	حالة دالة
10	Patient zero	المريض الصفر	المريض الصفر	المريض الصفر	أول مصاب بالمرض
11	Viral shedding	إفراز الفيروس	سفك الفيروسية	سفك الفيروسي	إفراز فيروسي
12	Hyperendemic	مفرط التوطن	فرط التوطن	فرط التوطن	فرط التوطن المرض
13	Telemedicine	التطبيب عن بعد	التطبيب عن بعد	التطبيب عن بعد	التطبيب عن بعد
14	Infomedicies	أدوية المعلومات	الأدوية	المعلومات	معلوماتية الوباء
15	Swab test	اختبار المسحة	اختبار المسحة	اختبار المسحة	اختبار المسحة

Analysis of Google Translate Output

Concerning Google's output, the percentage of errors appears less than that of Bing's and Yandex's. As seen in Table 1, the overall level of accuracy for Google translation of COVID-19 terms is 40%, which is obviously higher than those of Bing and Yandex. However, the number of accurate answers is eight out of fifteen words due to a low percentage that nearly approaches half. Google succeeded in providing accurate

translations of *fomite* أداة العدوى, *health screen* الفحص الصحي*viral shedding* إفراز فيروسي, *hyperendemic* مفرط التوطن, *telemedicine* التطبيب عن بعدand *test swab* اختبار المسحة, whereas, *Mass vaccination campaign* is translated as حملة تطعيم واسعة النطاق, Google provided a near accurate translation. In other words, Google rendered the word *vaccination* as تطعيم instead of تلقيح, but they still carry the same meaning since the word vaccination is translated into Arabic as either تطعيم or تلقيح. On the other hand, due to the literal translation, Google provided inconsistent translations for the rest of the words, such as *super spread* الموزعة الفائقة instead of ناشر العدوى الفائق. Also, the term *herd immunity* was translated as مناعة القطيع, it may be argued that Google translates words separately rather than the entire phrase, which could lead to problems.

Analysis of Bing Output

Having analyzed the output of Bing's translation, it was found that only five out of 15 responses were correct (2, 6, 12, 13, 15) with a percentage of 27%. This percentage reveals the shortage of Bing in translating medical terms. However, the number of errors is very high, and they are detected in both transliteration and literal translation. As for transliteration, number five was rendered as الفوميت instead of أداة العدوى. The other terms, on the other hand, were literally translated, for example, *patient zero* المريض الصفر; it is clear that Bing transforms single words; patient المريض then zero الصفر rather than transforming the whole expression. A combination of literal translation and transliteration was used to create some terminology like *Super-spreader* سوبر الموزعة instead of ناشر العدوى الفائق. Some terms were given inaccurate translations such terms as *droplet transmission* انتقال العدوى rather than انتقال الرذاذ. Another illustration is *Infomedicies* was rendered by Bing as الأدوية المعلوماتية.

Analysis of Yandex Output

Yandex and Bing are ranked similarly. They have a 27% percentage of right responses. According to this percentage, Yandex and Bing fall short when it comes to accurately translating COVID-19 terms. These errors result from transliteration or literal translation. As an example, the term *fomite* was transliterated as الفوميت by Bing and Yandex. However,

several terminologies were translated literally, such as *hygiene measure* قياس النظافة and *patient zero* المريض الصفر. Like Bing, some terminologies were a result of a combination of both literal translation and transliteration, such as *Super-spreader* سوبر الموزعة rather than ناشر العدوى الفائق.

The terms associated with COVID-19 are translated by the three online translators—Yandex, Bing, and Google in the table above. Furthermore, the table offers a precise interpretation in accordance with the COVID-19 Dictionary. The table indicates that the translations of COVID-19 words by the three websites are not accurate. Even still, Google's performance was only marginally better than the other two websites, with eight out of fifteen terms receiving the right response (2, 5, 6, 11, 12, 13). There were exactly four right answers out of an equal number of answers for Bing and Yandex (2, 6, 12, 13). Each of these websites had an obvious error in their COVID-19 terminology translations. However, Certain terms have common translations across all three websites, for instance, the term *herd immunity*. It was rendered literally as مناعة القطيع. It seemed that the online translators transmit every single word individually. Another term is *index case* which is transferred as حالة الفهرسinstead of الحالة الدالة على المرض. On the other hand, some terms have a little difference in their translations such as the term *super-spreader*; it was translated by Google as الموزعة الفائقة while Bing and Yandex provided the following translation سوبر الموزعة. The data above has been graphically represented.
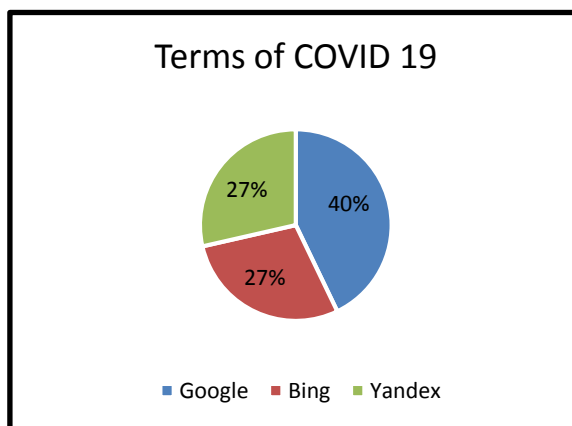
Figure 1

While Google's rate is a little higher (40%) and still lacking as it has not hit half, Bing and Yandex both have the same number of right responses (27%). It can be said that none of the three websites provides an accurate translation of COVID-19 terms.

Table 2: 15 Medical Terms

NO.	Terms	Google	Bing	Yandex	Concise Medical Dictionary
1	Ataxia	اختلاج الحركة	رنح	ترنح	اختلاج /الترنح الحركي الحركة
2	Cardiorrhexis	صدمات القلب	كارديوريكسيس	نزيف القلب	تمزق جدار القلب
3	Ketosuria	البيلة الكيتونية	كيتوسوريا	كيتوسوريا	السكريات الكيوتينية في البول
4	Byssinosis	داء الحويصلات	داء البيسين	بيسيوسيس	تلف الرئة
5	Canker	آفة	آفة	كانكر	التهاب الفم القلاعي
6	Pressure sore	الضغط قرحة	قرحة الضغط	قرحة الضغط	قرحة الفراش
7	Catheter	القسطرة	القسطرة	القسطرة	القسطرة
8	Cheilosis	_	داء الشفة	الشفة	تشقق الشفة بسب نقص فيتامين بي
9	Epuloid	-	ايبوليد	ابولويد	الورم اللثوي
10	Favid	-	فافيد	فافيد	طفح قرعي
11	Smallpox	الجدري	الجدري	الجدري	الجدري
12	Alochia	-	الوتشيا	الوشيا	عدم نزول سائل النفاس
13	Glossophytia	اللمعان	جلوسوفيتا	غلوسوفيتا	اسوداد اللسان
14	Heart attack	نوبة قلبية	قلبية	نوبة قلبية	نوبة قلبية
15	Videofluoroscopy	تنظير بالفيديو	تنظير بالفيديو	فيدوفلوروسكوبي	جهاز فحص البلع

Analysis of Google Output

The percentage of correct responses is 27%, this surprising percentage for Google was not expected. Out of fifteen terms, only four were translated accurately. Some terms, such as *favid*, are left blank, though. These blanks show Google's inadequacies in translating medical terms. In addition, some terms were literally translated, for example, *pressure sore* الضغط قرحة instead of providing the accurate translation قرحة الفراش. On the

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other hand, some terms like *Ketosuria* were transliterated. As for the rest of the terms, inappropriate translation was provided. For instance, *Cardiorrhexis* was rendered as صدمات القلب; the accurate translation is تمزق جدار القلب. All these issues prove that Google cannot provide accurate translation of medical terms.

Analysis of Bing Output

It is evident from the table above and the graphic below that all three websites have the same percentage of accurate translations of medical terms (27%). Similar to Google, Bing transformed four terms accurately. These terms are the same that were correctly transformed by both Google and Yandex. Unlike Google, Bing has not left blanks; rather the terms are translated or transliterated. A large number of terms are transliterated, for example, *Cardiorrhexis* كارديوريكسيس, whereas, this term was not translated accurately by Google. Another illustration of transliteration provided by Bing is *favid*. On the other hand, Bing did not provide an appropriate translation for the other terms. Such terms are *Byssinosis* داء البيسين, *Canker* آفة. Furthermore, some terms are translated literally like *pressure sore* قرحة الضغط. These shortcomings in translation reveal that Bing is not an accurate translator for medical terms.

Analysis of Yandex Output

Like Google and Bing, Yandex succeeded in translating only four terms correctly. These terms are the same ones that were accurately rendered by the other two applications. Unlike Google, Yandex has no blanks; the terms are either translated or transliterated. This does not mean that Yandex is better than Google because the accurate translation is similar to Google and they share the same terms. However, like Bing, many terms were transliterated, for instance, *Ketosuria, Favid, Alochia* and *Glossophytia*. Other terms are translated inaccurately like *Cardiorrhexis* نزيف القلب instead of تمزق جدار القلب. The three applications failed to provide an accurate translation of the previous term. In addition, Yandex rendered some terms literally, for example, *pressure sore* قرحة الضغط. It is clear from the table above that *pressure sore* was literally transformed by the three applications. The mistranslation of the medical terms is evidence that machine translation cannot provide accurate translation in medicine.

The table indicates the translation of some medical terms that have been selected randomly from the Concise Medical Dictionary to examine the accuracy of the online translators. In terms of the number of errors, the three online translators are equal. This table shows that these errors are almost similar in their linguistic nature to those detected in Bing's and Yandex's outputs. The errors of Bing's translation include inaccurate choice of lexical items such as *pressure sore* قرحة الضغط and *cheilosis* داء الشفة instead of تشقق الشفة. Yandex has also shown deficiencies in the translation of the medical terms due to the inaccurate selection of the words. For example, the term *cardiorrhexis* is rendered as نزيف القلب while the appropriate translation is تمزق جدار القلب. Both Bing and Yandex failed to transfer some medical terms and they provided literal translation. Such terms are *Ketosuria, epuloid, alochia, glossophytia and videofluoroscopy*. The output of Google Translate, on the other hand, was not better than the other two websites. Four terms are left untranslated. Furthermore, some terms such as *pressure sore* are translated literally الضغط قرحة. Very few terms have an accurate translation. The total number of right answers from each of the three websites is shown in the following graphic.
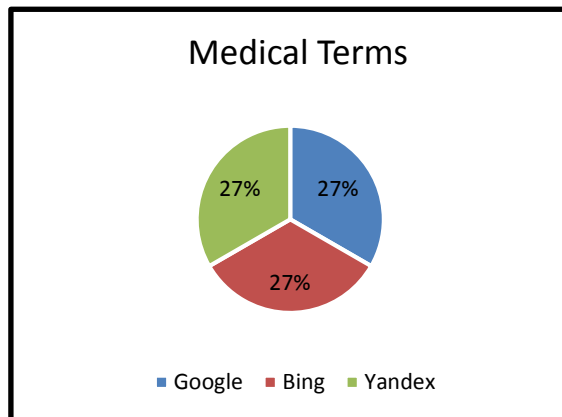

Figure 2

The graphic makes it very obvious that the three websites share the same 20% right answer percentage. It is regarded as extremely low, demonstrating that these websites are unable to translate medical terms accurately.

Table 3: 15 Medical Abbreviations

NO.	Medical Abbreviations	Google Translate	Bing	Yandex	Concise Medical dictionary
1	The medical H/O the patient is thoroughly studied.	تتم دراسة الطبية H/O للمريض.	تتم دراسة الطبية H/O للمريض.	الطبية ح / س يتم دراسة المرضى.	التاريخ الطبي للمريض.
2	BP is 70 over 50, and his heart rate is 130.	ضغط الدم 70 على 50 ومعدل ضربات القلب 130.	BP هو 70فوق 50	بي بي هو 70 على 50 ، ومعدل ضربات قلبه هو 130.	ضغط الدم 70 على 50 ومعدل ضربات القلب 130.
3	The patient was admitted to the hospital as a case of DM.	تم إدخال المريض إلى المستشفى كحالةDM	وأدخل المريض إلى المستشفى كحالة من حالات مرض دوشان.	تم إدخال المريض إلى المستشفى كحالة دم	داء السكري
4	For clinical correlation MRI is recommended.	من أجل الارتباط السريري يوصى بالتصوير بالرنين المغناطيسي.	للارتباط السريري يوصى بالتصوير بالرنين المغناطيسي.	للارتباط السريري ينصح التصوير بالرنين المغناطيسي.	أشعة الرنين المغنطيسي.
5	The patient needs to rest post OP.	يحتاج المريض إلى الراحة بعد إجراء العملية الجراحية.	يحتاج المريض إلى الراحة بعد OP.	يحتاج المريض للراحة بعد العملية.	بعد العملية
6	The patient was admitted to ICU.	تم إدخال المريض إلى وحدة العناية المركزة.	وأدخل المريض إلى وحدة العناية المركزة.	تم إدخال المريض إلى وحدة العناية المركزة.	وحدة العناية المركزة
7	The above mentioned Pt suffers from Dyspnea.	-	المذكورة Pt أعلاه يعاني من ضيق التنفس.	حزب العمال المذكور أعلاه يعاني من ضيق التنفس.	المريض
8	Lt hand is damaged.	-	يد اللفتنانت تالفة	اللفتنانت اليد تالفة.	اليسرى

9	This medicine is taken p. r. n.	يؤخذ هذا الدواء ص. ص. ن.	يؤخذ هذا الدواء p. r. n.	يؤخذ هذا الدواء ص. ن.	حسب الحاجة
10	Dr. Khaled at E. N. T., Medical Council.	دكتور خالد في قسم الأنف والأذن والحنجرة بالمجلس الطبي	الدكتور خالد في المجلس الطبي E. N. T.	-	الأنف والأذن والحنجرة
11	The patient c/o Dyspnea.	المريض ج/س ضيق التنفس.	المريض ج / س ضيق التنفس	المريض ج / س ضيق التنفس.	يشتكي من
12	This medicine should be taken b.d	يجب أن يؤخذ هذا الدواء ب	يجب أن يؤخذ هذا الدواء b.d	يجب أن يؤخذ هذا الدواء ب. د	مرتين يوميا
13	CT examination of the nose.	فحص الأشعة المقطعية للأنف.	الفحص المقطعي للأنف	فحص الأشعة المقطعية للأنف.	التصوير المقطعي
14	it is highly equipped for any urgent emergency in OPD.	وهو مجهز تجهيزًا عاليًا لأي حالة طوارئ عاجلة في العيادات الخارجية.	مجهزة تجهيزا عاليا لأي حالة طوارئ عاجلة في العيادات الخارجية.	وهي مجهزة تجهيزا عاليا لأي حالة طوارئ عاجلة في العيادات الخارجية.	العيادات الخارجية
15	It should be taken A.C.	يجب أن يؤخذ أ. س.	يجب أن تؤخذ AC.	-	قبل الوجبة

Analysis of Google Output

The overall accurate translation is 47%, which is obviously exceeding those of Bing and Yandex. Nearly half of the medical abbreviations were correctly rendered by Google (1, 2, 4, 5, 6, 10, 13, 14). Examples of these abbreviations are OP بعد إجراء العملية, and E. N. T الأنف والأذن والحنجرة. Very few abbreviations, however, are left untranslated, for instance Pt. In addition, some terms were literally transformed like A.C. أ.س. instead of قبل الوجبة.

Analysis of Bing Output

Both Bing and Yandex are in the same rank. Only 33% of the medical abbreviations were correctly translated. Although Bing did not leave blanks, some abbreviations have a literal translation, for example, c/o ج.

س. However, many abbreviations are rendered in English, Bing does not provide translation; such abbreviations are Bp, Pt and E. N. T.

Analysis of Bing Output

Yandex and Bing share the same percentage 33% of correct responses. Similar to Bing and Google, literal translation of some abbreviations was provided. For example, c/o ج. س. In addition, like Google, some abbreviations were left blank such as A.C.

The table above shows the translation of some medical abbreviations. In medical reports, these abbreviations are frequently utilized. In order to prevent ambiguity, they are included in sentences. The outputs of the Google translator look more accurate than those of the Bing and Yandex translators; 7 out of 15 were rendered accurately by Google translator (1,2,4, 5, 6, 10, 13, 14). It is also noticed that the number of correct responses of Bing and Yandex are the same; only 5 out of 15. Some of the terms are transformed into English with no translation such as H/O. Nonetheless, certain abbreviations, such as أ. س, are rendered literally by Google Translator. Conversely, Bing changed the English translation. Yandex did not offer an abbreviated translation. Compared to Bing, which has no untranslated abbreviations, Google and Yandex have two untranslated abbreviations. The percentage of the correct outputs of the translation is presented in the following graphic.
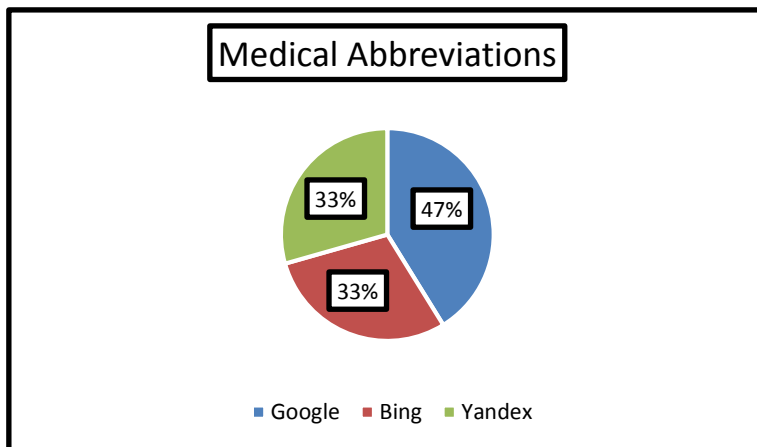

Figure 3

When comparing the percentages of the three websites, Google Translate has the highest percentage—nearly 50%. It can translate the majority of common abbreviations accurately, despite certain shortcomings. Yandex and Bing share the same amount of 33%. There are numerous mistakes in the translation of the abbreviations on those websites.

The following figure illustrates the percentage of right responses relative to wrong responses and summarises the information from the preceding figures.
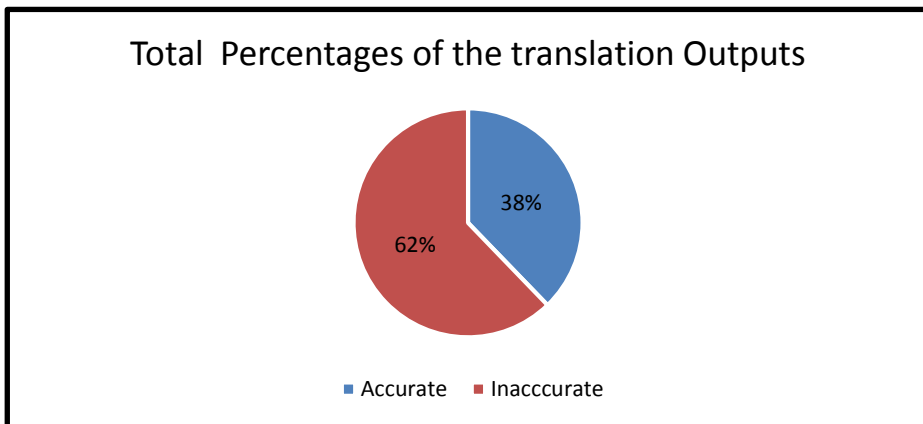

Figure 4

Given that the percentage of the inaccurate responses in the chart above represents 62% of all inaccurate answers for the previous three tables, it is evident that the percentage of inaccurate answers is significantly larger than the percentage of accurate ones. Based on this proportion, it can be concluded that the three websites are unreliable for translation purposes and have not successfully translated medical terminology. Comparing the percentage of errors to the number of correct outputs, the latter is much weaker—only 38% of the total outputs did not even approach half. Therefore, it showed that the three online applications are not reliable to provide accurate translations of the medical terms.

Conclusion

Even experienced professional translators found the translation of medical jargon challenging, students and less experienced translators faced significant obstacles and difficulties. Many professional translators and Arab medical students use MT to help them translate medical terms. This is due to the lack of sufficient experience and practice in medical translation, and the lack of up-to-date English-Arabic medical dictionaries are factors that have given rise to problems in medical translation. The current study found that medical translation is challenging, and machine translation cannot provide adequate translation. It also proved that machine translation does not provide accurate translation of different medical terms. Therefore, translators should have sufficient knowledge in the field of medicine. They also need to practice the translation of different medical documents. The results of the study clearly demonstrated the deficiencies of three online translators in translating different terms related to medicine.

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